Perception and Acceptance of Medical Chatbot Among Undergraduates in Ekiti State University, Nigeria

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ABSTRACT: *This study explores the perceptions and acceptance of medical chatbots among undergraduate students at Ekiti State University, Ado-Ekiti, Nigeria. A medical chatbot is an artificially intelligent conversational agent that simulates human-like communication, catering to user inquiries and generating logical responses. These chatbots leverage natural language processing and machine learning to engage in dynamic interactions, retrieve relevant information, and adapt to new data. This research investigates two primary aspects: the perception of undergraduate students towards the use of medical chatbots and the level of acceptance of these chatbots among the same demographic. The study employs a descriptive cross-sectional survey design, involving a sample size of 300 undergraduate students, determined using Taro Yamane's method. The data collection process includes a semi-structured questionnaire, validated by experts in Tests and Measurement and Public Health. The collected data are analyzed using SPSS version 28. The findings reveal an equitable gender distribution among participants, with a slightly higher representation of females. Additionally, a substantial proportion of respondents fall within the 18-25 age bracket, with a significant presence of undergraduates below 18 years old. The study indicates positive perceptions of medical chatbots among undergraduate students, suggesting a favorable view towards their adoption. While the majority of participants exhibit acceptance of medical chatbots, there is skepticism about the precision and reliability of healthcare suggestions provided by these platforms. In conclusion, this study sheds light on the positive perceptions and acceptance of medical chatbots among undergraduate students in Ekiti State University. The findings suggest a potential for integrating this technology into healthcare, education, and research endeavors, while acknowledging the need for further*

investigation into the underlying factors influencing these perceptions. As the healthcare landscape evolves, chatbots can potentially offer valuable contributions to enhancing health services, especially in scenarios where in-person visits are unnecessary. However, continuous research is essential to ensure their accuracy, trustworthiness, and effectiveness across diverse demographic groups

KEYWORDS: acceptance, medical chatbot, perception, undergraduates

INTRODUCTION

According to Khan and Das (2018), a chatbot refers to an artificially intelligent conversational agent that emulates human-like communication. This is achieved through the facilitation of user inquiries and the generation of logical responses. The chatbot retrieves pertinent information from a database, as indicated by the user's input (Crutzen, et al., 2011). Chatbots efficiently process user input in the form of natural language and effectively execute one or more associated commands. The most advanced systems employ machine learning technology, enabling them to acquire knowledge from their surroundings and adapt to novel data or human input. According to Radziwill (2017), chatbots frequently exhibit characteristics such as self-awareness, proactivity, and sociability.

Conversational agents, commonly referred to as chatbots, have been successfully utilised by several industries and organisations, such as the banking and tourism sectors, to alleviate their respective challenges and enhance their operational capacities. According to Georgian Partners (2019), the chatbot utilises algorithms to generate responses or further queries from a planned and limited set of potential replies, therefore simulating dynamic interaction with the user. In the context of patient care, these platforms undergo training facilitated by healthcare experts, wherein clinically confirmed material and questions are utilised (Rouger, 2019).

Artificially intelligent chatbots are computer systems that employ natural language processing techniques to emulate human conversation. Health chatbots are currently undergoing research and development, with the potential to enhance doctor-patient communication, optimise clinic operations, and address the increasing need for healthcare services such as tele-consultations, remote diagnostic testing, and medication adherence monitoring. The utilisation of chatbot technology enables the facilitation of various health-related activities, including conducting specific health surveys, generating personalised health reminders, engaging in discussions with clinical teams, arranging appointments, retrieving and analysing health data, and interpreting diagnostic patterns through behavioural indicators such as activity levels, sleep patterns, and dietary habits. Additional research is required to ascertain the accuracy of these assumptions before to make any determinations on the potential impact of this technology on the transformation of healthcare systems. This includes evaluating its potential to enhance the adoption, equity, and cost-efficiency of health services, while simultaneously reducing disparities in health and well-being. Thus far, chatbots have been utilised in the healthcare business for many purposes, including

mental health support, diagnostic assistance, and educational endeavours. Two examples of chatbots that offer immediate replies to health-related queries from patients while searching for particular symptom patterns to anticipate diseases are the online Doc-Bot accessible through smartphones and a Messenger-based chatbot for outpatient and translational medicine. The aforementioned entities possess sufficient adaptability to undergo modifications that cater to a diverse range of target demographics, medical conditions, and user behaviours.

