

# Clinicians' Knowledge and Perception of Telemedicine Technology

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## Abstract

**Introduction:** Telemedicine is an application of information and communication technology in the healthcare environment. This study aimed to compare knowledge and perceptions of telemedicine technology among different groups of clinicians.

**Methods:** This survey study was conducted in 2013. The potential participants included 532 clinicians who worked in two hospitals and three clinics in a northern province of Iran. Data were collected using a five-point Likert-scale questionnaire. The content validity of the questionnaire was checked, and the reliability was calculated using Cronbach's alpha coefficient ( $\alpha = 0.73$ ).

**Results:** The results showed that most of the clinicians (96.1 percent) had little knowledge about telemedicine. They perceived the advantages of telemedicine at a moderate level and its disadvantages at a low level. The knowledge of dentists about this technology was less than that of other groups, and as a result they were less positive about the advantages of telemedicine compared to nurses, general physicians, and specialists.

**Conclusion:** The limited knowledge of clinicians about telemedicine seems to have influenced their perceptions of the technology. Therefore, providing healthcare professionals with more information about new technologies in healthcare, such as telemedicine, can help to gain a more realistic picture of their perceptions.

**Keywords:** telemedicine, clinicians, perception

## Introduction

Telemedicine is one of the leading areas in which information and communication technology has a crucial role. This technology offers a new method of providing healthcare services across different geographical areas,<sup>1,2</sup> and is used for promoting and facilitating the accessibility of healthcare services to people who do not have access to such services in their residential areas.<sup>3</sup>

Although telemedicine has a number of benefits, as with any other information system, it is important to explore users' views about the technology.<sup>4,5</sup> Moreover, the users' knowledge of the technology is an important issue that should be considered before beginning a telemedicine program.<sup>6</sup> In fact, healthcare professionals' knowledge and perceptions of telemedicine are important factors that can influence its future success.<sup>7-9</sup> Research has shown that a lack of knowledge, skills, and training among users, along with factors such as a lack of technical expertise, initial costs, and reimbursement issues, is an important barrier to the use of telemedicine.<sup>10,11</sup> On the other hand, proper understanding of telemedicine technology, especially by physicians, is an important requirement for successful implementation and deployment of the technology.<sup>12</sup> The more knowledge of the benefits and capabilities of telemedicine the users have, the more positive their attitudes toward this technology are expected to be. As a result, their confidence in using this technology will increase. Consequently, if the use of a new technology is supported by the people working in the field, others will have more confidence in the use of the technology, and a higher degree of positive attitude will be realized.<sup>13</sup>

A literature review identified various studies that have been completed to show the understanding of telemedicine among clinical staff and patients. For example, a study conducted by Meher and Tyagi showed that physicians and patients tended to increase their awareness and effective use of telemedicine technology.<sup>14</sup> A study by El Gatit et al. showed that 12.2 percent of

physicians had limited information about telemedicine, 39 percent had a high level of understanding of telemedicine, and 48.8 percent had a good understanding of telemedicine.<sup>15</sup> The study also showed that physicians' perception of telemedicine was a major factor that influenced the development of telemedicine programs, and Libyan physicians' knowledge of the technology affected their attitudes toward the use of telemedicine technology.<sup>16</sup>

In another study, Shittu et al. found that only 14.1 percent of physicians were aware of the advantages of telemedicine applications.<sup>17</sup> A study by Hu et al. showed that the attitudes of medical staff toward telemedicine, and their perceptions of the potential risks of telemedicine technology, were important factors for selecting or deselecting this technology to be used in healthcare organizations.<sup>18</sup>

In Iran, the Social Security Organization (SSO) is one of the largest health insurance agencies across the country. This is the second organization in the country that is responsible for providing healthcare services, and it works independently from the Ministry of Health. Hospitals and clinics affiliated with this organization are responsible for providing free healthcare services for the insured individuals.<sup>19</sup> Because of the wide geographical coverage and the large number of insured individuals, the use of telemedicine technology may have a number of benefits for the SSO. However, before deploying this technology in the hospitals and clinics affiliated with the SSO, it is important to explore clinicians' knowledge and perception of telemedicine technology.

## Methods

This survey study was completed in 2013. The potential participants included 532 clinicians who worked in the hospitals and clinics affiliated with Social Security Organization in a northern province of Iran. Among them, 494 clinicians were working in the hospitals affiliated with the SSO, and 38 clinicians were working in the clinics.

