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ROLE OF AI CHATBOTS IN ONLINE PHARMACEUTICAL MARKETING: IMPACT ON CUSTOMER ENGAGEMENT AND DECISION-MAKING

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Abstract: The rapid advancement of Artificial Intelligence (AI) is transforming digital marketing by enabling organizations to provide personalized, interactive, and real-time customer communication. In the pharmaceutical sector, AI-powered chatbots are emerging as an important digital interface for disseminating product information, responding to customer queries, facilitating information search, and strengthening customer engagement. However, the application of AI chatbots in pharmaceutical marketing presents distinctive challenges because pharmaceutical communication involves health-related information, consumer trust, privacy, information accuracy, ethical responsibility, and regulatory considerations. This conceptual research paper examines the role of AI chatbots in online pharmaceutical marketing, with particular emphasis on their potential influence on customer engagement and consumer decision-making. Drawing on the Technology Acceptance Model (TAM) and Stimulus–Organism–Response (S-O-R) framework, the paper develops a conceptual model in which AI chatbot effectiveness is represented through responsiveness, information quality, personalization, ease of use, availability, interactivity, and perceived usefulness. These characteristics are proposed to influence customer engagement and, subsequently, consumer decision-making. A single overarching hypothesis is developed for future empirical testing. The paper synthesizes recent literature on AI chatbots, healthcare conversational agents, customer engagement, trust, and pharmaceutical applications of AI. Recent evidence indicates that AI conversational agents are increasingly used across healthcare, although their effectiveness and safety remain unevenly established. Research in India also indicates that trust significantly influences intention to use healthcare chatbots. The paper contributes to the emerging literature by positioning AI chatbots as conversational marketing interfaces rather than merely automated customer-service tools. It also highlights the importance of accuracy, transparency, privacy, responsible persuasion, and human oversight in pharmaceutical chatbot implementation. The proposed framework provides a foundation for future empirical research and offers practical implications for pharmaceutical marketers seeking to adopt AI-enabled digital engagement strategies responsibly.

Keywords: Artificial Intelligence, AI Chatbots, Pharmaceutical Marketing, Digital Marketing, Customer Engagement, Consumer Decision-Making, Conversational Marketing, Healthcare AI

1. Introduction

Digital transformation has fundamentally changed the manner in which pharmaceutical organizations communicate with customers and other stakeholders. Pharmaceutical marketing has traditionally depended on healthcare professionals, medical representatives, conferences, print media, television, and other conventional promotional channels. The rapid growth of websites, social media, mobile applications, online pharmacies, and digital healthcare platforms has expanded the opportunities for pharmaceutical organizations to communicate through digital channels.

Artificial Intelligence has accelerated this transformation. AI enables organizations to analyse large volumes of information, automate customer interactions, personalize communication, identify patterns, and provide decision-support capabilities. Davenport et al. (2020) argue that AI is capable of transforming marketing through enhanced customer understanding, personalization, automation, and interaction.

Among the most visible applications of AI in digital marketing are **AI-powered chatbots**. Chatbots enable customers to communicate with an organization through conversational interfaces rather than relying exclusively on conventional website navigation. They can answer questions, direct customers toward relevant information, provide recommendations within defined parameters, and support continuous interaction.

The application of AI chatbots is particularly relevant to pharmaceutical marketing. Consumers increasingly use digital channels to search for information about pharmaceutical products, healthcare services, treatment options, medication-related information, and pharmaceutical brands. Consequently, pharmaceutical organizations have an opportunity to use conversational AI as an additional digital touchpoint.

However, pharmaceutical marketing differs substantially from ordinary consumer marketing. Information about medicines and healthcare products may influence health-related behaviour and decisions. Consequently, chatbot-generated information must be accurate, appropriately sourced, transparent, and responsibly communicated.

Recent research demonstrates both the potential and limitations of AI conversational agents. A 2026 systematic umbrella review covering 44 systematic reviews found that AI-based conversational agents are being used across numerous healthcare domains, including education and clinical decision support, but concluded that evidence concerning overall effectiveness remains difficult to establish and that transparency and standardization require greater attention.