The utilisation of this technology in the field of health care exhibits significant potential. Through the examination of extensive quantities of personal health data stored in patient records, medical professionals and individuals may prioritise the health and well-being concerns that hold the utmost significance for the user (Rouger, 2019). In order to comprehend and extract valuable insights from the vast and expanding data collection, advanced analytical techniques such as artificial intelligence (AI) will be indispensable. In the year 2014, chatbots were employed to assist patients in diagnosing symptoms, offering a more efficient and cost-effective alternative to in-person consultations with medical practitioners (Pereira and Daz, 2019). According to Rouger (2019), a study conducted in 2017 including 4,737 individuals diagnosed with breast cancer revealed that the utilisation of a chatbot for prescription reminders resulted in a significant increase of over 20% in patients adhering to their recommended drug regimen.

The development of a counselling dialogue system is currently in progress to address the challenge of medical chatbot users experiencing multiple conditions simultaneously. This challenge is compounded by the increasing complexity of designing and testing automated systems, which has grown in tandem with the expanding range of targeted behaviours. The objective of this ongoing work is to employ a theory-driven methodology to effectively influence positive changes in health-related behaviour. Only a limited number of instances of mental disease exist in isolation. The management of chronic disorders such as diabetes, the prevention of diseases like cancer, and the treatment of overweight and obesity necessitate the concurrent modification of several behaviours. The use of a health information chatbot holds several potential advantages. Multiple recent studies (Ramsay, et al., 2017; Clarke et al., 2016) concur that the Internet serves as the predominant platform for individuals seeking information on dietary supplements. There may be a sense of scepticism among internet users regarding the credibility and dependability of the information they encounter online (Huntington et al., 2004). According to Skjuve and Brandtzaeg (2018), the prevalence of misinformation in the field of healthcare is not unexpected, considering the widespread dissemination of erroneous information facilitated by the contemporary Internet era. Distinguishing between trustworthy and fraudulent news may often be a challenging task. There exists a current need for readily available and trustworthy health information, and a chatbot developed by credible organisations such as a hospital might potentially address this need. This measure safeguards individuals against potentially harmful substances that might be present on websites with questionable credibility.

Despite the extensive use of this technology in several industries, its implementation in the healthcare domain has been somewhat sluggish owing to apprehensions over privacy, security, and the veracity of information (Arndt, 2018; Inkster et al., 2018; Pereira & Daz, 2019; Schueller et al., 2017). According to Brandtzaeg and Folstad (2018), there is a lack of clarity on the behaviour and motives associated with the usage of chatbot. This reason and many more spur the researchers to assess the perception and acceptance of medical chatbot among undergraduates in Ekiti State.

The study specifically
1.   examined the perception of undergraduate students towards the use of medical chatbot in Ekiti State University;
2.   determined the level of acceptance of medical chatbot among undergraduate students in Ekiti State University
The two research questions raised were;
1.   What is the perception of undergraduate students towards the use of medical chatbot in Ekiti State University?
2.   What is the level of acceptance of medical chatbot among undergraduate students in Ekiti State University?

RESEARCH METHODOLOGY

Descriptive cross-sectional survey research design was used for the study. A descriptive cross-sectional survey research design is used to collect data from a specific group of individuals (in this case, undergraduate students) at a particular point in time. This design is used to describe characteristics, opinions, behaviors, or other variables of interest within the study population. The study population consists of Undergraduate Students in Ekiti State University, Ado-Ekiti, Ekiti state. The sample size was determined with the use of Taro Yamane's method which yielded sample size of 300. Multistage sampling procedure was used to select the sample size. Multistage sampling involves breaking down the population into smaller groups or stages and then selecting samples from each stage. This method is often used when it is not feasible to directly sample the entire population.

Quantitative data was collected through the use of semi-structured questionnaire comprising of 3 sections (A, B, and C). Section A sought for bio-data of the respondents, section B consists of item on the perception of undergraduate students towards the use of medical chatbot while section C consists of item on the level of acceptance of medical chatbot among undergraduate students. The questionnaire was validated by experts of Tests and Measurement, and Public Health. The questionnaire was administered through physical contact with the respondents, and all the copies of the questionnaire were retrieved immediately after filling. Data collected were coded and analysed using SPSS version 28.

RESULTS

Socio-demographic Characteristics of Respondents
Table 1: Distribution of respondents by socio-demographic characteristics

Socio-demographic characteristics	Frequency	Percentage
Gender		
Male	138	46.0
Female	162	54.0
Age		
Below 18 years	69	23.0
18-25 years	210	70.0
Above 25 years	21	7.0
Total	300	100.0

On socio-demographic characteristics of the respondents, 138(46.0%) were male while 162(54.0%) were female. Only 69(23.0%) were below 18 years, 210(70.0%) between 18-25 years, while 21(7%) were above 25years

Question 1: What is the perception of undergraduate students towards the use of medical chatbot in Ekiti State University?