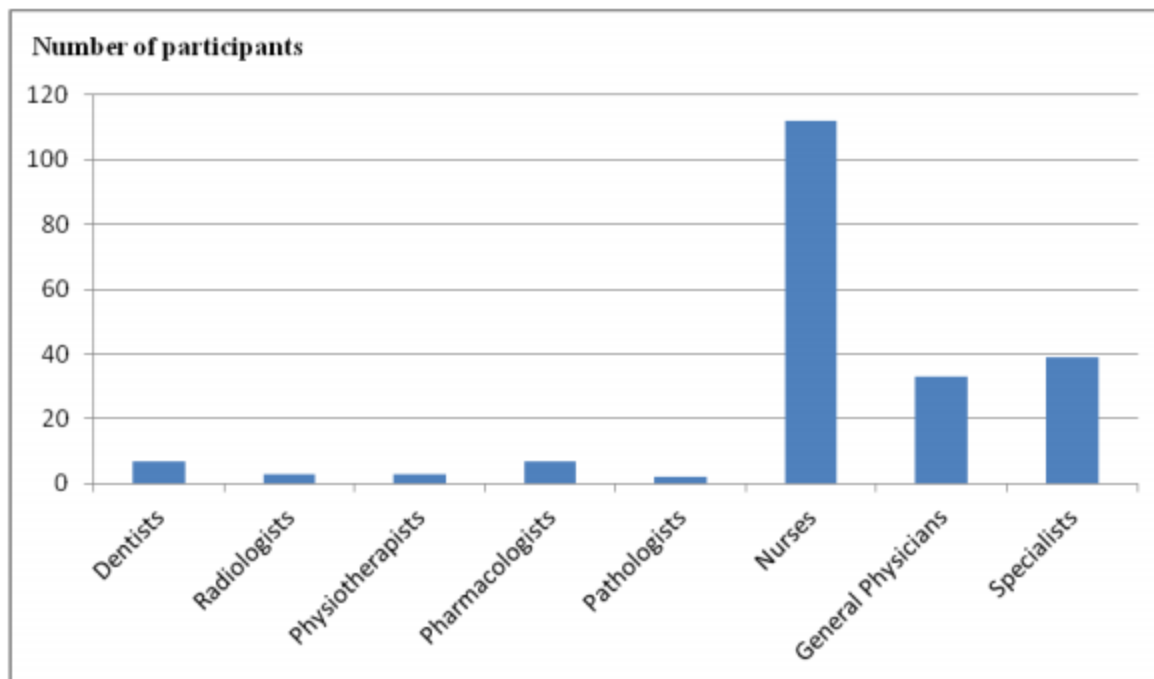
To collect data, a five-point Likert-scale questionnaire (see [Appendix](#)) was designed on the basis of the literature review. The scale ranged from very high (5) to very low (1). The questionnaire consisted of seven parts. Part 1 included personal information (eight questions), part 2 was related to the clinicians' knowledge of telemedicine technology (seven questions), and part 3 investigated clinicians' perception of the advantages of telemedicine technology (seven questions). Parts 4 to 7 asked about clinicians' perception of the disadvantages of telemedicine technology (eight questions), the necessity of deploying telemedicine technology (six questions), the impact of the application's ease of use (six questions), and the importance of the security of telemedicine technology (six questions).

The questionnaire was validated using face and content validity methods. The reliability of the questionnaire was calculated using Cronbach's alpha coefficient ( $\alpha = 0.73$ ).

## Results

In total, 206 clinicians completed the questionnaire, and the response rate was 39 percent. About half of the respondents ( $n = 110$ , 53.4 percent) were women, and 96 respondents (46.6 percent) were men. The findings showed that the age group with the highest frequency (41.3 percent) was 40–49 years. The specialists had the most work experience ( $15.82 \pm 6.11$  years). The clinical roles of the study participants are presented in Figure 1.

