



# Telehealth and Virtual Health: Evolution, Safety, and Hazard Management in Modern Healthcare Delivery



Hirni J Patel, Swapnil Raskar

**Abstract:** The rapid expansion of telemedicine has reshaped healthcare delivery, particularly amid increased demand for remote services. However, disparities in usage, awareness, and trust remain significant barriers. This study investigates the patterns of telemedicine adoption, perceptions of safety protocols, and associated challenges among healthcare professionals and patients. A cross-sectional observational study was conducted in November 2024, involving 111 participants: 3.5% healthcare professionals and 86.5% patients. Data were collected via Google Forms distributed through social networks and during patient counselling sessions. The questionnaire assessed demographics, frequency of telemedicine usage, and awareness of telehealth safety measures, including data privacy and security. Results showed that 42.3% of respondents used telemedicine occasionally, motivated by convenience, while 27% used it rarely due to limited awareness, trust concerns, and usability issues. Frequent users (5.4%) were typically more technologically adept. Younger participants (18–30 years) demonstrated higher acceptance and ease of use, whereas older individuals (>50 years) required simplified interfaces and additional guidance. Awareness of data security protocols was inconsistent—18.2% were unaware, and 44% only partially informed. Notably, even healthcare providers with fewer than 5 years of experience reported challenges in using telehealth tools effectively. The study highlights critical barriers to telemedicine adoption, including limited awareness, trust issues, and user interface difficulties, particularly for older adults and inexperienced providers. To promote broader adoption, the study recommends targeted interventions, including public awareness campaigns, enhanced communication about safety protocols, user-friendly platform designs, integration of telemedicine into routine care, and specialised training for healthcare professionals.

**Keywords:** Telemedicine, Awareness, Data Security, Usability, Healthcare Providers

## Nomenclature:

HRSA: Health Resources and Services Administration

PDC: Percentage of Days Covered

MPR: Medication Possession Ratio

VR: Virtual Reality

EHRs: Electronic Health Records

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AR: Augmented Reality

AI: Artificial Intelligence

SPSS: Statistical Package for the Social Sciences

## I. INTRODUCTION

Telemedicine, an essential and continuously evolving component of the healthcare system, offers an efficient approach to delivering medical services, particularly through synchronous telehealth, where patients and caregivers interact via real-time, two-way video communication [1]. As the world shifts from conventional to smart healthcare, digital technologies now enable seamless access to health information, enhanced connectivity among stakeholders, optimized resource management, and dynamic responses to healthcare demands [1,2]. This transformation marks a significant global move toward intelligent healthcare systems. Telehealth's evolution is rooted in historical milestones, such as Alexander Graham Bell's first medically purposed telephone transmission in 1876 and Hugo Gernsback's visionary "Teledactyl" device in 1925 [3,4], which anticipated remote patient evaluations [5–7]. The term "telehealth," as defined by the Health Resources and Services Administration (HRSA), encompasses a range of electronic communication technologies used in public health, clinical care, and education, including internet services, videoconferencing, streaming media, store-and-forward systems, and both landline and cellular communication tools [6–8]. Telemedicine offers numerous benefits, including reducing appointment no-shows, enhancing patient availability, and improving medication adherence, as measured by metrics such as Percentage of Days Covered (PDC) and Medication Possession Ratio (MPR) [8,9]. It also leads to high cost and time savings while expanding healthcare access in underserved or remote areas [8,9]. Looking ahead, the future of telemedicine is driven by emerging technologies such as artificial intelligence (AI) for diagnostics and personalized care, wearable devices for continuous health monitoring, improved interoperability with electronic health records (EHRs), and immersive tools like virtual reality (VR) and augmented reality (AR) for training and patient education [9]. These innovations are poised to transform healthcare delivery further and improve outcomes globally.



II. MATERIALS AND METHODS

This study employed a cross-sectional observational design to assess the usage, awareness, and perceptions of telemedicine among the general population. Data were collected in November 2024 through both online and in-person interviews. A total of 111 participants were surveyed using a structured Google Form questionnaire, which included an informed consent section. The questionnaire was disseminated via social media platforms, including WhatsApp, and during patient counselling sessions.

