Assessment on Adoption Behavior of First-time Mothers on the Usage of Chatbots for Breastfeeding Consultation

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Abstract

In today's world, there is more reliance on technologically advanced systems and artificial intelligence (AI) to shoulder the work-related commitments of individuals, corporate giants, government, or businesses. Artificial intelligence refers to the human-like intelligence exhibited by a computer, robot, or other machines (www.ibm.com). Many high-tech advancements in the field of healthcare are all due to improvements and evolutions in AI. Moreover, an AI-powered chatbot swiftly responds to all the queries; reducing the lag time and other hindrances. They have become real-time healthcare assistants, bringing about revolutions in the healthcare industry. The future belongs to AI-enabled technologies and henceforth, leading to an increased importance of the introduction of this kind of technology in the public health sector also. An important constituent in the public health sector is a maternal issue like breastfeeding. There are several challenges, doubts, hesitations, and skepticism that new mothers face while breastfeeding their kids. Along with facing postpartum depression, several new or first-time mothers have limited knowledge about breastfeeding. This paper focuses on the usage of AI-enabled chatbots that educates first-time mothers regarding anxiety, stress, postpartum depression, and lactation patterns. The paper gives an insight into the adoption behavior of new mothers using chatbots related to breastfeeding counseling. The authors have gone thru 85 peer-reviewed papers published between the years 2002 and 2020 and found this research to be one of its kinds in this sphere. The study includes the population of new mothers from the city of Amritsar and Jaipur, India, and gives solutions with respect to problems and doubts pertaining to breastfeeding the newborn.

Keywords: Artificial intelligence in Healthcare, Chatbots, Postpartum depression.

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Introduction

Breastfeeding is regarded as a sacred and the most natural way of protecting and nurturing infants in India. WHO recommends breastfeeding to be done for the initial 6 months of a baby's life followed by additional semi-solid foods to complement it in the later stages of life. It is believed that an infant should be breastfed for at least 2 years of his initial life for developing a good immunity as well as to protect a baby from malnutrition.[1] It is a general belief that says that a mother's milk has certain enzymes that act as catalysts to promote the healthy brain and body development of an infant. In many sectors in India, people believe that breastfeeding in early childhood is important yet, the percentage of women that breastfeed is abysmally low and the resulting outcome that is malnutrition in children is extremely high. Only one out of four mothers can start breastfeeding within 1 hour of giving birth and less than half of all mothers can exclusively breastfeed their babies for the first 6 months after birth (WHO) (https://www.who.int/health-topics/breastfeeding). Nursing an infant is considered more of pressure rather than a mother's duty. For the first few days, people prefer giving water or honey from a sacred temple in the vicinity to a newborn. At times, people in the rural as well as urban areas feed the infant, cow's milk. In the urban areas, mothers shy away from breastfeeding because they think that it will ruin the shape of their breasts and many a time, working mothers do not have adequate time. Breastfeeding Promotion Network of India (BPNI) an NGO suggests that many baby food manufacturing giants are extensively promoting supplementary baby food, thus misleading the mothers and undermining breastfeeding practices.

In lieu of all the challenges and problems being faced, the concept of a chatbot that helps new mothers is very much in demand these days.

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The usage of chatbots in different spheres of life is significantly on the rise for a few years. Chatbots are already being used widely in different parts of the world for the expedition, support, and improving numerous processes in different industries example, retail, and now, this technology is gaining traction in health care, where it is helping patients and providers perform a plethora of tasks.

For clinicians, chatbots can reduce and streamlining the work burden substantially. Chatbots are helping provide electronic data records by reducing the constant fatigue and burnout due to overwork and over documentation. The information shall be intact and there shall be less distraction ultimately providing them to focus on their areas of expertise with more efficiency.

