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Integrating Artificial Intelligence into Primary Healthcare Communication Systems for Effective Malnutrition Prevention: Insights from KAAP Among Nursing Mothers in Lagos

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ABSTRACT

The issue of child malnutrition in Nigeria remains unresolved, with high levels of stunting in children under-five and inconsistent feeding practices, even in urban centers like Lagos. Mothers are the main conduits between nutrition messages and actual child care; however, the messages conveyed at Primary Healthcare Centers (PHCs) have been shown to result in high surface level awareness without the necessary knowledge and practice. Therefore, the purpose of this study is to analyze the involvement of mothers in nutrition messages on malnutrition and identify areas where AI could be used to improve current communication process. The research uses the Knowledge, Attitude and Practice (KAP) model, which was extended by introducing an additional component of Awareness (KAAP) and theoretical approaches from the Social Cognitive Theory and Diffusion of Innovations to examine mothers' responses to malnutrition messages and explore the role of AI in communication improvement. A convergent parallel mixed-method design is used in the study. Quantitative data were gathered from 416 nursing mothers with children aged 0-5 years attending selected PHCs in three coastal Lagos communities. Qualitative data were gathered from in-depth interviews conducted with 23 health workers at selected PHCs. Data analysis involved using descriptive and inferential statistics and thematic coding. It was discovered that a high level of awareness is possessed by those mothers who visit PHCs on a regular basis due to health talks and growth monitoring. Nevertheless, the knowledge level was not high, as only 39.2% of respondents were able to define malnutrition and cultural beliefs regarding fontanelles, eggs and introduction of water were widely spread. Positive attitude, as well as trust to health workers, were found, although the practice was not always proper. It was discovered that education acts as a predictor of knowledge and practice. The operational difficulties are related to personnel shortage, lack of time, irregular supply of support regarding food demonstration and the fact that not all people come to PHCs. This study shows that PHC communication is successful in awareness building, although it is ineffective regarding knowledge building and practice. Regarding artificial intelligence, it can provide some practical solutions regarding maintaining communication after the clinic visit, personalized explanations concerning beliefs, certain reminders and prioritization of high-risk children as long as technology will not substitute the face-to-face communication and will be only an addition. The recommendations concerning the solution of this issue are related to maintaining interactive methods, such as food demonstration, piloting low-bandwidth AI reminders and culturally appropriate material. One of the recommendations was that the Primary Healthcare Centres need to

maintain and grow the interaction techniques that health care professionals believe are most effective, namely food demonstrations and individual counseling sessions.

Keywords:

Artificial Intelligence, Primary Healthcare, Health Communication, KAAP, Malnutrition, Nursing Mothers

Introduction

Nutrition-related issues in children remain a big danger to the lives of many children in Nigeria. The nutrition issues include poor immunity, stunted growth, and increased mortality rates amongst children below five years of age. Basically, malnutrition entails three different kinds of nutrition issues, including undernutrition, essential nutrient deficiencies, and obesity/overweightness. Despite the key role played by nursing mothers in ensuring proper feeding, the knowledge they have about good nutrition does not always result in proper actions. Primary healthcare centers remain the places where mothers are exposed to such knowledge as part of prenatal care, immunization, and growth-monitoring programs. The process by which they understand, interpret, and take action from such knowledge forms the basis of the knowledge awareness attitude practice (KAAP) research study. The seriousness of the problem can be illustrated by the fact that nearly half of all deaths amongst children below five years of age arise as a result of malnutrition (UNICEF, 2021).

Indeed, one can look back and note that the approaches adopted in tackling the problem of malnutrition among children have evolved slowly. The declaration of Alma-Ata in 1978 defined the need for primary health care to form a basis for an equal health care system and stressed the significance of community education (World Health Organization, 1978). Over the years, the Baby-Friendly Hospital Initiative called for the adoption of exclusive breastfeeding in the initial six months as an indicator (World Health Organization, 2020). Further initiatives involved the introduction of complementary feeding messages, vitamin A campaigns, and nutrition programs for mothers and children. Similarly, there have been improvements in the approach to communication that involve the use of

straightforward posters and radio jingles, moving to face-to-face interaction, drama among the communities and mother-to-mother clubs. This has officially been codified in the form of nutritional policies and programs conducted by community health workers in Nigeria, which engage directly with mothers (Federal Ministry of Health, 2017). One point that unites them all is that dissemination of information alone does not bring any behavioral change unless it is done in an appropriate cultural and linguistic context.