Participants were selected based on specific inclusion criteria, including any gender, internet access, ability to read and understand English, and willingness to participate. Individuals who declined to participate were excluded from the study. The study employed purposive sampling to recruit a diverse population meeting the criteria.

The materials used included a pre-validated Google Form for data collection. The study plan involved initial development and review of relevant literature, followed by the design and distribution of the survey. Once responses were collected, the data were compiled and entered into Microsoft Excel. Subsequently, statistical analysis was performed using both Excel and the Statistical Package for the Social Sciences (SPSS) software. Descriptive statistics, including graphs, tables, and pictograms, were used to interpret and present the findings effectively. This methodological approach ensured a systematic and comprehensive analysis of telemedicine usage and awareness patterns among the participants.

III. RESULT AND DISCUSSION

Demographic details of the participants in the survey are summarised in the table below.

A total of 111 participants were included in the project. Among them, 13.5% were healthcare professionals, and the remaining 86.5% were patients.

Table I: Demographic Details of Participants and Their Frequency of Usage of Telemedicine

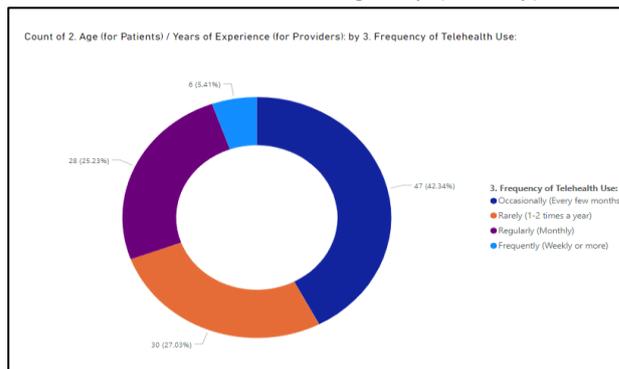
Parameter	Variable	No. of Participants (Percentage)
Response to Survey	Sent	150
	Responded	111
	Response Rate	74%
Age	18-30	31 (27.9%)
	31-40	28 (25.2%)
	40-50	24 (21.6%)
	>50	13 (11.7%)
Experience of a healthcare provider	0-5 years	15 (100%)
Frequency of Use	Rarely (1-2 times a year)	30 (27%)
	Occasionally (Every few months)	47 (42.3%)
	Regularly (Monthly)	28 (25.2%)
	Frequently (Weekly or more)	06 (5.4%)

Results of frequency usage indicate that approximately 42.3% (N=47) used it occasionally due to their needs, whereas only 5.4% used it frequently because it was convenient and easy for them.

Comparison Of Age Group, Experience of Healthcare Providers and Frequency of Participants.

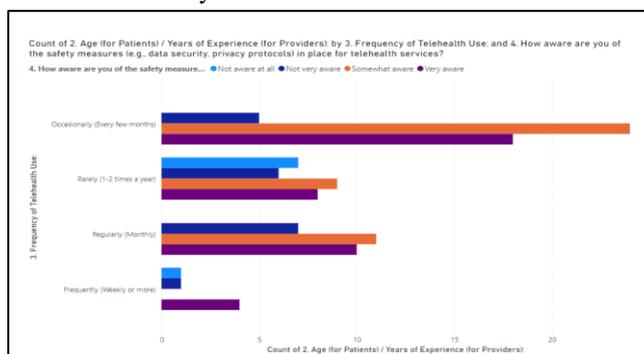
A. Graph 1 Comparison of Age Group, Experience of Healthcare Providers and Frequency of Participants

47 (42.34%) of participants were occasionally using it among 111. 6 people (5.41%) used it frequently; approximately 27% used it rarely because they were not aware of it; and 25.23% used it regularly (monthly).



[Graph 1. Comparison of Awareness on Telehealth Safety Measures between Age, Frequency, Frequency and Safety Measures]

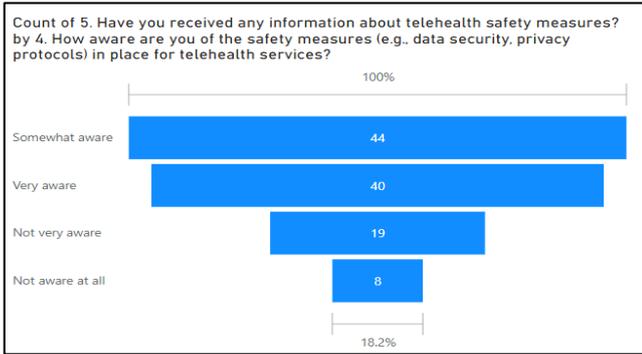
Most participants reported being somewhat aware of safety measures, such as data security and privacy protocols, and that they used them frequently; however, many had trust issues because they were not aware of these measures.