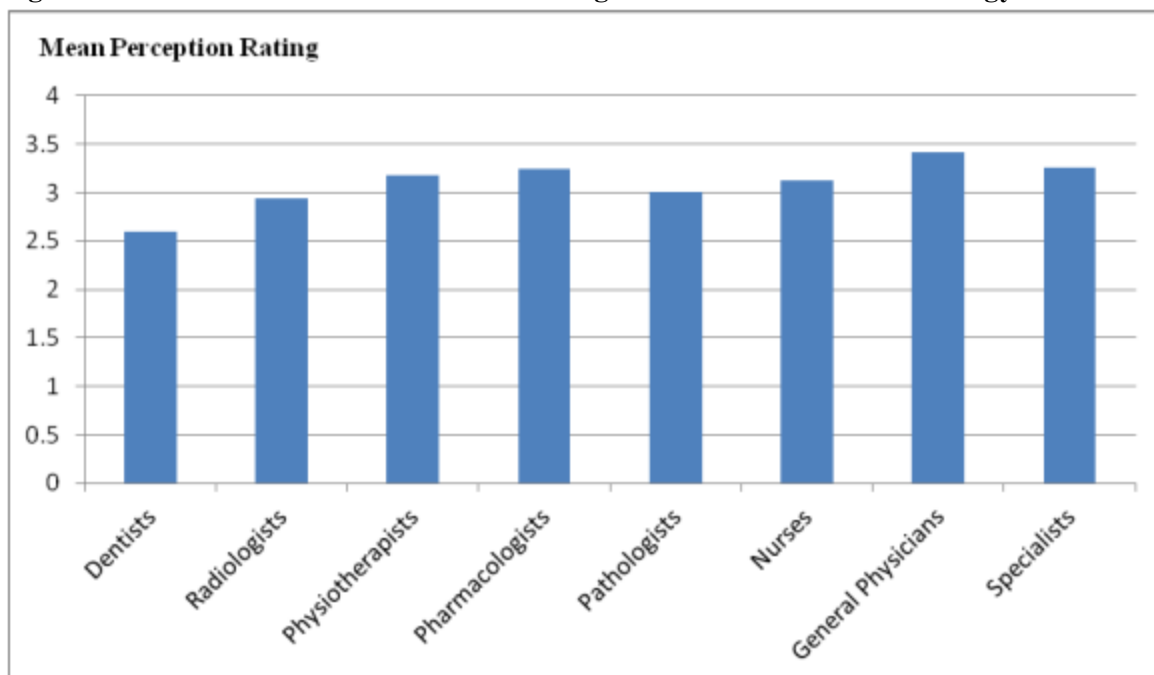
### Figure 1: Clinical Roles of Study Participants



The findings showed that the knowledge of a majority of clinicians (96.1 percent) about telemedicine technology was at a low or very low level ( $1.75 \pm 0.51$ ). They believed that continuous training in the use of telemedicine would be the most efficient solution to increase their knowledge about telemedicine ( $3.88 \pm 0.68$ ). Among clinicians, pharmacists' knowledge of the application of telemedicine technology ( $2.0 \pm 0.81$ ) was more than that of other groups of clinicians, and the knowledge of dentists ( $1.14 \pm 0.37$ ) was lower than that of others.

The clinicians' perception of the advantages of using telemedicine technology was at a moderate level ( $3.07 \pm 0.72$ ). In this part of the questionnaire, the highest mean value was related to the reduction of unnecessary transportation costs ( $3.94 \pm 0.79$ ) and the lowest mean value ( $1.82 \pm 1.04$ ) was related to the overall familiarity of clinicians with the advantages of telemedicine. Regarding the reduction of unnecessary transportation costs, the nurses had the highest mean value ( $4.02 \pm 0.72$ ), and the pharmacists and dentists had the lowest mean value ( $3.42 \pm 0.97$ ). A comparison of the clinicians' views about the advantages of telemedicine technology is presented in Figure 2.