Times have changed, and the situation seems somewhat complex at the moment. First of all, stunted growth in children younger than five remains to be one of the major concerns in the country; this puts Nigeria in the ranks of countries with highest burdens in the world (UNICEF, 2023; National Population Commission & ICF, 2019). Secondly, there are cities in the country such as Lagos, which face the burden of malnutrition and obesity problems. The policies call for multisectoral approaches as well as for improving provision of services related to primary healthcare. The issue of technology is being considered as well as even the poorest people own cell phones nowadays. The use of technologies of artificial intelligence allows for providing personal information according to individual literacy, reminding, and helping identify mothers with children with early warnings. This method includes involving health professionals, who are respected and demonstrations that mothers can see and participate in. It becomes obvious that the existing situation is a result of the traditional interpersonal approach and emerging technologies being combined together.

Considering the above facts, the challenge of translating nutritional information into action by nursing mothers remains vital in the efforts to reduce child deaths in Lagos and elsewhere. Primary Healthcare Centers have managed to reach out to many women using various forms

of interaction while carrying out vaccinations and weighing activities. Some of the approaches adopted to convey this message include health talks, demonstrations of food and individual counseling sessions. Cultural factors, economic influences and sometimes personnel shortages continue to play a role in this regard. In the following research, data from selected Primary Healthcare Centers in the coastal and slum areas will be analyzed to bring out the current ways of reaching the nursing mothers with the information. The possibility of adopting artificial intelligence in the current communication channels to increase awareness will be considered.

Malnutrition in under-five children persists as a significant challenge in Nigeria and contributes to high morbidity and mortality. As per recent statistics, about one-third of under-five children suffer from stunting in the country, with additional cases of wasting and underweight (UNICEF, 2023; National Population Commission & ICF, 2019). In Lagos State, the situation is mixed but worrying, as 19% of under-five children suffer from stunting, 6% from wasting and 12% from underweight as per latest national survey figures. Nursing mothers in Primary Healthcare Centres receive frequent messages regarding exclusive breastfeeding, complementary feeding and good hygiene practices. Still, many of them have cultural beliefs that contradict these messages. For example, soft spots on the heads of babies are regarded as traditional ulcers; eggs and fish are avoided to prevent children from becoming thieves; and water and herbal drinks are given to children early as breast milk is believed to be insufficient. What is remarkable is that there is a huge difference between high surface knowledge and deep knowledge or regular practice of the messages conveyed. Approximately 39% of mothers in the settings of the research could correctly explain the concept of malnutrition, yet harmful feeding practices still prevailed. A limited number of staff, mothers' hurry, insufficient budget for demonstrating how to prepare food, and an inability to communicate with non-attending mothers additionally limit the effect of the messages being sent.

The desired state of affairs is when messages lead to correct understanding of malnutrition, a positive attitude toward prevention measures, and reliable practices that protect children from the disease. The current state does not satisfy the criteria. These shortcomings have serious implications. Children are still at risk of stunted growth and increased vulnerability to diseases, whereas health workers have to make do with limited time and resource constraints. With no clear evidence on the actual interactions between nursing mothers and malnutrition communication messages from PHCs, and also with no mechanisms of bridging the existing gaps, interventions may fall short. This research is therefore aimed at filling the gap between the existing KAAP level and the desired behavioral change.

The objectives of the study include:

1. To assess the overall Knowledge, Awareness, Attitude, and Practice (KAAP) of nursing mothers toward malnutrition messages in selected Primary Healthcare Centres in Lagos State.
2. To identify the gaps and challenges in current PHC communication strategies for delivering malnutrition messages.
3. To explore how Artificial Intelligence can be integrated into PHC systems to address KAAP gaps, overcome barriers, and improve nutrition communication outcomes.