[Graph 2. Awareness of Telehealth Safety Measures Among Age, Frequency and Safety Measures]

In the comparison of safety measures between age and frequency, it gave results that extremely few, i.e., less than 40%, people were using telehealth rarely for their treatment due to many reasons like lack of information, inability to use it, lack of confidence in using it, Fear, Stress, trust issues and many more reasons. In contrast, fewer than 10% of people used it frequently because they were familiar with the advancing technology and highly aware of telehealth use, its significance, and its safety measures.



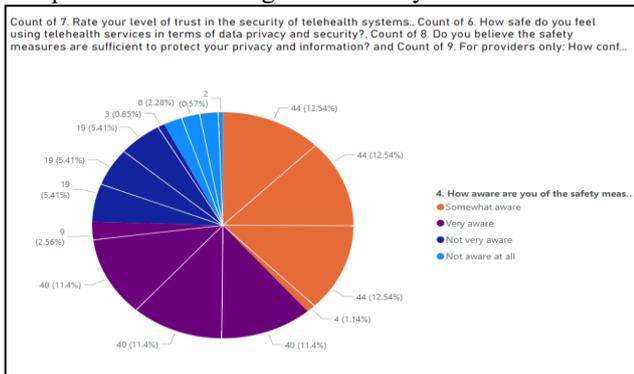


[Graph 3. Comparison of Information on Telemedicine and Safety Measures]

Approximately 18.2% were not aware of safety measures, such as security, privacy, and protocols, in these places, whereas 44% were somewhat aware of these measures.

**B. Comparison of Perception on Telehealth Safety Measures Between Age, Frequency, and Safety Measures and Security**

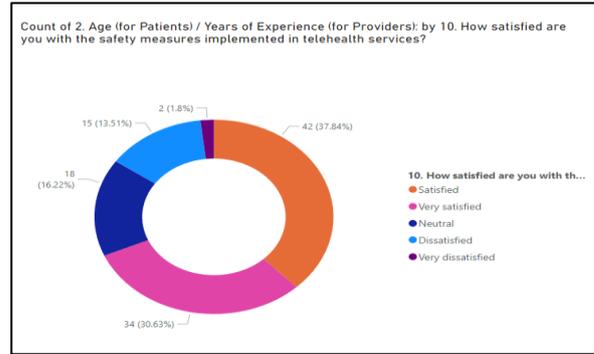
In the comparison of perception on telehealth safety measures between the ages and their feelings related to safety measures, the results showed that around 44% of the people were somewhat aware of the security parameters that are followed, such as the usage of antivirus software like Bitdefender, which protects more than 30 layers of presentation and detection technology. Bitdefender protects healthcare organisations against ransomware, fileless malware, and other modern attacks. It facilitates compliance with key regulatory requirements, including HIPAA, PCI and NST. SE46 Software ID from Nexus is also an antivirus software used in hospitals that prevents data from being removed from computer systems via peripheral devices, such as USB flash drives, CDs, and DVDs, thereby maintaining patient safety and system integrity. The graph below presents the results of our study on people’s perceptions and knowledge of the safety measures used.



[Graph 4. Comparison of Perception on Telehealth Safety Measures Between Age, Frequency, and Safety Measures and Security]

**C. Comparison of Satisfaction with Telehealth Safety Measures between Age, Frequency, Frequency and Safety Measures and Security**

People’s satisfaction with telehealth and virtual care has become an important part of contemporary life as the world moves toward digital health. Satisfaction with these services is valuable, as feedback can be collected and used to improve healthcare facilities. The pie chart below shows the percentage of satisfaction.