**Figure 2: Clinicians' Views about the Advantages of Telemedicine Technology**



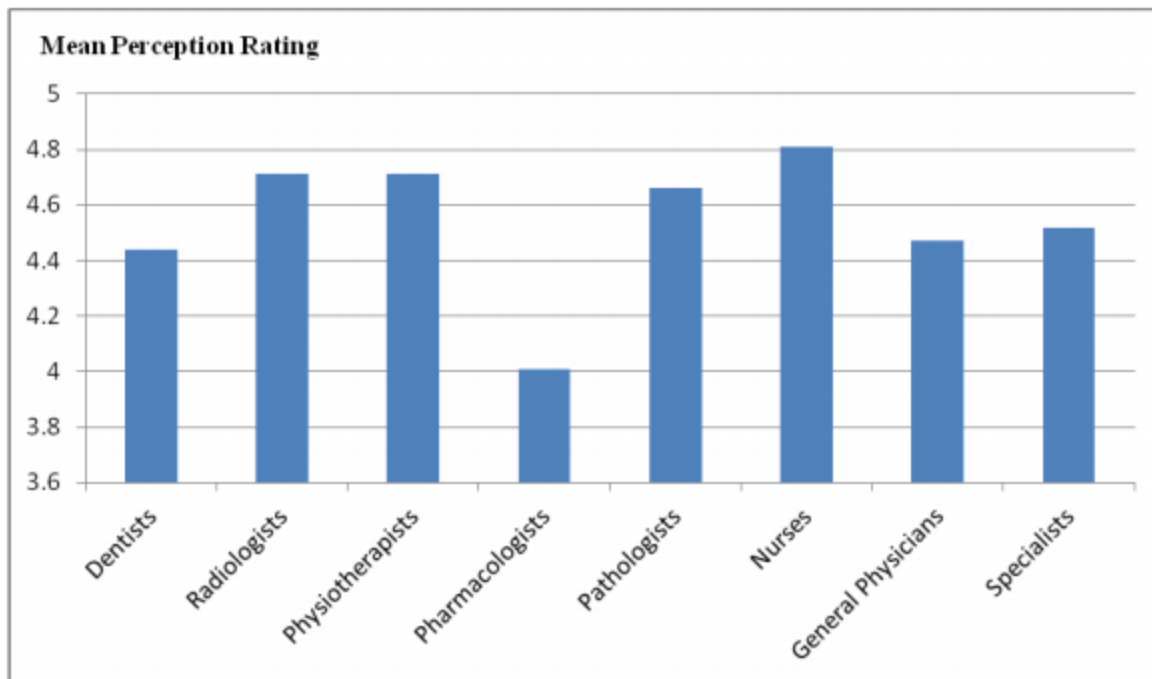
According to the results, more than half of the clinicians ( $n = 140$ , 68.0 percent) thought that the disadvantages of telemedicine technology were at a low or very low level ( $2.31 \pm 0.47$ ). The highest mean value ( $3.14 \pm 0.73$ ) was related to increased malpractice because of the use of telemedicine technology, and the lowest mean value ( $1.85 \pm 0.86$ ) was related to the psychological impact on patients. Regarding the increased malpractice, the dentists had the highest mean value ( $3.28 \pm 0.48$ ), and the pathologists had the lowest mean value ( $2.50 \pm 0.70$ ).

The results showed that most of the clinicians ( $n = 154$ , 74.8 percent) agreed with the necessity of using telemedicine technology ( $3.76 \pm 0.56$ ). In this section, the highest mean value ( $4.16 \pm 0.63$ ) was related to the necessity of using telemedicine technology to provide healthcare services to remote areas, and the lowest mean value ( $2.94 \pm 0.63$ ) was related to providing healthcare services at the point of need. In relation to the necessity of using telemedicine for distant areas, the pathologists had the highest mean value ( $4.50 \pm 0.70$ ), and the dentists had the lowest mean value ( $3.57 \pm 0.53$ ).

Regarding the impact of ease of use on the actual use of telemedicine, most of the clinicians ( $n = 198$ , 96.1 percent) thought that the system's characteristics, such as ease of use, can highly influence the use of telemedicine technology ( $4.46 \pm 0.73$ ). The highest mean value ( $4.48 \pm 0.59$ ) was related to the impact of the system's ease of use on the learnability of the system by users, and the lowest mean value ( $3.99 \pm 0.90$ ) was related to the impact of the system's ease of use on the work efficiency. Regarding the impact of the system's ease of use on the learnability, the nurses had the highest mean value ( $4.55 \pm 0.53$ ), and the pharmacists had the lowest mean value ( $3.71 \pm 0.48$ ).

The security of telemedicine technology was an important issue from clinicians' perspectives ( $4.82 \pm 0.55$ ) (see Figure 3). In this section, the highest mean value ( $4.83 \pm 0.53$ ) was related to the necessity of addressing data confidentiality issues, and the lowest mean value ( $4.50 \pm 0.73$ ) was related to the importance of legal supports. Concerning the importance of data confidentiality when using telemedicine, the pathologists, radiologists, and physiotherapists had the highest mean value ( $5 \pm 0$ ), and the pharmacists and dentists had the lowest mean value ( $4.42 \pm 1.13$ ).

**Figure 3: Clinicians' Views about the Security of Telemedicine Technology**



Finally, clinicians' views were compared using the Kruskal-Wallis test to identify any significant differences between groups. The results showed a significant difference between the clinicians' perspectives about the advantages of telemedicine ( $p = .003$ ) and the security of telemedicine ( $p = .008$ ). Regarding the advantages of telemedicine, there was a significant difference between dentists and nurses ( $p = .003$ ), general physicians ( $p = .002$ ), and specialists ( $p = .014$ ). This finding indicates that dentists were less positive about the advantages of telemedicine compared to nurses, general physicians, and specialists. Moreover, there was a significant difference between nurses and general physicians ( $p = .002$ ), meaning that general physicians were more positive about the advantages of telemedicine than nurses were. Regarding the security of telemedicine,

there was a significant difference between nurses and general physicians ( $p = .001$ ) and specialists ( $p = .003$ ), meaning that nurses were more concerned about the security of telemedicine than general physicians and specialists were.