Literature of Review

Promotion and support of breastfeeding need to be considered in planning and education of breastfeeding practices.[2] Garg et al. concluded in their study health education on breastfeeding remains in the dark area and should be promoted by health

workers, and Divyarani et al. stated that the majority of mothers had inadequate knowledge and improper technique used for breastfeeding and Binns et al. study revealed that the needful information of the breastfeeding practices and benefits can be conveyed to the community with the help of chatbots.[3–5] Aruldas et al. revealed in their study that chatbots and technology can reduce the mortality rate by 20%, and early breastfeeding with good breastfeeding skills positively influence the practice of exclusive breastfeeding.[6] Javaid et al. and Patel et al. suggested that technology and chatbots can help in filling the gaps through video learning tools.[7,8] Weekly cell phones counseling and structured text messages are effective in improving breastfeeding indicators, but it increases the workload on healthcare workers so, the latest study Miner et al. concluded that chatbots if perfectly designed and deployed, could help by sharing information about breastfeeding, encouraging desired health impacting factors, and improving health indicators.[9] Paneru mentioned that lactating mothers were found unnourished leading to an increase in the mortality rate due to lack of resources and money and hence, chatbots have the potential to guide them and establish communication with them.[10] According to the studies conducted by Sisk et al., counseling of VLBW infants increases the incidence of lactation initiation and breastfeeding without maternal stress and anxiety.[11] Phukan found that the timely initiation of breastfeeding is beneficial for the child's survival within the first month of birth, it decreases the mortality and efforts should be taken for effective policy on early breastfeeding initiation.[12] Green et al. suggested that chatbots have a great potential to address the large gap that exists in many resources and have the potential in addressing breastfeeding challenges.[13] Kaur concluded that the services offered by the chatbots are safe and feasible for pregnant women or new mothers. In her study, she also emphasizes the promotion and sustainable breastfeeding practices among working women, adequate maternity leave, flexible working hours, and provide some spaces for breastfeeding at the workplace.[14] Murali mentioned that chatbots offer an effective, safe and, non-judgmental medium for getting information about breastfeeding but there is a speech constraint because women are hesitant to talk in front of men's voices. He suggested various video programs for easy implementation of these policies. Various interventions support breastfeeding including primary care specialists. He concluded in their study that; breastfeeding is increasingly equated to ideologies of the "good mother" in our society in response to a growing body of evidence identifying its benefits.

Huller concluded in his study that, the human resource crisis is widening worldwide, and it is obvious that it is not possible to provide adequate care without a workforce. He suggested that breastfeeding promotion should have a public health focus, focus not only for mothers but also for the community. Felix et al. suggested that promoting breastfeeding by midwives and nursing up to 6 months of age can help prevent childhood diseases and disorders, it should be an effective strategy to prevent malnutrition in the country.[15]

Gaps in Literature

The authors found no evident study which considers these challenges as a whole, the authors took only one parameter in the study but after reviewing the literature they found that all these challenges are correlated to each other and so they want to cater to these seven challenges in this study (i.e., education, formula use, anxiety, stress, counseling, breastfeeding practices, and post-partum depression) by identifying the knowledge, perception, and attitude of breastfeeding mothers and the usage of chatbots as a solution of these challenges.

The authors did not find any study on the adoption behavior of chatbots in breastfeeding promotion programs and breastfeeding counseling. The authors also could not find sufficient literature on the usage of chatbots in the healthcare domain because chatbots is a new concept and there are very few articles are published in the tech-enabled counseling of breastfeeding.[16–28]

RESEARCH QUESTION

What is the adoption behavior of first-time breastfeeding mothers on the usage of Chatbots for breastfeeding consultation?

AIM AND OBJECTIVE

To assess the adoption behavior of first-time mothers on the usage of Chatbots for breastfeeding consultation.

MATERIALS AND METHODS

The purpose of this study is to know:

- The behavior of first-time breastfeeding mothers of two Indian cities, i.e., Jaipur and Amritsar.
- To understand what major types of problems first-time mothers are facing and their feedback on the use of breastfeeding chatbots for their help.

RESEARCH APPROACH AND RESEARCH DESIGN

The respondents include the new mothers (first-time mothers) who were interested to co-operate. To collect the data, we prepared a structured questionnaire and adopted the telephonic interview method for interviewing the mothers.

The research design of the study is a quantitative observational design. The sampling technique adopted is convenient. The sample consists of 125 respondents.