REVIEW OF RELATED LITERATURE

The Burden of Child Malnutrition and the Role of Nursing Mothers

Malnutrition among children remains one of the major challenges affecting the survival and development of children in LMICs. According to Black et al. (2013), undernutrition has been identified as causing about half of the deaths occurring among children below five years of age. This finding has continued to inform the global mortality estimates to date. In Nigeria, this problem is particularly prevalent. According to a study by Fadare et al. (2019), mothers' knowledge about nutrition has been found to be related to better growth results in their children, but most of them lack correct knowledge on nutrition. Examining this issue in the urban context, Olatona et al. (2019) revealed

that even when the health facilities are readily available, knowledge, attitudes, and practices related to the prevention of malnutrition in mothers in the slums of Lagos remained suboptimal.

The Knowledge, Attitude and Practice (KAP/KAAP) Framework in Nutrition Research

KAP approach has developed into an effective instrument in examining health behavior. As pointed by Launiala (2009), the KAP survey may often oversimplify social and cultural aspects that affect decision-making; however, it serves as an efficient method to determine the differences between awareness and real action. Similar to the study of health-related issues, the KAP framework enables to detect the level of knowledge of the symptoms of improper development of children among mothers, attitudes towards recommended food and their conversion into daily practices. Gebremichael et al. (2021) have used the similar methodology in the rural area of Ethiopia and found out that numerous mothers had a lack of knowledge about nutrition steps. It is no less relevant in Nigerian studies. What is common in all the mentioned works is the idea that mere awareness does not ensure correct practices when culture and family context are taken into account.

Existing Evidence on Maternal Knowledge, Attitudes and Practices in Nigeria

This conflict has been observed by researchers from Nigeria on several occasions. For instance, in the findings of Udoh & Amodu (2016), the deficiency in translating the information on nutrition into practices was noticed among women. Also, according to Adebayo et al. (2021), there have been found deficiencies in communication strategies, which do not account for the literacy and cultural needs of Nigeria. According to Ogunba et al. (2021), even the health workers themselves need resources and education to make their counseling at Primary Healthcare Centers effective. Moreover, Olatona et al. (2019) note that relatives and neighbors may be more convincing when discussing food taboos in informal conversations. These examples demonstrate how complex the information

environment of the breastfeeding mothers is. Cultural beliefs serve as a persistent barrier in the process of obtaining accurate information. According to several researches conducted in Nigeria, it was found that mothers are convinced that the presence of a fontanelle indicates an ulcer or the lack of proper nutrition, as well as giving eggs and fish to the child will make him/her steal. Thus, mothers use herbal remedies rather than altering their diet. During the study carried out by Shapu et al. (2020), there have also been revealed such results concerning adolescent females in northern Nigeria. According to the research by Starkweather et al. (2020), it has been proved that nutrition-based programs can positively influence knowledge of the mother and her feeding practices, yet, as noted by the authors, the efficiency of these programs relies on the family/household situation. It turns out that effective communication takes place only when it is related to the social circle of the individual.

Communication Channels and Strategies in Primary Healthcare Centres

The channels of communication have also received attention. In particular, the research carried out by Ajani et al. (2018) has emphasized the typical combination of posters, health talks, drama within communities, and direct communication that represents the channel of communication of public health in Nigeria. According to Ekanem (2020), the majority of these methods do not include any localization and have an inconsistent implementation. Previously, Hornik (2002) stressed the importance of implementing different reinforcing methods of communication channels instead of focusing on just one channel in public health communication. The Lagos case shows that Primary Healthcare Centers are the consistent channel of communication between nursing mothers regarding antenatal visits, immunization, and growth monitoring of children. Nonetheless, understaffing and time restrictions influence the degree of messages implementation and follow-up. It can be said that all the data collected represent the efficient channel of communication that reaches numerous nursing mothers with basic

information but does not include any reinforcement after they return home. These tendencies characterize the background for the understanding of the opportunities and drawbacks of current methods. The high level of awareness corresponds to the lack of full knowledge and inconsistency in practice.

Socio-demographic and Operational Influences on Message Effectiveness

It would seem that the problem of education is a key factor in the interpretation by lactating mothers of nutritional recommendations. Higher educated women are more likely to understand the language used in science and also to state their adherence to the given recommendation. In their study, Akinyemi et al. (2020) proved that maternal education is one of the strongest factors affecting children's wellbeing in Nigeria. The current data supports the trend since the level of knowledge and practice rises significantly after controlling for literacy and education, but not for age. Poverty may restrict the effect of the most rational decision making. Practitioners in Lagos clinics have given some examples of women agreeing to the recommendation and being unable to buy it owing to economic difficulties or focusing on other people in the family rather than the youngest child. It should be understood that information is only one aspect of a broader picture.

