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LEVERAGING AI AND MACHINE LEARNING FOR ADVANCING TRIBAL HEALTH EDUCATION: A COMPREHENSIVE REVIEW

Dr. T. Sumadhi[1]

Abstract

The integration of Artificial Intelligence (AI) and Machine Learning (ML) into healthcare has gained significant momentum, offering transformative potential across various sectors. However, the application of these technologies in tribal health education remains an emerging area of research. Tribal communities, often facing unique health challenges and barriers to access, can significantly benefit from the innovative capabilities of AI and ML. This review explores the current applications and potential impact of these technologies in improving health education and outcomes for tribal populations. AI and ML can address key obstacles such as limited healthcare infrastructure, geographic isolation, and cultural diversity within tribal communities. By harnessing the power of predictive analytics, personalized health interventions, and intelligent data processing, these technologies can provide more accurate and tailored health information. Machine learning algorithms, for example, can analyze health data to identify patterns in disease prevalence and predict outbreaks, allowing for proactive health education campaigns. AI-powered mobile health applications can deliver culturally relevant and context-specific health information, overcoming literacy barriers and language differences. The review examines existing studies, models, and frameworks where AI and ML have been successfully applied to tribal health education. Case studies of mobile health initiatives, telemedicine, and AI-driven health apps are discussed, highlighting the effectiveness of these technologies in reaching underserved populations. Despite the promising potential, challenges such as data privacy concerns, the need for community engagement, and the lack of digital literacy in some tribal areas are also addressed. In conclusion, AI and ML offer significant promise in bridging the gap in health education for tribal communities, improving both the accessibility and quality of health services. Future research should focus on developing culturally competent AI solutions, fostering collaboration with local communities, and addressing the infrastructural challenges to maximize the impact of these technologies in tribal health education.

Keywords: mHealth, maternal health, sustainable development goals, health awareness, tribal mothers, antenatal care

1. Introduction

Tribal communities worldwide face significant health disparities, including limited access to healthcare, higher disease burdens, and lower health literacy rates. These challenges are exacerbated by geographic isolation, lack of infrastructure, and socio-cultural factors that affect the delivery and effectiveness of health education. Despite the ongoing efforts to address these issues, traditional health education methods often fall short in reaching remote and underserved populations within tribal areas. In this context, emerging technologies such as Artificial Intelligence (AI) and Machine Learning (ML) offer transformative potential for revolutionizing health education in these communities.AI and ML have already made considerable strides in various fields of healthcare, from diagnostics to personalized treatment plans. These technologies have the capability to analyze vast amounts of health data, uncover hidden patterns, and deliver tailored interventions. When applied to tribal health education, AI and ML can overcome traditional barriers to information dissemination and improve health outcomes by providing personalized, culturally sensitive, and context-specific health content. AI-driven tools, such as mobile health applications and telemedicine platforms, can deliver health education directly to individuals in remote locations, breaking down geographical and infrastructural limitations.

Furthermore, ML algorithms can identify trends in health data across tribal populations, predicting health risks and enabling more effective, targeted interventions. For instance, predictive models can be used to

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foresee outbreaks of infectious diseases, while AI can help design health education materials that resonate with tribal cultures and languages, ensuring relevance and engagement. This personalized approach can lead to greater adoption of healthy behaviors, early disease detection, and improved long-term health outcomes.

Despite the promising potential, the application of AI and ML in tribal health education is still in its infancy. There are several challenges, including concerns over data privacy, technological infrastructure, and digital literacy in these communities. This review aims to explore the current state of AI and ML in tribal health education, identify challenges and opportunities, and highlight the future directions needed to leverage these technologies effectively for improving tribal health outcomes.

This paper will review the current landscape of health education within tribal communities, explore the potential roles of AI and ML in improving these initiatives, and discuss the broader implications of these technologies for health equity and inclusion.