Similarly, research examining AI chatbot-generated drug-therapy responses found that accuracy and quality must be carefully evaluated before such systems are used for patient-specific healthcare decisions.

These developments establish the need to examine AI chatbots not simply as technological tools but as **digital marketing interfaces capable of influencing customer engagement and information-based decision-making**.

Accordingly, this conceptual paper develops a framework explaining how AI chatbot effectiveness may influence customer engagement and consumer decision-making in online pharmaceutical marketing.

2. Research Problem

Pharmaceutical organizations are increasingly exploring AI-enabled digital communication. However, the effectiveness of AI chatbots as marketing and customer-engagement mechanisms remains insufficiently understood.

Three issues are particularly important.

First, consumers may value chatbots because of their convenience, availability, and responsiveness.

Second, consumers may hesitate to rely on chatbot-generated information because of concerns regarding accuracy, trust, privacy, and accountability.

Third, pharmaceutical information is associated with greater potential consequences than conventional product information. An ineffective or misleading chatbot may therefore have consequences beyond customer dissatisfaction.

The central research problem is therefore:

How can AI chatbot effectiveness in online pharmaceutical marketing influence customer engagement and consumer decision-making?

3. Research Objectives

The conceptual study has the following objectives:

1. To examine the emerging role of AI chatbots in online pharmaceutical marketing.
2. To identify the major dimensions of AI chatbot effectiveness relevant to pharmaceutical digital marketing.
3. To conceptualize the relationship between AI chatbot effectiveness and customer engagement.
4. To examine conceptually how customer engagement may contribute to consumer decision-making.
5. To develop a conceptual framework and hypothesis for future empirical research.

4. Review of Literature

4.1 Artificial Intelligence in Marketing

AI has become an important component of contemporary marketing. It supports customer analytics, segmentation, personalization, recommendation systems, marketing automation, content development, and customer interaction.

Davenport et al. (2020) identify AI as a major technological development capable of changing the future of marketing by improving customer understanding and enabling increasingly individualized interactions.

The shift from conventional digital marketing toward conversational marketing is particularly important because AI allows consumers to interact with organizations rather than simply receive information from them.

4.2 AI Chatbots and Customer Interaction

Chatbots represent a form of conversational AI in which users communicate with an automated system through natural-language interaction.

Araujo (2018) demonstrated that anthropomorphic and communicative characteristics can affect consumers' perceptions of conversational agents and the organizations behind them.

Similarly, Ashfaq et al. (2020) examined determinants of satisfaction and continuance intention toward AI-powered service agents, demonstrating that chatbot-related perceptions can influence users' continued interaction.

Research in customer-service settings also suggests that chatbot characteristics such as anthropomorphism and interaction design can influence adoption and customer responses.

These findings provide a basis for considering chatbot interaction as a potentially important component of digital customer engagement.

4.3 AI Chatbots in Healthcare

The healthcare environment presents a particularly important context for conversational AI.

Aggarwal et al. (2023) systematically reviewed AI-based chatbots used for health behavioural change and identified applications involving healthy lifestyles, smoking cessation, treatment adherence, and other health behaviours.

A more recent systematic review of 89 articles concluded that healthcare chatbot research has expanded substantially, with medical information, telemedicine, and mental health among major research areas. ([ScienceDirect](#))

Similarly, a systematic review and meta-analysis of patient engagement with conversational agents found that chatbots have potential for increasing engagement, but the evidence base remains insufficient to support broad claims of effectiveness. ([Springer](#))

Thus, the literature supports the potential of conversational AI while simultaneously highlighting the need for rigorous empirical evaluation.

5. AI Chatbots in Pharmaceutical Marketing

The pharmaceutical industry provides a distinctive application environment for AI chatbots.

5.1 Product Information

AI chatbots can provide consumers with accessible information concerning pharmaceutical products, subject to appropriate content controls and approved information sources.

5.2 Customer Query Management

Chatbots can respond to frequently asked questions and direct consumers toward appropriate resources.

5.3 Digital Information Search

A conversational interface may simplify information search by allowing customers to formulate questions naturally.

5.4 Personalized Communication

Chatbots can tailor interactions according to the information supplied by the user, potentially increasing relevance.