## Discussion

Generally speaking, the use of information technology in healthcare organizations, as in any other organization, is affected by many factors. To deal with these factors, appropriate strategies need to be taken into account to facilitate the deployment of technology. Among these factors, human-related factors such as users' knowledge and perception of technology are of high importance. In fact, the users' positive perception of technology may help implementation of information technology proceed more smoothly and efficiently.<sup>20</sup>

In the current study, the results showed that overall, the clinicians' knowledge of telemedicine technology was low. Similarly, in the studies conducted by El Gatit et al.<sup>21</sup> and Shahpori et al.,<sup>22</sup> the results showed that physicians had little knowledge about telemedicine. In another study, Demartines et al. stated that although surgeons had limited knowledge and experience of telemedicine, most of them were interested in using it.<sup>23</sup> Similarly, the study by El-Mahalli et al. showed that the greatest barrier to the implementation and adoption of telemedicine was the lack of clinicians' knowledge about telemedicine.<sup>24</sup> Therefore, the findings of the current study are consistent with those of other studies. The results also showed that the study participants perceived the advantages of telemedicine technology at a moderate level. In this regard, Zailani et al. showed that the perception of usefulness has a positive and significant impact on the acceptance of telemedicine.<sup>25</sup> However, in the study conducted by Shittu et al., the results showed that only 14.1 percent of clinicians were familiar with the advantages of telemedicine applications, and only 6 percent of the respondents thought that telemedicine could reduce the cost of patient care.<sup>26</sup> In another study, Bagayoko et al. showed that telemedicine technology had potential to improve the recruitment, satisfaction, and retention of care professionals in remote areas.<sup>27</sup> Therefore, the results of the current study are consistent with those of previous studies.

According to Armfield et al., telemedicine implementation may have some shortcomings, and little evidence-based or practical information is available to guide clinicians and policy makers.<sup>28</sup> In the current study, a majority of clinicians thought that the disadvantages of this technology were at a low level. Among the clinicians, dentists perceived more disadvantages than advantages, which might be related to their limited knowledge about telemedicine. In the study conducted by Chang et al., the results showed that according to 24.1 percent of healthcare providers, the use of telemedicine could cause discomfort and inconvenience for patients.<sup>29</sup> Similarly, the American Medical Association considers the possibility of medical malpractice as an obstacle to the use of telemedicine. According to this association, a lack of standard legal frameworks between and within the states for telemedicine practice is the main reason for not using the technology.<sup>30</sup> The findings of the current study are in line with other studies, as the highest mean value in this section was related to increased malpractice due to the use of telemedicine.

According to the results of this study, despite the clinicians' limited knowledge of telemedicine, a majority of them thought that the use of this technology is necessary. The results are in line with the findings of other studies, in which clinicians have reported the necessity of using telemedicine. For example, the study by Bagayoko et al. showed that telemedicine technology provides new opportunities for continuous education among healthcare professionals in rural and remote areas.<sup>31</sup> In another study, Blozik et al. found that teleconsultation is a powerful tool for diagnosis and triage, and can help to provide timely care to patients.<sup>32</sup> George et al. indicated that the use of telemedicine can help to consult specialists at the right time to provide high-quality patient care.<sup>33</sup> Therefore, the current findings are in line with the results of similar studies that have emphasized the positive aspects of the technology.

In the current study, a majority of clinicians thought that the ease of use of the technology influences the effective use of the system. Among the clinicians, nurses perceived the telemedicine technology as easy to use, and dentists and pharmacists did not agree with this assessment. Generally, many studies have demonstrated the impact of the system's characteristics on the actual system usage. For example, in a study conducted in Spain, Saigí-Rubió et al. found that physicians' perceived ease of use of information and communication technologies in clinical practice was a variable that determined telemedicine use.<sup>34</sup> Chang et al. showed that telemedicine can improve efficiency if it is easy to use.<sup>35</sup> Similarly, Zanaboni and Wootton noted that advantages for users, such as ease of use and incentives, are the crucial determinant when designing an effective telemedicine system.<sup>36</sup> Rho et al. showed that perceived ease of use affected perceived usefulness and respondents' intention to use the technology.<sup>37</sup>

Finally, the results showed that according to most of the clinicians, the security of telemedicine technology should be considered at a high level. In a similar study, Judi et al. acknowledged that operational processes, such as maintaining the confidentiality of patient information and documentation, are the most important factors to establish a secure network for telemedicine.<sup>38</sup> Shittu et al. found that about half of the respondents were concerned about the ethical and legal issues related to telemedicine.<sup>39</sup> In the current study, the importance of implementing security policies and procedures in telemedicine technology was confirmed. Therefore, our results are in line with the results of similar studies.