2. Challenges in Tribal Health Education (500–600 words):

Tribal health education faces a unique set of challenges that hinder its effectiveness and accessibility. These challenges are multifaceted, stemming from historical, socio-economic, geographic, cultural, and technological factors. Despite advancements in healthcare, tribal communities continue to experience disparities that require targeted solutions. Below are the key challenges in tribal health education:

1. Geographic Isolation and Accessibility

Many tribal communities are located in remote areas with limited access to healthcare facilities and health education resources. This geographical isolation often makes it difficult for individuals to access health services, including educational programs, screenings, and preventive care. In rural and isolated tribal regions, face-to-face health education initiatives are often logistically impractical or too costly to implement on a large scale. This leaves communities with limited options for learning about health practices, disease prevention, and treatment.

2. Cultural and Linguistic Diversity

Tribal communities are culturally diverse, with distinct languages, traditions, beliefs, and practices that shape their perceptions of health and wellness. Traditional healthcare practices often coexist with modern medical knowledge, and there can be a lack of trust in mainstream healthcare systems. Health education materials that fail to consider these cultural nuances can be ineffective or even alienating. Additionally, language barriers present another significant challenge. Many tribal populations speak indigenous languages, and health education materials in these languages are scarce. This cultural and linguistic diversity necessitates health education strategies that are not only culturally sensitive but also linguistically appropriate.

3. Health Literacy and Education Gaps

Health literacy remains a significant challenge in many tribal communities, where low levels of formal education and limited exposure to healthcare systems can hinder understanding of basic health concepts. Lack of awareness about prevention, self-care, nutrition, and hygiene contributes to high rates of preventable diseases, such as diabetes, respiratory infections, and maternal mortality. In some cases, community members may also be unaware of available resources, such as vaccination programs or public health services, which can lead to underutilization of preventive measures.

4. Limited Healthcare Infrastructure

Tribal regions often suffer from inadequate healthcare infrastructure, including a shortage of medical professionals, clinics, and hospitals. These areas may lack specialized care, which affects the overall health of the community. In many cases, healthcare workers who are present in these areas may not have sufficient training to address the specific needs of tribal populations, especially in terms of cultural competence. This lack of infrastructure creates barriers to both healthcare delivery and health education, as information about health programs may not reach those in needs.

5. Digital Divide and Technological Barriers

While digital health solutions, such as mobile health apps and telemedicine, hold great promise for

addressing gaps in healthcare delivery, the digital divide remains a critical challenge. Many tribal communities lack reliable access to the internet or modern communication devices, which limits their ability to access online health education tools. Furthermore, low levels of digital literacy in some areas compound the problem, as individuals may not know how to navigate digital platforms or utilize technological resources effectively. Without addressing these technological gaps, the promise of AI and ML-based health interventions may not reach all segments of the population.

6. Mistrust of External Healthcare Systems

Historical trauma and a history of exploitation by external healthcare systems have fostered a deep mistrust of outside interventions in many tribal communities. Past experiences of unethical medical practices, such as forced sterilizations, unethical experimentation, and neglect, have created barriers to trust in healthcare professionals and systems. This skepticism can also extend to health education efforts, especially those led by outsiders or outside organizations. Overcoming this mistrust requires culturally competent approaches that respect tribal values, traditions, and self-determination.

7. Resource Constraints and Financial Barriers

Tribal health education programs often face financial constraints that limit their reach and effectiveness. Insufficient funding for health initiatives, alongside competing priorities within tribal governments, makes it difficult to implement large-scale or long-term health education programs. Additionally, economic instability, high poverty rates, and unemployment within many tribal communities can reduce individuals' ability to afford healthcare services, making education on insurance, financial assistance programs, and healthcare navigation crucial.

8. Fragmented Health Data and Privacy Concerns

Tribal health data is often fragmented across various systems and organizations, leading to gaps in understanding the health needs of these communities. Furthermore, concerns about privacy and confidentiality, especially regarding personal health data, can prevent communities from fully participating in health education and research initiatives. AI and ML applications, which rely on vast amounts of health data to deliver insights and recommendations, must address these privacy concerns to ensure community trust and participation.