5.5 Customer Engagement

Conversational interaction can encourage users to spend more time exploring pharmaceutical information and digital content.

5.6 Decision-Making Support

Chatbots may facilitate information gathering and evaluation, particularly during the early stages of consumer decision-making.

Importantly, the role of the chatbot should remain clearly distinguished from clinical diagnosis or individualized prescribing. The purpose of pharmaceutical marketing chatbots should be to provide reliable information and facilitate appropriate information seeking rather than replace professional medical judgement.

WHO's 2024 discussion paper specifically recognizes the growing role of AI across pharmaceutical development, delivery, marketing, registration, and post-approval activities while emphasizing the need for appropriate governance and public-health benefit.

6. Dimensions of AI Chatbot Effectiveness

This paper conceptualizes AI chatbot effectiveness as a multidimensional construct.

6.1 Responsiveness

Responsiveness represents the speed with which the chatbot responds to customer queries.

A rapid response can reduce perceived waiting time and improve convenience.

6.2 Information Quality

Information quality represents the perceived accuracy, relevance, clarity, and completeness of chatbot information.

This is particularly important in pharmaceutical marketing because information errors can undermine trust and potentially create consumer harm.

6.3 Personalization

Personalization refers to the ability of the chatbot to adapt its communication to the customer's stated information needs.

Personalized communication may improve perceived relevance and engagement.

6.4 Ease of Use

Ease of use refers to the extent to which consumers can interact with the chatbot without substantial effort.

This dimension is consistent with the Technology Acceptance Model proposed by Davis (1989).

6.5 Availability

Chatbots can potentially provide information continuously, including outside conventional customer-service hours.

6.6 Interactivity

Interactivity reflects the extent to which the customer can participate in two-way conversational communication.

6.7 Perceived Usefulness

Perceived usefulness reflects the degree to which the consumer believes that the chatbot helps achieve an information-search objective.

7. Customer Engagement

Customer engagement represents the extent to which consumers become cognitively, emotionally, and behaviourally involved in interactions with a brand.

AI chatbots can create a more interactive customer experience than static digital content.

The proposed relationship is:

Chatbot Effectiveness → Attention → Interaction → Information Exploration → Customer Engagement

Customer engagement in pharmaceutical digital marketing may include:

- Attention to brand information
- Frequency of interaction
- Willingness to continue using the chatbot
- Exploration of additional content
- Interest in the pharmaceutical brand
- Willingness to revisit the digital platform

The literature supports the potential of conversational agents to generate engagement, although evidence also indicates that engagement outcomes depend on implementation quality and context.

8. Consumer Decision-Making

Consumer decision-making generally includes:

1. Need recognition
2. Information search
3. Evaluation of alternatives
4. Decision
5. Post-decision evaluation

AI chatbots are particularly relevant to the **information-search and evaluation stages**.

An effective chatbot may help consumers obtain relevant information more efficiently, clarify general product information, and identify additional information sources.

However, pharmaceutical decision-making is more complex than ordinary product purchasing. Decisions may depend on:

- Physician recommendations
- Pharmacist advice
- Perceived risk
- Product efficacy
- Safety considerations
- Price
- Availability
- Previous experience
- Brand reputation
- Trust
- Individual health circumstances

Consequently, this paper conceptualizes chatbot influence as **decision-making support**, not autonomous medical decision-making.

9. Theoretical Foundation

9.1 Technology Acceptance Model

Davis's (1989) Technology Acceptance Model proposes that perceived usefulness and perceived ease of use influence acceptance and use of information technology.

Applied to pharmaceutical chatbots:

Ease of Use + Usefulness → Technology Acceptance → Continued Interaction

This provides theoretical justification for incorporating perceived usefulness and ease of use into AI chatbot effectiveness.

9.2 Stimulus–Organism–Response Framework

The S-O-R framework provides a second theoretical foundation.

The model can be applied as:

Stimulus: AI chatbot characteristics



Organism: Customer engagement



Response: Consumer decision-making

The chatbot's technological characteristics function as external stimuli. Customer engagement represents the consumer's internal response to the interaction, while decision-making represents the behavioural outcome.

10. Research Gap

The literature reveals four important gaps.