Table 2: Analysis of perception of undergraduate students towards the use of medical chatbot

S/N	ITEMS	SA (%)	A (%)	N (%)	D (%)	SD (%)	Mean	S.D.
1	I posit that the utilisation of a medical chatbot can afford expeditious and convenient accessibility to healthcare information.	117 (39.0)	165 (55.0)	12 (4.0)	6 (2.0)	-	4.30	0.68
2	It is my contention that a medical chatbot can efficaciously aid in the self-diagnosis of health issues	21 (7.0)	171 (57.0)	63 (21.0)	52 (14.0)	3 (1.0)	3.53	0.86
3	I posit that the use of a medical chatbot holds potential in the facilitation of managing minor health concerns, hence obviating the need for an in-person consultation with a healthcare practitioner.	102 (34.0)	135 (45.0)	54 (18.0)	12 (4.0)	-	4.05	0.84

4	I place my confidence in the precision and dependability of the information disseminated by a medical chatbot	39 (13.0)	105 (35.0)	96 (32.0)	51 (17.0)	9 (3.0)	3.36	1.01
5	I harbour unease and apprehension about the confidentiality and safeguarding of my personal health data while engaging with a medical chatbot.	54 (18.0)	126 (42.0)	57 (19.0)	60 (20.0)	3 (1.0)	3.56	1.04
6	I maintain the conviction that a medical chatbot possesses the capability to provide precise and dependable suggestions pertaining to subsequent medical interventions or therapies	48 (16.0)	165 (55.0)	63 (21.0)	21 (7.0)	3 (1.0)	3.74	0.85
7	The utilisation of a medical chatbot has the potential to optimise time management and mitigate the necessity for face-to-face consultations with healthcare professionals.	96 (32.0)	150 (50.0)	39 (13.0)	15 (5.0)	-	4.07	0.83
8	I am of the opinion that the utilisation of a medical chatbot has the potential to enhance my level of proactivity in the management of my personal health and overall well-being.	96 (32.0)	141 (47.0)	48 (16.0)	15 (5.0)	-	4.05	0.84

Mean Cut-off: 3.0   (Key: SA – Strongly Agree; A – Agree; N – Neutral; D –Disagree; SD – Strongly Disagree)

On perception of undergraduate students towards the use of medical chatbot, 117(39%) posit that the utilisation of a medical chatbot can afford expeditious and convenient accessibility to healthcare information, 165(55%) agreed, 12(4%) were neutral while 6(2%) disagreed. Only 39(13%) placed their confidence in the precision and dependability of the information disseminated by a medical chatbot, 105(35%) agreed, 96(32%) were neutral, 51(17%) disagreed while 9(3%) disagreed. Only 96(32%) strongly agreed the utilisation of a medical chatbot has the potential to optimise time management and mitigate the necessity for face-to-face consultations with healthcare professionals, 150(50%) agreed, 39(13%) were neutral while 15(5%) disagreed. Only 96(32%) strongly agreed they are of the opinion that the utilisation of a medical chatbot has the potential to enhance their level of proactivity in the management of my personal health and overall well-being, 141(47%) agreed, 48(16%) while 15(5%) disagreed.

Based on the mean cut-off, perception of undergraduate students towards the use of medical chatbot was good and above average

Table 3: One sample proportion test of perception of undergraduate students towards the use of medical chatbot