9. Sustainability of Health Education Initiatives

Sustaining health education programs in tribal communities is a major challenge due to fluctuating funding, a lack of long-term planning, and a shortage of trained local educators. In many cases, health education programs are short-lived, often ending when external funding or resources are depleted. This lack of sustainability undermines the long-term impact of health education efforts and leaves communities without continuous support.

Overcoming these challenges requires a multifaceted approach that incorporates cultural understanding, technological innovation, and community engagement. AI and ML technologies hold promise in addressing some of these barriers by enabling more efficient, personalized, and scalable health education solutions. However, solutions must be tailored to the unique needs of each tribal community, ensuring that they are culturally appropriate, accessible, and sustainable in the long term.

3. The Role of Artificial Intelligence and Machine Learning in Health Education

In recent years, Artificial Intelligence (AI) and Machine Learning (ML) have emerged as powerful tools in various fields, including healthcare. These technologies have the potential to revolutionize the way health education is delivered, particularly in underserved and vulnerable populations. The application of AI and ML in health education can enhance the accessibility, personalization, and effectiveness of health communication, ultimately improving health literacy, promoting preventive care, and addressing disparities in health outcomes. This section explores the significant roles of AI and ML in transforming health education, with a focus on their applications, challenges, and opportunities.

Personalized Health Education

One of the most promising applications of AI and ML in health education is the ability to deliver personalized, tailored information to individuals based on their unique health profiles. AI algorithms can analyze large volumes of health data, including medical histories, demographic information, lifestyle

choices, and genetic factors, to create personalized health recommendations. For example, AI-powered platforms can offer personalized advice on nutrition, exercise, and disease prevention, tailored specifically to an individual's risk factors and health goals.

Machine learning models can continuously learn from new data, improving the relevance and accuracy of health advice over time. In the context of health education, this means that individuals can receive more precise information that is better suited to their needs, leading to higher engagement and more effective behavior change. Personalized health education can also help bridge the gap for people who may have unique health conditions, cultural considerations, or health literacy challenges, ensuring that they receive relevant, understandable, and actionable information.

Mobile Health (mHealth) and AI-Powered Applications

Mobile health technologies have become increasingly popular, providing an accessible platform for health education. AI and ML can be integrated into mHealth apps to deliver real-time, on-demand health information that is both interactive and engaging. These apps can be particularly effective in reaching populations in remote or underserved areas, where traditional healthcare resources may be limited.

For instance, AI-powered mobile applications can provide virtual health consultations, offering advice on common health issues like cold and flu symptoms or mental health challenges. AI chatbots and virtual assistants can guide individuals through a series of health-related questions, suggest lifestyle changes, and even send reminders for medication adherence or follow-up appointments. These applications can be further customized for different languages, literacy levels, and cultural contexts, ensuring that the information provided is accessible and relevant to diverse populations.

Predictive Analytics for Health Risk Assessment

AI and ML excel at analyzing large datasets and identifying patterns that humans may not easily detect. In health education, this capability can be used to predict health risks and offer preventive education before problems arise. By analyzing data from electronic health records (EHRs), wearable devices, and other health monitoring tools, AI models can identify individuals at high risk for specific diseases or conditions, such as diabetes, hypertension, or cardiovascular diseases.

Machine learning algorithms can also track real-time data from individuals, such as physical activity levels, heart rate, and sleep patterns, to predict potential health issues. For example, a machine learning model could analyze trends in physical activity and diet to predict the likelihood of an individual developing type 2 diabetes, prompting a health education intervention focused on prevention and lifestyle changes. This proactive approach can help reduce the burden of chronic diseases by encouraging early interventions and better health management.