Primary Data

The setting selected was to Indian cities namely, Amritsar and Jaipur, and the population consisted of first-time mothers. The telephonic interview method was used for the survey. The tool is a questionnaire with each question having five options where the respondents have to tick the most appropriate answer for the question. Data were collected with the help of a validated telephonic interview schedule. The data thus collected were analyzed using Tableau for appropriate graphical presentation. Important aspects of biographical information of the respondents like name, age, and education were not included in the interview schedule, all the data collected were kept confidential under ethical considerations. Further 5-point Likert scale was converted into a 3-point Likert scale for the analysis. Questionnaires were administered among the new mothers and the 3-Likert scale weightage was given to 25 questions out of 100 (which is assumed) based on their type- (strong-correlation, Mediocre, Dummy questions). Conversion of Likert scale to weights was done by taking reference from the various literatures.[29] After the weightage to the question, the conversion of weights to ranges was done (positive, negative, neutral).

Positive ranges from 40.54 to 53.5
Neutral ranges from 27.57 to 40.53
Negative ranges from 14.6 to 27.56 and data analysis was adopted to understand the variables defined.[29]

Secondary Data

Extensive secondary research was carried out to understand the adoption behavior of breastfeeding mothers on the usage of chatbots and challenges faced by them during breastfeeding. Sources of data include a public database of previous studies done, journals, different search engines like—Google Scholar, PubMed, Research Gate, and various blogs. The authors picked up 85+ peer-reviewed papers (published during the last 18 years) on public health, artificial intelligence (AI) and healthcare analytics, the psychology of breastfeeding mothers, etc.

The information about the breastfeeding chatbot technology given by IIT, Delhi was obtained as secondary research data to build the foundation of our primary research.

Variables

Dependent Variable

Knowledge and perception of breastfeeding mothers on using chatbots.

Independent Variables

Challenges faced by the breastfeeding mothers, psychology of breastfeeding mother.

Mediating Variable

Breastfeeding Chatbots

Hypotheses

Ho: Adoption behavior of breastfeeding mother on using chatbots for breastfeeding consultation is positive.
Ha: Adoption behavior of breastfeeding mother on using chatbots for breastfeeding consultation is not positive.

ANALYSIS

Finding suggests on a survey to assess the adoption behavior of breastfeeding mothers on the usage of chatbots for breastfeeding consultation in two cities of India (Amritsar and Jaipur) is that out of total 125 participants, 95 mothers showed a positive response on using chatbots, 28 mothers gave a neutral response and the remaining 2 mothers showed a negative response (Fig. 1).

According to State-wise Data

Respondent city	Positive	Neutral	Negative
Amritsar (63)	34	27	2
Jaipur (62)	61	2	0

Findings prove that the stated hypothesis and mother's behavior toward the usage of chatbots. The survey proves three different assumptions with the following results:

- **Positive response** of breastfeeding mother behavior on adoption toward the usage of Chatbots is **76%**.
- **Neutral response** of breastfeeding mother behavior on adoption toward the usage of Chatbots is **22.4%**.
- **Negative response** of breastfeeding mother behavior on adoption toward the usage of Chatbots is **1.6%**.

Seventy-six percent of the mothers showed positive behavior on the adoption of chatbots. It shows that there is a strong motivation that pushed them to use chatbots followed by a curiosity of adopting a completely new technology among them and only 1.6% of the mothers showed a negative behavior toward the adoption of technology.

The results signify that the null hypothesis (Ho) is not rejected. This result shows a clearly positive behavior of breastfeeding mothers on the adoption of the usage of chatbots for breastfeeding consultation.

(A question wise analysis has been done separately in the annexure of the paper).

RESULTS

It is observed that the adoption behavior of breastfeeding mothers on the usage of chatbots as according to the survey done in the two cities of the two different states (i.e., Jaipur and Amritsar) is positive. Weightage analysis shows that the null hypothesis (H_0) is not rejected (Fig. 2).

$H_0 > Ha$

Response	Count
Positive	95
Neutral	28
Negative	2
Total	125

The above table revealed that out of the 125 participants, 95 breastfeeding mothers would like to adopt the breastfeeding chatbots, 28 out of them were given neutral responses and only 2 mothers disagree with it. Two areas of the two states were taken, i.e., Amritsar and Jaipur.