Items	Test Type	Asymptotic Standard Error	Z	P (sig)
I posit that the utilisation of a medical chatbot can afford expeditious and convenient accessibility to healthcare information.	Exact Binomial	.026		<.001
	Mid-p Adjusted Binomial	.026		<.001
	Score	.026	9.152*	.000
It is my contention that a medical chatbot can efficaciously aid in the self-diagnosis of health issues	Exact Binomial	.049		.009
	Mid-p Adjusted Binomial	.049		.007
	Score	.049	2.800*	.007
I posit that the use of a medical chatbot holds potential in the facilitation of managing minor health concerns, hence obviating the need for an in-person consultation with a healthcare practitioner.	Exact Binomial	.042		<.001
	Mid-p Adjusted Binomial	.043		<.001
	Score	.043	6.173*	<.001
I place my confidence in the precision and dependability of the information disseminated by a medical chatbot	Exact Binomial	.052		.691
	Mid-p Adjusted Binomial	.052		.621
	Score	.052	-.558	.619
I harbour unease and apprehension about the confidentiality and safeguarding of my personal health data while engaging with a medical chatbot.	Exact Binomial	.051		.046
	Mid-p Adjusted Binomial	.051		.037
	Score	.051	2.090*	.037
I maintain the conviction that a medical chatbot possesses the capability to provide precise and dependable suggestions pertaining to subsequent medical interventions or therapies	Exact Binomial	.048		<.001
	Mid-p Adjusted Binomial	.048		<.001
	Score	.048	5.010*	<.001
The utilisation of a medical chatbot has the potential to optimise time management and mitigate the necessity	Exact Binomial	.039		<.001
	Mid-p Adjusted Binomial	.039		<.001
	Score	.039	7.028*	<.001

for face-to-face consultations with healthcare professionals.				
I am of the opinion that the utilisation of a medical chatbot has the potential to enhance my level of proactivity in the management of my personal health and overall well-being.	Exact Binomial	.043		<.001
	Mid-p Adjusted Binomial	.043		<.001
	Score	.043	5.672*	<.001

*P<0.05

Table 3 shows that only 1 item out of the 8 items was not significant because its p-value was greater than 0.05. This implies that most of participants do not place confidence in the precision and dependability of the information disseminated by a medical chatbot (z = -0.558, p>0.05). The table above showing the inferential statistics further showed that most of the items were significant except one of the items, it can be concluded that undergraduate students had good perception towards the use of medical chatbot.

Question 2: What is the level of acceptance of medical chatbot among undergraduate students?

Table 4: Descriptive Analysis of acceptance of medical chatbot

S/N	ITEMS	SA (%)	A (%)	N (%)	D (%)	SD (%)	Mean	S.D.
1	The concept of employing a medical chatbot as a healthcare resource is quite interesting to me	63 (21.0)	265 (53.0)	66 (22.0)	4 (4.0)	-	3.91	0.81
2	I posit that the integration of a medical chatbot has the potential to augment my accessibility to pertinent healthcare information and services	105 (35.0)	168 (56.0)	24 (8.0)	3 (1.0)	-	4.21	0.68
3	I am inclined to utilise a medical chatbot as a means of acquiring information pertaining to my health issues and symptoms.	75 (25.0)	165 (55.0)	51 (17.0)	9 (3.0)	-	3.99	0.76
4	I have confidence in the capability of a medical chatbot to deliver precise and dependable healthcare suggestions and guidance	45 (15.0)	120 (40.0)	111 (37.0)	24 (8.0)	-	3.60	0.86
5	I am receptive to utilising a medical chatbot as a means of	75 (25.0)	150 (50.0)	60 (20.0)	15 (5.0)	-	3.91	0.83

	self-diagnosing minor health concerns prior to seeking guidance from a healthcare practitioner							
6	I am prepared to disclose my personal health information to a medical chatbot in order to receive more effective support and advice	60 (20.0)	141 (47.0)	78 (26.0)	18 (6.0)	3 (1.0)	3.78	0.88
7	I am receptive to the use of a medical chatbot as a beneficial instrument for addressing my healthcare requirements	69 (23.0)	141 (47.0)	78 (26.0)	6 (2.0)	6 (2.0)	3.85	0.87

Mean Cut-off: 3.0 (Key: SA – Strongly Agree; A – Agree; N – Neutral; D –Disagree; SD – Strongly Disagree)

On the level of acceptance of medical chatbot among undergraduate students, only 63(21%) strongly agreed the concept of employing a medical chatbot as a healthcare resource is quite interesting to them, 265(53%) agreed, 66(22%) neutral while 4(4%). Only 105(35%) strongly agreed the integration of a medical chatbot has the potential to augment my accessibility to pertinent healthcare information and services, 168(56%) agreed, 24(8%) were neutral while 3(1%) disagreed. Only 45(15%) strongly agreed they have confidence in the capability of a medical chatbot to deliver precise and dependable healthcare suggestions and guidance, 120(40%) agreed, 111(37%) were neutral while 24(8%) disagreed.

Based on the mean cut-off, level of acceptance of medical chatbot among undergraduate students is above average.