Gap 1: Limited Pharmaceutical Marketing Focus

Much existing research focuses on healthcare service delivery, customer service, or general chatbot adoption rather than pharmaceutical marketing specifically.

Gap 2: Limited Integration of Engagement and Decision-Making

Existing studies frequently examine adoption, satisfaction, or trust separately. There is scope to integrate customer engagement and consumer decision-making within a single pharmaceutical marketing framework.

Gap 3: Limited Indian Context

Recent Indian research has examined trust and intention to use healthcare chatbots among 397 urban respondents, demonstrating the importance of trust in chatbot adoption. However, the marketing implications of AI chatbots for pharmaceutical customer engagement remain underexplored. ([ScienceDirect](#))

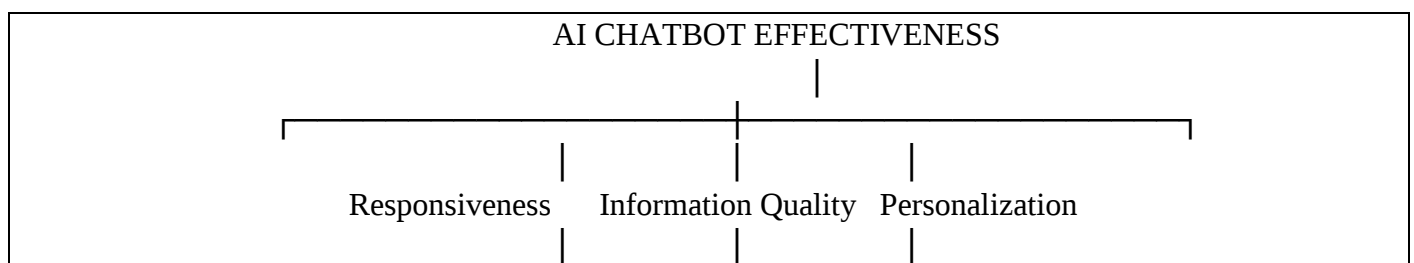
Gap 4: Ethical and Information-Quality Concerns

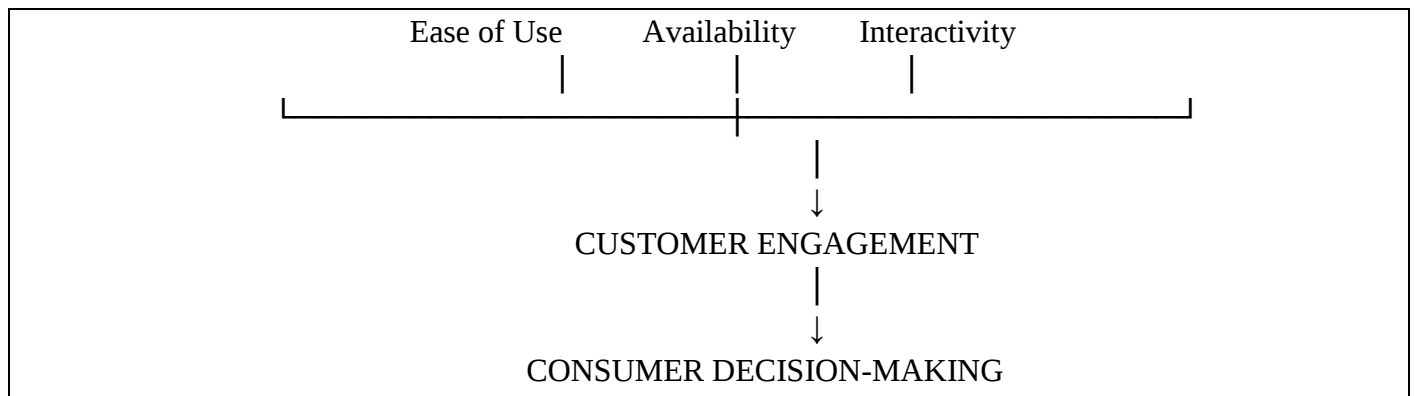
Recent evidence shows that AI-generated healthcare and drug-therapy responses require careful evaluation for accuracy and quality. ([Springer](#))

Therefore, a framework integrating **effectiveness, engagement, decision-making, and responsible pharmaceutical communication** is warranted.