Participatory techniques have been noted to be more useful compared to one-way communication. Sessions that demonstrate food preparation by mothers and watching their kids eat the meals prepared from locally available inexpensive ingredients always receive acclaim from health care workers. Counselling on a one-on-one basis, especially where there is malnutrition, gives chance for a discussion about home situations. Health talks during vaccination days still bring the largest crowds and raise surface level knowledge due to constant repetition. According to Starkweather et al. (2020), interpersonal nutrition education campaigns were more successful in raising awareness and feeding behaviors where there was provision of explicit information and person-to-person interactions. These conclusions are confirmed in Lagos: mothers

react better where there is something tangible. Posters and leaflets play supplementary roles; without them there is no change in behavior.

Emerging Digital Tools and the Potential of Artificial Intelligence

The digital medium has started infiltrating this scenario as well. While mobile phones have become widespread in even poor areas of Lagos, they open up many options like reminder messages, voice notes in local languages and chat-based assistance. It was stated as far back as Hornik's (2002) time that there is power in reinforcement in public health communication across different channels. Reminders that echo the information delivered at the clinic align well with that theory and have already proven their statistical connection with comprehension and usage in quantitative findings. Levels of literacy, the number of kids and language preference can be utilised for personalization to minimize the dissonance between standardized messages and the true state of affairs of the individual. Diffusion of innovation as per Rogers (2003) states that innovation will be more quickly accepted if it is compatible with existing values and has relative advantage.

There is another dimension of artificial intelligence to consider. Predictive modeling could highlight women whose babies exhibit early signs of malnutrition to prioritize follow up. The natural language generation would develop culturally appropriate stories based on myths regarding eggs, fish or fontanels. The decision support dashboard would help overworked nurses to keep track of the messages that have been sent to each woman. None of these technology implementations eliminate the need for human intervention – they serve to extend limited staff resources to mothers who do not normally get seen at clinics. Bandura's (1986) social cognitive theory emphasizes that behavioral change involves both knowledge and self-efficacy. AI solutions providing recurring and personalized motivational messages, along with some actual clinical examples, could prove useful in developing this self-efficacy. The literature review gives us the picture of the communication context showing high levels of

surface knowledge but not being able to move on to deeper knowledge.

Theoretical Framework

The research is built mainly on the Knowledge, Attitude and Practice (KAP) model. It considers knowledge as the base, attitude as the link, and practice as the result of behaviour. Launiala (2009) observed that KAP studies may oversimplify the complicated realities of society; however, it is still effective for illustrating the areas in which message success or failure can be mapped out. In the case of nutrition, KAP is used to indicate whether mothers know what malnutrition is, how they perceive the feeding methods, and how they practise them. This research employs the same process to evaluate nursing mothers' reaction to malnutrition messages in Lagos PHC.

The social cognitive theory provides the second helpful perspective. According to Bandura (1986), individuals are not only exposed to the transfer of knowledge but also learn by observation, by their experience, and by having faith in their own ability to succeed. The food demonstrations, which involve the mother witnessing and participating in meal preparation, correspond to this definition of observational learning. The one-on-one consultations, taking into account the specific circumstances of a particular mother's family, can help to increase her self-efficacy. The diffusion of innovations theory introduces another component. As Rogers (2003) has stated, innovations tend to diffuse better when they are compatible with the prevailing values, easy to comprehend and possess obvious advantages. Nutrition messages based on locally grown foods and local languages satisfy the condition of compatibility. The messages that disregard culturally significant beliefs regarding eggs, fish, or the fontanelle encounter opposition. Digitisation that allows sending individual reminders can provide the relative advantage of the recommended practices through their constant presence outside the clinic visits. These are the three perspectives from which the present communication model and the possible role of artificial intelligence can be analyzed.

METHODOLOGY

The methodology of the study employed was that of convergent parallel mixed-methods approach. Data was collected simultaneously for both approaches and eventually combined for a better understanding of the ways in which nursing mothers respond to malnutrition information. Data was collected from 11 Primary Healthcare Centres within three coastal Lagos communities of Apapa, Ajeromi-Ifelodun, and Somolu. This selection of communities was made because they represented all the three senatorial districts and shared common socio-economic characteristics. One more center was unable to be included in the study owing to logistic barriers such as crossing the waters. The quantitative sample consisted of 416 nursing mothers with children in age groups of 0 to 5 years accessing any of the centers for either antenatal, postnatal or immunization purposes. In addition, the qualitative part of data collection was conducted using in-depth interviews involving health workers who were strategically selected due to their direct involvement in nutrition education programs.