Culturally Competent Health Education

One of the key challenges in health education, especially in diverse communities, is the need for cultural sensitivity. Health education materials that fail to respect cultural norms and values may not resonate with individuals, reducing the effectiveness of the education provided. AI and ML technologies can be leveraged to create culturally competent health education programs that are specifically tailored to the beliefs, traditions, and languages of different populations.

AI can analyze cultural data and tailor educational content accordingly. For example, in tribal or indigenous communities, where traditional health practices may coexist with modern medicine, AI could help design health education campaigns that integrate both approaches. Machine learning models can also help identify linguistic preferences, ensuring that health information is delivered in the native languages of the community, which increases accessibility and understanding.

Telemedicine and Virtual Health Education

Telemedicine, which utilizes technology to provide remote medical consultations and health services, is increasingly being used in health education. AI and ML are enhancing telemedicine platforms by enabling virtual health assistants to conduct health assessments, provide information, and even offer counseling sessions. These virtual assistants can guide patients through health education sessions, explain medical concepts, and answer questions in real time.

Moreover, AI can enhance telemedicine's effectiveness by analyzing patient interactions and

recommending personalized educational content based on the individual's health concerns. For example, a virtual health assistant in a telemedicine platform may analyze symptoms reported by a patient and provide educational resources about the condition, preventive measures, and treatment options. This real-time, interactive learning experience can improve patient understanding, self-management, and compliance with medical advice.

Overcoming Barriers to Health Education

AI and ML have the potential to overcome many of the barriers that limit traditional health education methods. One of the most significant barriers is the accessibility of information, especially in rural or underserved areas. AI and ML can help bridge this gap by providing digital platforms that deliver health education remotely, reducing the need for in-person visits and overcoming geographic barriers.

Another major challenge is health literacy, which affects many populations, particularly in low-income, rural, or marginalized communities. AI-powered tools can help address health literacy issues by using simple language, visuals, and interactive formats. For example, AI can generate easy-to-understand infographics or videos that explain complex medical concepts, making health education more accessible to individuals with lower literacy levels. Additionally, AI can adapt content to different levels of understanding, ensuring that information is both comprehensible and engaging.

Challenges and Ethical Considerations

While AI and ML offer many benefits, their use in health education also raises several challenges and ethical considerations. One concern is data privacy and security. AI models often require large datasets to operate effectively, and health-related data is particularly sensitive. Ensuring that patient data is protected and used responsibly is crucial to gaining the trust of users, particularly in communities that may already have a history of mistrust in healthcare systems.

Additionally, there is the risk of algorithmic bias. AI models are only as good as the data they are trained on, and if the training data is biased or unrepresentative, the resulting recommendations may be less effective or even harmful. Ensuring that AI systems are trained on diverse and representative datasets is critical to minimizing biases and promoting fairness in health education.

AI and ML have the potential to significantly improve health education by making it more personalized, accessible, and effective. These technologies can bridge gaps in healthcare delivery, particularly for underserved populations, by providing tailored health advice, real-time risk assessments, and culturally competent resources. However, the full potential of AI and ML in health education will only be realized if their ethical implications are carefully considered and addressed. With the right safeguards and continuous innovation, AI and ML can play a transformative role in advancing global health education, improving health literacy, and ultimately contributing to better health outcomes for all.

4. Case Studies and Real-World Applications

- Case Study 1: AI in Malaria Prevention in Indian Tribal Communities:

In India, where malaria is endemic in several tribal areas, AI models have been used to predict outbreaks and educate communities on prevention through mobile platforms. By analyzing environmental and health data, AI helps target health campaigns where they are most needed.

- Case Study 2: AI-Based Health Education in African Tribes:

In several African countries, AI-powered platforms have been used to deliver health education in local languages via mobile phones. These platforms focus on family planning, maternal health, and the prevention of communicable diseases.

- Case Study 3: AI and Traditional Knowledge Integration in Health Education:

In some Indigenous communities, AI technologies have been used to integrate traditional knowledge with modern medical information. This partnership fosters trust and improves the effectiveness of health education efforts, especially when navigating health beliefs that may differ from Western practices.