11. Conceptual Framework

The proposed framework is presented below:





Proposed framework

Independent Variable

AI Chatbot Effectiveness

Dimensions:

- Responsiveness
- Information quality
- Personalization
- Ease of use
- Availability
- Interactivity
- Perceived usefulness

Outcome Variables

- Customer engagement
- Consumer decision-making

12. Hypothesis Development

An effective AI chatbot can reduce information-search effort, increase convenience, facilitate interactive communication, and provide relevant information. These characteristics may encourage consumers to interact more extensively with the pharmaceutical brand.

Greater engagement may subsequently facilitate information exploration and evaluation, potentially influencing decision-making.

Based on the theoretical foundation and literature review, the following hypothesis is proposed:

H₁

AI chatbot effectiveness in online pharmaceutical marketing has a significant positive influence on customer engagement and consumer decision-making.

H₀

AI chatbot effectiveness in online pharmaceutical marketing does not have a significant positive influence on customer engagement and consumer decision-making.

13. Proposed Research Methodology for Future Empirical Validation

Although the present study is conceptual, the framework can be empirically validated through quantitative research.

Research Design

A quantitative, descriptive and explanatory research design is recommended.

Population

Consumers who have interacted with AI chatbots on pharmaceutical company websites, healthcare platforms, or online pharmacy platforms.

Sampling

Purposive sampling is recommended because respondents must have prior experience with AI chatbot interaction.

Sample Size

A sample of approximately **300 respondents** would provide a practical basis for preliminary empirical validation.

Measurement

A five-point Likert scale may be used:

- 1 – Strongly Disagree
- 2 – Disagree
- 3 – Neutral
- 4 – Agree
- 5 – Strongly Agree

Data Analysis

Future empirical studies may employ:

- Descriptive statistics
- Cronbach's alpha
- Exploratory factor analysis
- Confirmatory factor analysis
- Correlation analysis
- Multiple regression
- PLS-SEM

The proposed study should test whether the relationship represented by H_1 is statistically significant.

14. Proposed Measurement Framework

Construct	Indicative Dimensions
AI Chatbot Effectiveness	Responsiveness, information quality, personalization, ease of use, availability, interactivity, usefulness
Customer Engagement	Attention, interaction, information exploration, continued usage, brand interest
Consumer Decision-Making	Information search, evaluation, confidence, consideration, decision support

15. Managerial Implications

The conceptual model has several implications for pharmaceutical marketers.

15.1 Chatbots Should Be Treated as Strategic Digital Touchpoints

Pharmaceutical organizations should not view chatbots merely as automated customer-service systems. They can form part of an integrated digital customer-engagement strategy.

15.2 Information Quality Should Be a Core KPI

For pharmaceutical chatbots, response accuracy should be monitored alongside conventional metrics such as engagement and conversion.

15.3 Personalization Should Be Responsible

Personalization can improve relevance, but pharmaceutical companies should avoid inappropriate or manipulative targeting based on sensitive information.

15.4 Trust Must Be Prioritized

The Indian healthcare chatbot literature demonstrates that trust is a significant factor influencing intention to use AI chatbots.

15.5 Human Escalation Should Be Available

Questions involving diagnosis, treatment decisions, adverse effects, or individualized medical advice should be appropriately escalated to healthcare professionals.

15.6 Continuous Evaluation Is Necessary

Pharmaceutical organizations should monitor:

- Response accuracy
- Customer satisfaction
- Engagement
- Repeat interaction
- Information usefulness
- Trust
- Escalation rates
- Complaint rates

16. Ethical Considerations

AI chatbot implementation in pharmaceutical marketing requires careful ethical governance.

16.1 Accuracy

Information provided by chatbots should be based on validated and appropriate sources.

16.2 Transparency

Consumers should be clearly informed that they are interacting with an AI system.

16.3 Privacy

Personal and health-related information should be protected in accordance with applicable data-protection requirements.

16.4 Accountability

Organizations deploying AI chatbots should establish responsibility for chatbot outputs.