The questionnaire for assessing awareness, knowledge, attitude, practices, demographic variables and communication strategies was the key quantitative tool. Interviews delved into these areas, but as viewed by the health professionals. The ethical clearance for this study was secured from the Lagos State Primary Health Care Board, while permission was sought from each LGA. Research assistants, familiar with Yoruba and Pidgin English, helped some mothers to complete the questionnaires. Quantitative data analysis involved descriptive statistics, multiple regressions and one-way ANOVA, while qualitative data coding was done in response to the research questions. Qualitative data was thematically coded and categorised according to the research questions. Finally, the two streams were merged to bring out areas of convergence and divergence.

Data Presentation, Analysis and Discussion **Overall levels of Knowledge, Awareness, Attitude, and Practice (KAAP)**

Results of the mixed methods study indicate the existence of a consistent trend among the 416 nursing mothers. These included high levels of awareness on malnutrition messages, low levels

of knowledge, positive attitudes and inconsistent practices.

Table 1: Summary of KAAP Levels Among Nursing Mothers

Dimension	Key finding	Approximate level
Knowledge	Correct definition or description of malnutrition	39.2 %
Awareness	Most mothers had heard the main messages	High (majority)
Attitude	Trust in PHC messages and perceived relevance	Predominantly positive
Practice	Consistent application of recommended feeding and hygiene	Mixed / partial

Source: Field Survey 2025

According to the findings by health workers, there was the high surface level of awareness among frequent clinic attendees. According to a nurse from Ohekenu PHC, "I would say that is like 90 percent aware, especially in this Lagos... 90 percent of the mothers are aware of malnutrition" From Ijora PHC, "There is no day they come here for their immunization that we don't give them health talk."

Knowledge gaps were greater. Cultural perceptions were responsible for shaping knowledge. Health professionals have also mentioned mothers' perceptions regarding sunken fontanel as being due to cultural conditions, and many mothers were still refusing the use of eggs and fish among other foods due to their fears since ages. Level of education proved to be an important predictor of good knowledge and practice. Attitude of the people were found to be favorable towards the services provided to them. Majority of mothers expressed their trust in the information provided by the PHC staff. However, the practice varied the most among all domains. Exclusive breast feeding was very common during the early period; but early introduction of water and herbs and poor diet diversity after six months were common practices.

Gaps and challenges in existing PHC communication strategies

The interviews of the healthcare workers brought to light similar issues in practice and society which hinder the effectiveness of existing malnutrition communication programs at the chosen Primary Health Care Centers. Lack of manpower proved to be a recurring issue. Most centers had very few nurses (one or two) taking care of many mothers. This reduced the

time available to discuss matters of health in detail and counsel the individuals. This is highlighted by the worker from Bajulaye who remarked, "The only thing when they come for the immunisation is that we do give them health talk on malnutrition... That's where we get them." The time constraint from the mothers further complicates the issue.

They have the mindset that they will only get services like immunization and thus do not have patience to stay longer and listen. Discussions on health issues are either terminated or carried out when the mothers are preparing to leave. There are practical methods of training that face some challenges. Training through demonstrations of cooking was among the most recommended methods of training mothers in preparing healthy but affordable foods. This training method faces limitations of resources. Where resources are available, it succeeds, but where they are not, it fails or is postponed.

It has very little impact on others outside the normal users of the clinics. These are the mothers who live far from the clinics, cannot afford the cost of transport or those who do not attend the clinics are left out of this process of education that improves the awareness level of normal attendees. This is how an interviewee from Akere described this situation: "If there is a red case it simply shows that perhaps this individual has never had her child vaccinated since she is outside." (AKR 003). The problem of language and illiteracy also makes poster and written material less effective. Moreover, the older generation, particularly mother-in-law, tends to override the advice given by the health workers at the clinics such as avoiding herbal concoctions, proteins and water