5. Ethical and Practical Considerations

The integration of Artificial Intelligence (AI) and Machine Learning (ML) in health education holds

immense promise for improving healthcare delivery and outcomes, especially in underserved or vulnerable populations. However, the use of these technologies raises a number of ethical and practical considerations that must be carefully addressed to ensure that they are used responsibly and equitably. These concerns include issues of privacy, data security, algorithmic bias, cultural sensitivity, access to technology, and the role of human oversight. This section outlines key ethical and practical considerations that need to be taken into account when applying AI and ML in health education.

1. Data Privacy and Security

One of the most significant ethical concerns when using AI and ML in health education is data privacy. Health-related data is highly sensitive, and the collection, storage, and sharing of this information must be handled with the utmost care to prevent misuse. Personal health information (PHI) is subject to strict regulations, such as the Health Insurance Portability and Accountability Act (HIPAA) in the U.S., which mandates that patient data must be protected from unauthorized access.

As AI and ML systems rely on large datasets to train models and provide personalized health recommendations, there is a risk that personal data could be exposed or exploited if not properly safeguarded. There are also concerns around secondary uses of data, such as selling it to third parties or using it for purposes other than the intended educational interventions. Ensuring that health data is anonymized, encrypted, and stored securely is essential to maintaining patient trust and upholding ethical standards.

2. Algorithmic Bias and Fairness

AI and ML algorithms are only as good as the data they are trained on. If the training data is unrepresentative or biased, the resulting models may perpetuate these biases, leading to unfair or harmful outcomes. In health education, this can be particularly problematic. For example, if an AI model is primarily trained on data from a specific population—such as individuals from urban, Western, or predominantly white backgrounds—its recommendations may be less relevant or even inappropriate for people from diverse cultural, ethnic, or socio-economic backgrounds.

Algorithmic bias can also occur if historical inequalities in healthcare are encoded into the data used to train the models. For instance, populations that have historically received inadequate or substandard healthcare may be underrepresented in health data, which can lead to AI systems providing suboptimal health education to these groups. To mitigate this risk, it is essential to ensure that datasets used for training are diverse, representative, and inclusive, covering various demographics, health conditions, and socio-economic statuses.

Additionally, ongoing audits of AI models should be conducted to detect and correct biases as they arise, ensuring that health education interventions are equitable and fair.

3. Cultural Sensitivity and Relevance

Cultural competence is a critical consideration in health education, especially in communities that have distinct cultural practices, languages, and beliefs about health. AI and ML technologies used in health education must be designed to respect and accommodate these cultural differences. Failure to do so can lead to health education materials that are irrelevant, disrespectful, or misunderstood by the target population.

For example, in indigenous or tribal communities, traditional health practices and beliefs may differ significantly from Western medical knowledge. AI systems need to integrate local cultural perspectives and health practices, providing information in ways that are meaningful and acceptable to these communities. Additionally, health education content should be available in local languages and tailored to the literacy levels of the population. Ensuring that AI-based health education is culturally sensitive is essential for fostering trust and engagement.

4. Digital Divide and Access to Technology

While AI and ML offer great potential to improve health education, their effectiveness is contingent on access to the technology required to use them. The digital divide—the gap between those with access to the internet, smartphones, and other digital tools and those without—remains a significant barrier in many underserved communities, particularly in rural, low-income, and developing areas.

In tribal or remote communities, where access to healthcare resources is already limited, the lack of reliable internet or smartphones can hinder the adoption of AI-driven health education tools. Even when individuals have access to the necessary technology, low levels of digital literacy or unfamiliarity with technology may prevent them from effectively engaging with AI-based health education platforms. For AI and ML solutions to have a meaningful impact, efforts must be made to ensure that technology is accessible, user-friendly, and affordable. This may involve partnering with local organizations to increase digital literacy and providing alternative solutions, such as offline apps or SMS-based systems for people without internet access.