CONCLUSION

New mothers tend to have genuine anxieties about breastfeeding procedures. Perception of breastfeeding (in the Indian context) is a sensitive matter; draped with stigmas, and it requires an unwavering effort to bust the myths around it. Along with time, new mothers have got rid of some. However, there remain questions that are yet to be answered, and glitches yet to be amended. Also, new mothers are not that comfortable to deliberate on this topic. That propels technology to transpire and enables the new mothers to
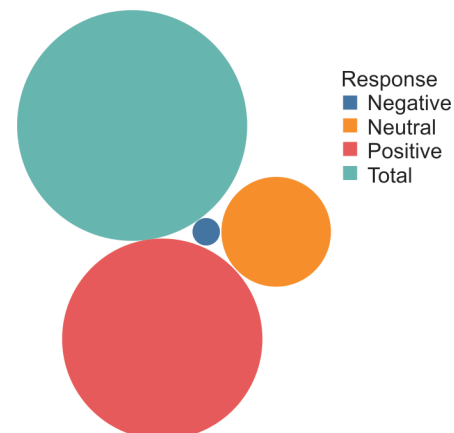

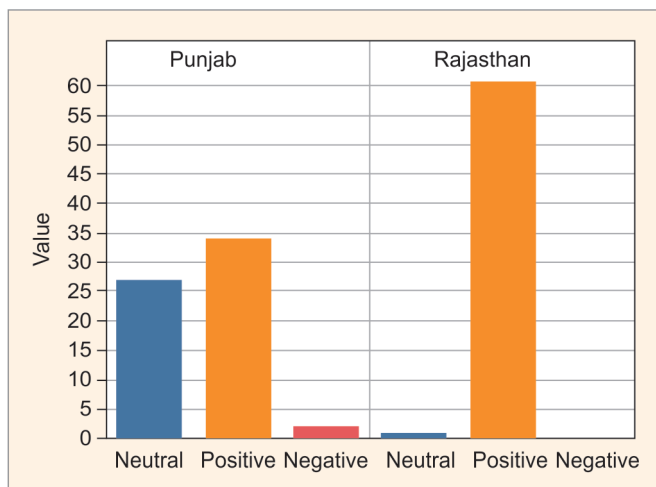**Fig. 1:** Labeled-response behavior of the mothers in adoption of chatbots

Fig. 2: Response behavior of two states in adoption of chatbots

an unprejudiced advisor and clarify their doubts at the click of a button. The authors have come up with a research objective that helps to evaluate the necessity of an AI-enabled chatbot that can address the anxiety related to breastfeeding and advise first-time mothers. If developed, such chatbots could help as virtual assistants through which a lactating mother could gain insights into what is to be done and what not; without being concerned about her privacy or any other related matters.

Encapsulated Findings of the Study

An AI-enabled chatbot has been seen as and agreed upon to be an essential part of the surveyed population. The authors anticipate that up to a certain extent, such a chatbot would indeed help to exterminate the social stigmas around this topic. Also, it would aid in providing timely and requisite information.

- The authors have designed a research instrument (a questionnaire with 23 questions with a 5-pointer Likert scale). The study was conducted on 125 respondents (first time breastfeeding mothers based out of Jaipur and Amritsar—two urban cities of India) to comprehend their anxiety with respect to breastfeeding, and if an AI-enabled chatbot could be of help to consult; as and when required.
- It was found that many women either do not know about chatbots or are hesitant to pick up a new technology; especially if the same is concerned with their babies.
- This study has illustrated that on this subject, >70% of respondents (out of 125 volunteered to participate in this study) are willing to get advised by an AI-enabled chatbot.

Limitations of the Study and Future Dimensions

One, since COVID-19 has hit the entire globe, causing large-scale damage in India, the authors had to limit the number of respondents and locations. A comparative study of at least four to eight urban cities, or urban vs semi-urban cities, metro vs urban cities, or a benchmarking study on rural areas of India would definitely add more flavor to the study. Two, a mixed-method, comprising of both qualitative and quantitative research designs would have certainly enabled to gather more insights from the

survey participants as the authors firmly believe that such a topic could not be assessed merely with questionnaires. Such a study calls for qualitative research instruments like in-depth interviews and focused group discussions (FGDs) for the collection of data. Three, the scope is immense for a chatbot developing firm to use this study as a base document and capitalize on the same. Four, various corporate hospitals, as well the Government of India could take initiatives to devise a "Train the Trainer" plan for their healthcare workers like doctors, nurses, ASHA, and ANM's who shall further educate pregnant women about clarifying their myths around breastfeeding. Five, there should be awareness campaigns and other such ways to pass on this AI-enabled chatbot concept to healthcare facilitators. It would certainly reduce a minuscule part of the workload of their health workers that are used to frequently council a first-time mother.

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