16.5 Human Oversight

AI should complement, rather than replace, qualified healthcare professionals in situations requiring professional judgement.

16.6 Responsible Persuasion

The ability of AI to personalize communication should not be used to exploit consumer vulnerability.

WHO's guidance states that ethics and human rights should remain central to the design, deployment, and use of AI in health.

WHO's pharmaceutical AI discussion paper further emphasizes that AI applications in pharmaceutical development and marketing require appropriate governance and public-health benefit.

17. Theoretical Contributions

This paper makes three primary theoretical contributions.

First

It extends AI marketing research into the **online pharmaceutical marketing context**.

Second

It conceptualizes AI chatbot effectiveness as a multidimensional construct consisting of technological and interactional characteristics.

Third

It connects AI chatbot effectiveness with both **customer engagement and consumer decision-making**, thereby providing an integrated conceptual perspective.

The overall theoretical pathway is:

AI Chatbot Effectiveness → Customer Engagement → Consumer Decision-Making

18. Practical Contributions

The proposed framework can assist pharmaceutical companies in developing and evaluating chatbot-based digital marketing initiatives.

The framework suggests that successful pharmaceutical chatbots should simultaneously provide:

Responsiveness + Information Quality + Personalization + Ease of Use + Availability + Interactivity + Usefulness

while being supported by:

Trust + Transparency + Privacy + Accuracy + Human Oversight

This combination can help organizations balance marketing objectives with responsible healthcare communication.

19. Limitations

This paper is conceptual and does not report primary survey data or statistical findings. Therefore, the proposed hypothesis has not been empirically validated within this study.

The conceptual model also assumes that AI chatbot effectiveness will have a broadly positive relationship with engagement and decision-making. Future empirical research may demonstrate that certain dimensions have stronger effects than others.

In addition, consumer pharmaceutical decision-making is influenced by numerous factors beyond digital marketing, particularly healthcare professionals, individual health circumstances, perceived risk, product characteristics, and accessibility.

20. Future Research Directions

Future empirical studies can extend this framework by examining:

- **Trust as a mediator**
- **Perceived risk as a moderator**
- **AI literacy as a moderator**
- **Privacy concerns**
- **Perceived credibility**
- **Technology readiness**
- **Generative AI capability**
- **Human-AI collaboration**

Future researchers could also compare:

AI Chatbot vs. Human Customer Service and **Traditional Website vs. AI Chatbot**

to determine whether conversational AI produces superior engagement and decision-support outcomes.

Longitudinal studies could further investigate whether repeated chatbot interaction leads to sustained customer relationships, brand loyalty, and trust.

21. Conclusion

Artificial Intelligence is increasingly reshaping digital marketing, and AI chatbots represent one of the most significant developments in conversational customer interaction. In pharmaceutical marketing, these systems can potentially provide consumers with accessible, responsive, personalized, and interactive information.

The present conceptual paper proposes that AI chatbot effectiveness—comprising responsiveness, information quality, personalization, ease of use, availability, interactivity, and perceived usefulness—can contribute to customer engagement and consumer decision-making.

Recent healthcare research confirms that conversational AI is expanding rapidly, while also emphasizing that effectiveness, accuracy, usability, transparency, and governance require continued evaluation.

The pharmaceutical context makes these considerations particularly important. AI chatbot implementation should therefore move beyond a narrow emphasis on marketing efficiency and consider consumer welfare, information accuracy, trust, privacy, transparency, and human oversight.

The proposed conceptual framework provides a foundation for future empirical research examining whether and to what extent AI chatbots influence pharmaceutical customer engagement and decision-making. It also provides pharmaceutical marketers with a structured approach to evaluating chatbot effectiveness while maintaining responsible digital marketing practices.