Table 2: Main gaps and challenges reported by health workers

Challenge	Description	Frequency in interviews
Staffing shortages	Few nurses handling large caseloads	Very common
Time pressure	Mothers eager to leave quickly	Very common
Limited funding for practical teaching	Irregular supplies for food demonstrations	Common
Limited community reach	Non-attenders remain outside the system	Common
Cultural and family influence	Home advice often contradicts clinic messages	Common

Source: Interview 2025

Leveraging Artificial Intelligence to address the identified gaps

Some of the areas in which AI could support the existing efforts in the field of PHC based on the KAAP model and the issues raised are as follows. One obvious use of AI is through the expansion of interaction beyond the short period of clinic visits. The mothers usually get the message at the clinics during the immunization or weighing of the children, but they tend to leave fast without getting much assistance at home. Automated and language-dependent messages sent to the mother via SMS and voice notes will be very helpful in reinforcing the message. This reminder may be related to the age of the baby, like encouraging the mother to give complementary food to the baby when he/she is six months old. Since all the past interaction is saved by the computer, no extra time of the staff is needed.

Another potential opening area involves the existing knowledge gaps in spite of good surface

awareness. Beliefs regarding fontanelles, eggs, fish and sufficiency of breast milk are still influential on nutrition practices. AI software solutions can be developed to predict such issues and provide concise answers recognizing cultural beliefs and recommending better solutions at the same time. The availability of such information in simple language, including Pidgin, would decrease the burden on health care professionals to address similar misconceptions over and over again. Another opening involves understaffing and the difficulty of communicating with non-attendees. Machine learning algorithms utilizing data from clinic visits combined with a few basic indicators may help to recognize those infants who are most likely to develop further problems in the future, so that follow-ups will be more targeted. Another solution might be chatbot interfaces available via simple phone applications for mothers who do not visit the center regularly.

Table 3: Linking observed gaps to potential AI support

Observed gap	Potential AI contribution
Thin knowledge despite high awareness	Personalised explanations that address common local beliefs
Limited reinforcement after clinic visits	Automated, timed reminders in everyday language
Staff shortages and rushed encounters	Risk-flagging tools to prioritise follow-up
Weak reach beyond regular attenders	Simple chatbot access for non-attenders
Uneven translation into practice	Age-linked prompts that support day-to-day feeding decisions

This technology is not going to take away from the necessity for personal counseling that is relied upon. The food demo, the talk, and the human interaction between the nurse and the mother play an important role. What technology such as AI can offer is the chance to stretch out the human touch even further and make sure that the information remains accessible even when the doors to the office are closed.

Overall KAAP levels

There is an extremely high level of nutrition awareness regarding nutrition messages among the mothers who regularly visit the centers. The health professionals have been consistent in noting that the mothers learn about these nutrition messages when they visit on days of immunization, weighing, and antenatal clinic services, and most of them can recall the nutrition messages vividly. This is in agreement with previous studies conducted in Lagos and Nigeria, where most of the mothers who visited the clinic facilities knew about exclusive and complementary breastfeeding (Olatona et al., 2019; Flax et al., 2022). It was only about 39 percent of the mothers who could give the correct definition or description of malnutrition. Beliefs about the fontanelle as “ulcer,” concerns about the fear that eggs and fish will cause a child to become a thief, and the belief that breastmilk is never enough on its own have continued to influence mothers’ understanding of these messages. Such misconceptions are common in other areas of West Africa (Gebremichael et al., 2021; Shapu et al., 2020).

Most attitudes toward the messages are positive. Mothers have greater faith in the information provided by the PHC staff than in any other informal source. That’s a great place

to start. Nonetheless, it is not universal. There is an abundance of exclusive breastfeeding in the early months of a child’s life, but early introduction of water or herb drinks and low food diversity after the sixth month of age is also prevalent. It was demonstrated that education of mothers had a significant role in both feeding knowledge and practice, similar to previously conducted research in Nigeria (Fadare et al., 2019; Akinyemi et al., 2020). In this case, the KAAP framework will help analyze the situation: awareness exists, but there is no link between it and knowledge and practice due to cultural or home influences.