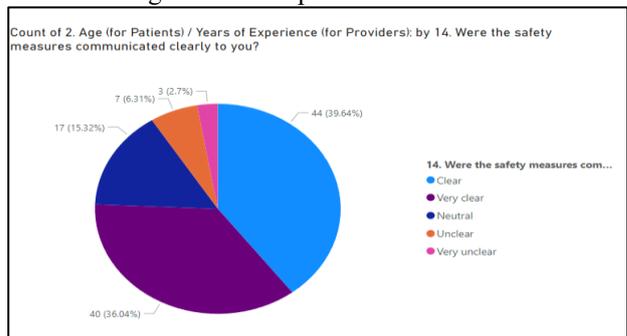


[Graph 5. Comparison of Satisfaction with Telehealth Safety Measures between Age, Frequency, Safety Measures and Security]

The pie chart describes as; 37.4% i.e. 42 people were extremely satisfied with the safety measures that the hospital uses for the protection of data as well as patient safety, around 13.51%, i.e. 15 people were not at all satisfied with safety measures as they had trust issues and lack confidence, as there is no physical evaluation of the patient.

**D. Comparison of Communication and Usability of Safety Measures Between Age and Frequency**

Comparing the communication and usability of telehealth by age and frequency is necessary because it justifies why people use it. Some of the reasons given by participants were: reduced time spent in hospital, greater availability of doctors and other healthcare professionals during emergencies, the potential to save someone’s life, and reduced waiting times in hospital.



[Graph 6. Comparison of Communication and Usability of Safety Measures Between Age and Frequency]

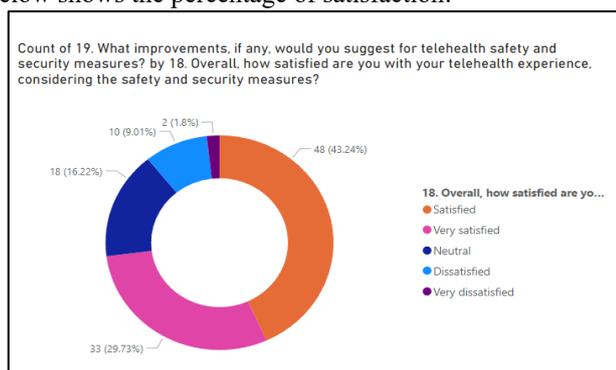
The graph above shows that how clearly the communication of safety measures was informed to the people and its interpreted as, that 39.64% were clearly communicated as they were somewhat aware about it and 2.7% of people were not clear about the telehealth since they were lacking knowledge of it, preferred physical hospital going for follow-ups, not availability of internet facilities, and many more reasons.

**E. Overall Satisfaction with Improvement Suggestions by Healthcare Professionals**

The overall experience of people and healthcare professionals on telehealth and virtual health was necessary, as it provides suggestions. for better improvement in the hospital sector in a more significant manner, which attracts



more people and creates greater awareness of its use and importance, and helps improve safety measures, such as developing safer software than is currently in use. The graph below shows the percentage of satisfaction.



[Graph 7. Satisfaction with Improvement Suggestions by Healthcare Professionals]

## IV. CONCLUSION

The survey reveals a growing acceptance of telemedicine, with 42.3% reporting occasional use and 25.2% reporting regular use. Younger users (18–30) showed greater adoption, while older individuals faced trust and technology barriers. Awareness of telehealth safety protocols remains limited—44% are somewhat aware, and 18.2% lack knowledge. Satisfaction with safety measures varies: 37.4% are highly satisfied and 13.51% dissatisfied, due to concerns about trust and evaluation. Key challenges include limited awareness, usability issues, and limited internet access. Addressing these through education, transparent communication, and improved platform design is crucial. Advanced technologies such as AI can enhance the user experience. Telemedicine remains valuable for emergency and routine care. Building trust and accessibility is key to broader adoption.

## DECLARATION STATEMENT

After aggregating input from all authors, I must verify the accuracy of the following information as the article's author.

- **Conflicts of Interest/ Competing Interests:** Based on my understanding, this article has no conflicts of interest.
- **Funding Support:** This article has not been funded by any organizations or agencies. This independence ensures that the research is conducted objectively and free from external influence.
- **Ethical Approval and Consent to Participate:** The content of this article does not necessitate ethical approval or consent to participate with supporting documentation.
- **Data Access Statement and Material Availability:** The adequate resources of this article are publicly accessible.
- **Author's Contributions:** The authorship of this article is contributed equally to all participating individuals.

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