Table 5: One sample proportion test of acceptance of medical chatbot

	Test Type	Observed - Test Value[a]	Asy. Standard Error	Z	p (Sig)
The concept of employing a medical chatbot as a healthcare resource is quite interesting to me	Exact Binomial	.244	.042		<.001
	Mid-p Adjusted Binomial	.244	.042		<.001
	Score	.244	.042	5.186	<.001
I posit that the integration of a medical chatbot has the potential to augment my accessibility to pertinent	Exact Binomial	.410	.031		<.001
	Mid-p Adjusted Binomial	.410	.031		<.001
	Score	.410	.031	9.091	.000

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healthcare information and services					
I am inclined to utilise a medical chatbot as a means of acquiring information pertaining to my health issues and symptoms.	Exact Binomial	.283	.038		<.001
	Mid-p Adjusted Binomial	.283	.038		<.001
	Score	.283	.038	6.111	<.001
I have confidence in the capability of a medical chatbot to deliver precise and dependable healthcare suggestions and guidance	Exact Binomial	.055	.049		.429
	Mid-p Adjusted Binomial	.055	.049		.371
	Score	.055	.049	.902	.368
I am receptive to utilising a medical chatbot as a means of self-diagnosing minor health concerns prior to seeking guidance from a healthcare practitioner	Exact Binomial	.252	.046		<.001
	Mid-p Adjusted Binomial	.252	.046		<.001
	Score	.252	.046	5.018	<.001
I am prepared to disclose my personal health information to a medical chatbot in order to receive more effective support and advice	Exact Binomial	.184	.042		<.001
	Mid-p Adjusted Binomial	.184	.042		<.001
	Score	.184	.042	3.610	<.001
I am receptive to the use of a medical chatbot as a beneficial instrument for addressing my healthcare requirements	Exact Binomial	.189	.045		<.001
	Mid-p Adjusted Binomial	.189	.045		<.001
	Score	.189	.045	4.104	<.001

Table 4.5 shows that only 1 item out of the 7 items was not significant because its p-value was greater than 0.05. This implies that most of participants do not have confidence in the capability of a medical chatbot to deliver precise and dependable healthcare suggestions and guidance (z = 0.902, p>0.05) while other 6 items were significant because their p-values was less than 0.05. It can be concluded that acceptance of medical chatbot among undergraduate students is high and significant.

DISCUSSION

The results of the study indicate a generally even distribution of genders among the participants, with a little greater proportion of females. The data on age distribution reveals that a significant proportion of the participants belong to the 18-25 year age bracket, with undergraduates below the age of 18 constituting the subsequent largest group.

The study's findings indicated that undergraduate students usually expressed positive perceptions about the adoption of a medical chatbot. The aforementioned discovery implies a favourable view; nonetheless, it would be advantageous to delve into the precise factors contributing to this perception. The results are primarily relevant to those enrolled in undergraduate programmes. It is essential to acknowledge that individuals' perspectives may vary from those of other demographic groups, such undergraduate students, healthcare professionals, or patients. The favourable perception exhibited by undergraduate students towards medical chatbots implies that the integration of this technology into healthcare environments, instructional curricula, or research endeavours involving undergraduate students is likely to be positively embraced. In conclusion, the results indicate that undergraduate students had a positive impression about the use of a medical chatbot. However, further investigation is required in order to comprehend the fundamental factors contributing to their favourable image and to evaluate the applicability of these results to different demographic groups. Based on a study done by Molnár and Szuts (2018), it was shown that college students exhibit a higher inclination to place faith in their acquaintances from online chat platforms compared to their level of trust in online search engines. The inclination of students to place greater faith in their conversation companions compared to a search engine serves as a demonstration of the educational use of chatbots.

The results of the study revealed that among the 7 items under investigation, only 1 item failed to provide a statistically significant outcome, as its p-value exceeded the threshold of 0.05. The findings indicate that a majority of participants express scepticism over the ability of a medical chatbot to deliver precise and dependable healthcare suggestions and guidance. Conversely, the remaining six questions exhibited statistically significant findings, as shown by p-values below 0.05. This suggests that the participants generally demonstrated acceptance of the medical chatbot, as seen by their favourable answers towards different factors associated with its utilisation. Additional investigation is warranted to delve into the underlying factors contributing to the absence of confidence in the precision and dependability of the medical chatbot among participants. Furthermore, it is crucial to examine the potential consequences of this discovery on the general acceptance and utilisation of medical chatbots among undergraduate students. According to a study conducted by Nadarzynski et al. (2019), there was a negative correlation between students' confidence in their proficiency with information technology and their acceptance of the idea. The research revealed that as the level of acceptance increased to 67%, students' confidence in their ability to utilise information technology fell. There was initially resistance towards the integration of artificial intelligence (AI) in personalised healthcare owing to concerns over the precision and reliability of this technology. Nevertheless, the majority of respondents expressed a favourable disposition towards the utilisation of chatbots for addressing minor health concerns in situations when a visit to a doctor was deemed unnecessary. Khanna et al., (2015) conducted a study which revealed that preoperative patients exhibited a preference for utilising a chatbot survey as opposed to a basic computer survey due to their perception of it being a more time-efficient option.