5. Human Oversight and Accountability

While AI and ML can automate many aspects of health education, they should not replace human oversight. It is essential to maintain a balance between technological innovation and human involvement to ensure that the ethical and practical dimensions of healthcare are appropriately addressed. AI systems can provide recommendations, but health educators, medical professionals, and community leaders should play an active role in interpreting these recommendations and guiding the process of implementation.

For example, AI can suggest a personalized health plan based on an individual's health data, but a healthcare professional should review this plan to ensure that it aligns with the patient's clinical history, preferences, and values. Human oversight is also necessary to address unforeseen consequences or errors that may arise from AI-driven recommendations. This will help ensure that health education remains compassionate, accurate, and safe.

In addition, accountability mechanisms must be in place to ensure that AI and ML systems are transparent and explainable. If an AI system makes an incorrect recommendation or decision, it is important to understand how and why the algorithm arrived at that conclusion. This transparency is crucial for building trust with users and for ensuring that AI interventions are ethical and justifiable.

6. Sustainability and Long-Term Impact

The long-term sustainability of AI-driven health education initiatives is another practical concern. Implementing AI and ML in health education can be costly, requiring ongoing investments in technology, data infrastructure, and expertise. Ensuring that these systems are sustainable over time, particularly in resource-poor settings, is essential for maximizing their impact. This may require innovative funding models, partnerships with governmental and non-governmental organizations, and a focus on training local experts who can manage and maintain AI systems over the long term.

While the application of AI and ML in health education holds great promise, it is crucial to address the ethical and practical considerations involved. Ensuring data privacy, reducing algorithmic bias, providing culturally competent content, bridging the digital divide, and maintaining human oversight are essential for the responsible deployment of these technologies. By addressing these challenges, AI and ML can become powerful tools in creating more equitable, accessible, and effective health education systems that benefit all populations, including the most vulnerable and underserved communities.

6. Conclusion

The integration of Artificial Intelligence (AI) and Machine Learning (ML) into health education presents transformative opportunities to improve healthcare access, quality, and equity, particularly for underserved and marginalized communities. By leveraging the power of data analysis, personalization, and real-time interventions, AI and ML can make health education more relevant, tailored, and effective. These technologies have the potential to reach individuals in remote areas, personalize health recommendations, and break down barriers of language, literacy, and culture, thus improving health literacy and outcomes on a global scale.

However, the successful implementation of AI and ML in health education requires careful attention to several ethical and practical challenges. Data privacy and security must be prioritized to maintain trust and comply with regulations like HIPAA. The risk of algorithmic bias must be mitigated through diverse, representative datasets and continuous model evaluations to ensure that health education is equitable for all populations, particularly those historically marginalized or underrepresented in health data. Moreover, AI systems must be designed with cultural sensitivity to ensure that health messages resonate with and

respect local beliefs, practices, and languages.

The digital divide remains a significant obstacle, particularly in low-income, rural, and tribal communities where access to technology and the internet is limited. Ensuring that AI-driven health education tools are accessible, user-friendly, and compatible with the technological infrastructure of these communities is crucial. Additionally, human oversight is essential to ensure that AI-generated health advice is clinically accurate, culturally appropriate, and aligned with the individual's needs and preferences.

In conclusion, while AI and ML hold immense potential to revolutionize health education, their implementation must be approached with a mindful focus on ethical principles, equity, and accessibility. When designed and deployed thoughtfully, these technologies can significantly enhance health education efforts, empowering individuals to make informed decisions about their health and ultimately contributing to healthier, more resilient communities. The future of health education lies in the harmonious integration of cutting-edge technology and human-centered care.

References

[1]. Rowland SP, Fitzgerald JE, Holme T, et al. What is the clinical value of mHealth for patients? NPJ Digit Med 2020; 3 (1): 4.