References

1. Aggarwal, A., Tam, C. C., Wu, D., Li, X., & Qiao, S. (2023). Artificial intelligence–based chatbots for promoting health behavioral changes: Systematic review. *Journal of Medical Internet Research*, 25, e40789. <https://doi.org/10.2196/40789>
2. Araujo, T. (2018). Living up to the chatbot hype: The influence of anthropomorphic design cues and communicative agency framing on conversational agent and company perceptions. *Computers in Human Behavior*, 85, 183–189. <https://doi.org/10.1016/j.chb.2018.03.051>
3. Ashfaq, M., Yun, J., Yu, S., & Loureiro, S. M. C. (2020). I, Chatbot: Modeling the determinants of users' satisfaction and continuance intention of AI-powered service agents. *Telematics and Informatics*, 54, 101473. <https://doi.org/10.1016/j.tele.2020.101473>
4. Brandtzaeg, P. B., & Følstad, A. (2018). Chatbots: Changing user needs and motivations. *Interactions*, 25(5), 40–44. <https://doi.org/10.1145/3236669>
5. Chellasamy, A., Elangovan, N., Nagarathinam, A., & Rangasamy, S. (2025). Patients' trust in the Indian healthcare system and its impact on the intention to use artificial intelligence-based healthcare chatbots. *Journal of Asia Business Studies*, 19(3), 730–747. <https://doi.org/10.1108/JABS-06-2024-0289> (ScienceDirect)
6. Chung, M., Ko, E., Joung, H., & Kim, S. J. (2020). Chatbot e-service and customer satisfaction regarding luxury brands. *Journal of Business Research*, 117, 587–595. <https://doi.org/10.1016/j.jbusres.2018.10.004>
7. Davenport, T. H., Guha, A., Grewal, D., & Bressgott, T. (2020). How artificial intelligence will change the future of marketing. *Journal of the Academy of Marketing Science*, 48, 24–42. <https://doi.org/10.1007/s11747-019-00696-0>
8. Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319–340. <https://doi.org/10.2307/249008>
9. De Cicco, R., Palumbo, R., & Alparone, F. R. (2020). Millennials' attitude toward chatbots: An experimental study in a social relationship perspective. *International Journal of Retail & Distribution Management*, 48(11), 1213–1233. <https://doi.org/10.1108/IJRDM-12-2019-0406>
10. Go, E., & Sundar, S. S. (2019). Humanizing chatbots: The effects of visual, identity and conversational cues on humanness perceptions. *Computers in Human Behavior*, 97, 304–316. <https://doi.org/10.1016/j.chb.2019.01.020>
11. Jenneboer, L., Herrando, C., & Constantinides, E. (2022). The impact of chatbots on customer loyalty: A systematic literature review. *Journal of Theoretical and Applied Electronic Commerce Research*, 17(1), 152–170. <https://doi.org/10.3390/jtaer17010008>
12. Sheehan, B., Jin, H. S., & Gottlieb, U. (2020). Customer service chatbots: Anthropomorphism and adoption. *Journal of Business Research*, 115, 14–24. <https://doi.org/10.1016/j.jbusres.2020.04.030>
13. Shiferaw, M. W., Zheng, T., Winter, A., Mike, L. A., & Chan, L.-N. (2024). Assessing the accuracy and quality of artificial intelligence (AI) chatbot-generated responses in making patient-specific drug-therapy and healthcare-related decisions. *BMC Medical Informatics and Decision Making*, 24, 404. <https://doi.org/10.1186/s12911-024-02824-5> (Springer)

14. Tewari, V., & Mehta, R. (2023). Exploring chatbot trust: Antecedents and behavioural outcomes. *Heliyon*, 9(5), e16074. <https://doi.org/10.1016/j.heliyon.2023.e16074>
15. Wang, X., Luo, R., Liu, Y., Chen, P., Tao, Y., & He, Y. (2023). Revealing the complexity of users' intention to adopt healthcare chatbots: A mixed-method analysis of antecedent condition configurations. *Information Processing & Management*, 60(5), 103444. <https://doi.org/10.1016/j.ipm.2023.103444> (ScienceDirect)
16. World Health Organization. (2021). *Ethics and governance of artificial intelligence for health: WHO guidance*. World Health Organization. <https://doi.org/10.1136/bmj.n2746> (World Health Organization)
17. World Health Organization. (2024). *Benefits and risks of using artificial intelligence for pharmaceutical development and delivery*. World Health Organization. (World Health Organization)
18. World Health Organization. (2025). *Ethics and governance of artificial intelligence for health: Guidance on large multi-modal models*. World Health Organization. (World Health Organization)