CONCLUSION

This study provides a comprehensive exploration of the perceptions and attitudes of participants, mainly undergraduate students, towards the integration of a medical chatbot. The analysis begins with a demographic overview, indicating a balanced gender distribution with a slightly larger representation of females. Notably, a significant proportion of participants fall within the 18-25 year age range, with the subsequent largest group being undergraduates below the age of 18.

The primary findings of this study revolve around the positive perceptions expressed by undergraduate students regarding the adoption of a medical chatbot. This optimistic perspective suggests a favorable inclination towards this technological innovation. However, the study highlights the importance of delving deeper into the intricate factors that contribute to these positive perceptions. While these results are particularly relevant to the undergraduate population, it's crucial to acknowledge that differing demographic groups, including healthcare professionals and patients, might hold distinct perspectives.

The positive perceptions showcased by undergraduate students hold implications for the future integration of medical chatbots. The findings suggest that incorporating this technology into healthcare environments, educational curricula, and research initiatives involving undergraduate students is likely to be well-received. Despite this optimistic outlook, the study acknowledges the necessity for further investigation to unveil the underlying determinants of this positive perception and to assess the transferability of these results to diverse demographic segments.

Furthermore, the study's analysis of participants' responses to specific items indicates that while most aspects of the medical chatbot were well-received, there exists skepticism about the precision and reliability of healthcare suggestions provided by the chatbot. This underscores the importance of addressing concerns related to the accuracy of medical information provided by the technology. In conclusion, the findings demonstrate that undergraduate students generally hold positive perceptions regarding the utilization of a medical chatbot. This optimism holds promise for the integration of such technology into various spheres. Nevertheless, the study underscores the need for further exploration to uncover the factors shaping these perceptions and their implications across diverse demographic groups. By addressing concerns and understanding the nuanced dynamics, medical chatbots can potentially offer valuable contributions to healthcare, education, and research while aligning with the preferences of the undergraduate population.

Recommendations

Based on the discussed findings, here are some recommendations for implementation by Government, Health Ministry and Prospective Researchers raised from the study;

1.   In-Depth Study of Factors: Conduct a comprehensive qualitative study to delve into the underlying factors that contribute to the positive perceptions of medical chatbots. By

understanding the specific reasons behind these perceptions, strategies can be developed to amplify the positive aspects and address any concerns.

2.   User Education and Awareness: Develop educational initiatives to enhance participants' understanding of the capabilities, limitations, and accuracy of medical chatbots. Increasing awareness can help mitigate skepticism and build trust in the technology.

3.   Accuracy Enhancement: Collaborate with healthcare professionals to refine the precision and reliability of medical information provided by chatbots. Implement rigorous fact-checking mechanisms and ensure the chatbot's responses are evidence-based.

4.   User-Centric Design: Involve undergraduate students in the design and development process of medical chatbots. Their input can lead to user-friendly interfaces and functionalities that align with their preferences and needs.

5.   Training for Healthcare Professionals: Offer training to healthcare professionals to effectively integrate medical chatbots into their practices. This can foster collaboration between technology and human expertise, ensuring optimal patient care.

6.   Tailored Communication: Develop communication strategies that highlight the educational value of chatbots, particularly in fostering trust-based interactions and providing reliable health information to users.

7.   Multidisciplinary Collaboration: Foster collaboration between technology experts, healthcare professionals, educators, and researchers to ensure a holistic approach to the integration of medical chatbots in healthcare, education, and research environments.

8.   Longitudinal Studies: Conduct longitudinal studies to track the evolving perceptions and attitudes of undergraduate students and other demographic groups over time. This can provide insights into the long-term impacts and trends related to chatbot adoption.

9.   User Feedback Mechanisms: Establish feedback mechanisms that allow users to provide input on their experiences with the medical chatbot. This iterative process can lead to continuous improvement and adaptation of the technology.

10.   Interdisciplinary Research: Encourage interdisciplinary research that examines the impact of chatbots on various aspects of healthcare, education, and research, including psychological, sociological, and ethical dimensions.

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