[2]. WHO. The global strategy for women's, children's and adolescents' health,2016–2030. Secondary The global strategy for women's, children's and adolescents' health, 2016–2030. 2021. https://www.who.int/life-course/partners/global-strategy/global-strategy-2016-2030/en/. Accessed June 2021.

[3]. Jaysawal N. Rural health system in India: a review. Int J Res Health 2015; 3 (1): 29–37. Online First.

[4]. Kumar MM, Pathak VK, Ruikar M. Tribal population in India: a public health challenge and road to future.J Family Med Prim Care 2020; 9 (2): 508–12.

[5]. Kearns A, Hurst T, Caglia J, et al. Focused antenatal care in Tanzania. Secondary Focused antenatal care in Tanzania 2014.

[6]. Anya SE, Hydara A, Jaiteh LE. Antenatal care in the Gambia: missed opportunity for information, education and communication. BMC Pregnancy Childbirth 2008; 8: 9.

[7]. Ghosh-Jerath S, Devasenapathy N, Singh A, et al. Ante natal care (ANC) utilization, dietary practices and nutritional outcomes in pregnant and recently delivered women in urban slums of Delhi, India: an exploratory cross-sectional study. Reprod Health 2015; 12 (1): 20.

[8]. Arsenault C, Jordan K, Lee D, et al. Equity in antenatal care quality: an analysis of 91 national household surveys. Lancet Glob Health 2018; 6 (11): e1186–e95.

[9]. Yaya S, Uthman OA, Amouzou A, et al. Inequalities in maternal healthcare utilization in Benin: a population based cross-sectional study. BMC Pregnancy Childbirth 2018; 18 (1): 194.

[10]. Kumar G, Choudhary TS, Srivastava A, et al. Utilisation, equity and determinants of full antenatal care in India: analysis from the national family health survey 4. BMC Pregnancy Childbirth 2019; 19 (1): 327.

[11]. Chauhan P, Chauhan VK, Shrivastava P. Maternal mortality among tribal women at a tertiary level of care in Bastar, Chhattisgarh. Glob J Health Sci 2012; 4 (2): 132–41.

[12]. Narayan L. Addressing language barriers to healthcare in India. Natl Med J India 2013; 26 (4): 236–8. Online First: 2014/04/25].

[13]. Mahapatro M, Kalla A. Health seeking behaviour in a tribal setting.Health Popul Persp Issues 2000; 23: 160–9.

[14]. Some DT, Sombie I, Meda N. How decision for seeking maternal care is made: a qualitative study in two rural medical districts of Burkina Faso. Reprod Health 2013; 10 (1): 8.

[15]. Echoka E, Makokha A, Dubourg D, et al. Barriers to emergency obstetric care services: accounts of survivors of life threatening obstetric complications in Malindi district, Kenya. Pan Afr Med J 2014; 17

Suppl 1 (Suppl 1): 4.

[16]. Black RE, Victora CG, Walker SP, et al.; Maternal and Child Nutrition Study Group. Maternal and child undernutrition and overweight in lowincome and middle-income countries. Lancet 2013; 382 (9890): 427–51. 2013/06/12].

[17]. Verma R, Khanna P, Dhankar M. Vaccination during pregnancy: today's need in India. Hum Vaccin Immunother 2016; 12 (3): 668–70.

[18]. 18. Yaya S, Kota K, Buh A, et al. Prevalence and predictors of taking tetanus toxoid vaccine in pregnancy: a cross-sectional study of 8,722 women in Sierra Leone. BMC Public Health 2020; 20 (1): 855.

[19]. 19. Clark J. The global push for institutional childbirths—in unhygienic facilities. BMJ 2016; 352: i1473.

[20]. 20. Bashi N, Fatehi F, Fallah M, et al. Self-management education through mHealth: review of strategies and structures. JMIR Mhealth Uhealth 2018; 6 (10): e10771.

21. Kay M, Santos J, Mhealth TM. New horizons for health through mobile technologies. World Health Organization 2011; 64 (7): 66–71.