Gaps and challenges in current communication strategies

A number of operational limitations were identified through discussions with the health care practitioners. Limited staffing is an issue where most health centers run on only a few nurses who attend to many mothers. Time is always limited as the mother comes to get vaccines for her children and leaves when she has received them. Demonstrations with food are believed to be one of the best ways to educate the mother but there is no constant supply of food and funds. It gets harder to approach other people than those who visit these health centers. The children who are most affected by malnutrition problems have mothers who never visit these health centers. Language limitation renders posters ineffective while mothers in law ignore the advice given in the clinic once the woman leaves.

Such constraints have been observed before in studies conducted within primary health care facilities in Nigeria. As pointed out by Ogunba et al. (2021), limited availability of resources and training is detrimental to counselling

effectiveness. According to Adebayo & Akinwumi (2020), communication barriers resulting from lack of appropriate matching of language and culture were also identified. Okafor & Uzochukwu (2019) indicated that informal networks still play their role by spreading inappropriate feeding concepts. Current research provides additional insights into such dynamics taking place in coastal Lagos PHCs.

Leveraging Artificial Intelligence to address the gaps

The combination of the KAAP model and the problems involved reveals some possible approaches through which AI could help improve current efforts without replacing the interpersonal relationship at the heart of the program. Reminders in the appropriate language, delivered by an automated system, could ensure the important messages are not forgotten during the brief time spent at the clinic, assisting in making the crucial leap from knowledge to action. This is consistent with research that shows the value of scheduled digital reminders in ensuring adherence to appropriate feeding practices (Flax et al., 2022; Starkweather et al., 2020). Prediction instruments for children who are at higher risk may assist overworked staff to prioritize follow up, an approach that has proven very effective in other parts of Africa (Ferguson et al., 2025). What makes the results stand out in particular is the focus on cultural adaptation. Since lack of information is often due to local beliefs, systems that can take these into account and provide solutions that are both respectful and pragmatic might be able to avoid repetitive correction. Access to a chatbot through regular phones would allow mothers who visit the centre infrequently to pose their queries. None of these technologies are intended to do away with one-on-one counseling and food demonstrations. They are rather meant to stretch limited human resources, maintain accurate information between visits, and draw attention to the marginalized mothers and children. There are multiple practical implications of these findings. Managers in PHCs in Lagos should ensure sufficient time and funding are available for methods that already work

effectively, namely food demonstrations and individual counseling. People researching digital health should have a list of priority criteria, which include follow-up reminders outside the consultation room, the use of plain language, predicting prevalent beliefs in the area, and assisting busy workers in identifying at-risk children. As far as policy is concerned, the development of AI to assist with communication in nutrition will be effective only if it is done in line with PHC practices.

CONCLUSION

This research aimed at evaluating the knowledge, awareness, attitude, and practice of lactating mothers regarding malnutrition awareness messages in selected Primary Healthcare Centers in Lagos State, to evaluate current approaches to communication in relation to malnutrition and how AI could contribute to addressing any gaps in such approaches. It is evident from the results obtained that regular attendees of the centers have been able to be aware of the messages and hold positive attitudes towards the information given to them. However, it is clear that knowledge is not completely accurate, while practice is hindered due to economic constraints, family pressures, and limitations of the centers themselves. Health workers admit that there are a number of constraints which limit their efficiency.

The KAAP model helped in understanding the trends. It highlights the strengths of the awareness-to-practice chain and its areas of weakness. Furthermore, it serves as a base to identify opportunities for carefully designed artificial intelligence technologies that can contribute to the following areas: expansion of the reach beyond the visit, providing culturally appropriate explanations of common myths, timely alerts based on the age of the child, and assisting in prioritizing high-risk patients.

RECOMMENDATIONS

Based on the findings, some recommendations are put forth.

1. The Primary Healthcare Centres need to maintain and grow the interaction techniques that health

care professionals believe are most effective, namely food demonstrations and individual counseling sessions.

2. Artificial intelligence tools can be introduced starting with low-bandwidth options like automated alerts and simple chatbots in English, pidgin, and the major local languages.
3. Content needs to be developed with the participation of health professionals and community members in order to anticipate existing cultural beliefs that conflict with clinic advice.
4. There is great need of artificial intelligence (AI) integrating into primary healthcare (PHC) communication systems as it helps improve malnutrition prevention by enabling early risk detection, automating dietary assessments and as well help in delivering tailored community education for all.
5. With full integration of AI into primary healthcare (PHC) communication systems many benefits will be realized such as streamlined communication, automated dietary assessment and personalized interventions.

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