## Limitations

The current study aimed to investigate clinicians' knowledge and perception of telemedicine technology. However, despite the effort made by the researchers, a limited number of clinicians participated in the study. The limited participation might be due to a lack of personal interest in the subject of the study or the time constraints in the healthcare centers. Therefore, the response rate was low, and the generalizability of the results to a larger population might be affected.

## Conclusion

While the use of telemedicine is common in many countries, the results of the current study showed that the clinicians' knowledge of telemedicine technology was limited. The limited information about the technology, especially among dentists, influenced clinicians' perception of the technology. Therefore, before this technology is deployed, it is essential to increase users' knowledge of the technology and demonstrate its capabilities and benefits. Adequate knowledge and positive perceptions of the technology are key factors to encourage users to use the technology in the future.

The security of telemedicine was another major issue, especially for nurses. Therefore, it is necessary to build the technology on a secure basis to avoid future loss or damages. Obviously, insecure technology will not be accepted and used by clinicians.

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[Back to text](#)

## Appendix: Questionnaire

### Part I: Personal Information

1. Age:



## 2. Gender:

☐ Female☐ Male

## 3. Type of employment:

☐ Permanent☐ Temporary

## 4. Education level:

☐ Bachelor's degree☐ Master's degree☐ PhD☐ GP☐ Specialist

## 5. University major

## 6. Work experience

## 7. Workplace:

☐ Hospital ☐ Clinic

## 8. Department in which you work:

**Part II: Knowledge of telemedicine technology****Please select from the most appropriate answer.**

No.	Responses	Very Low	Low	Average	High	Very High
	Questions					
1	To what extent are you familiar with telemedicine technology?					
2	To what extent are you familiar with the medical applications of telemedicine technology?					
3	Are conferences, speeches, or meetings held in your workplace regarding telemedicine technology?					
4	To what extent are you familiar with telemedicine tools?					
5	To what extent are you familiar with telemedicine guidelines?					
6	To what extent are you familiar with the use of telemedicine in other countries?					
7	To what extent is continuous training in the use of telemedicine necessary for doctors?					

**Part III: Clinicians' perception of the advantages of telemedicine technology**

8	To what extent are you familiar with the benefits of telemedicine?					
9	In your opinion, to what extent is telemedicine effective in reducing the unnecessary transportation costs?					

10	In your opinion, to what extent is telemedicine effective in reducing the costs of patient care in hospitals?					
11	In your opinion, to what extent does telemedicine influence users' satisfaction?					
12	In your opinion, to what extent does telemedicine technology save clinicians' time?					
13	In your opinion, to what extent does telemedicine technology provide faster and better medical care?					
14	In your opinion, how effective is telemedicine technology in improving patient care?					

#### Part IV: Clinicians' perception of the disadvantages of telemedicine technology

15	In your opinion, to what extent may telemedicine technology disrupt a doctor–patient relationship?					
16	In your opinion, to what extent has telemedicine technology reduced the effectiveness of patient care?					
17	In your opinion, can telemedicine technology cause psychological harm to the patient?					
18	In your opinion, to what extent does telemedicine technology endanger patient privacy?					
19	In your opinion, to what extent does telemedicine technology reduce the efficiency of patient care?					
20	In your opinion, to what extent may telemedicine technology result in unauthorized access to patient medical information?					
21	In your opinion, to what extent may telemedicine technology increase the expenses of a hospital?					
22	In your opinion, to what extent may telemedicine technology increase malpractice in healthcare?					

#### Part V: Clinicians' perception of the necessity of telemedicine technology

23	In your opinion, to what extent is telemedicine technology necessary for patient care?					
24	In your opinion, to what extent can telemedicine provide healthcare to patients in a timely manner?					
25	In your opinion, to what extent should new techniques be used along with the current technology?					
26	In your opinion, to what extent is telemedicine essential to provide healthcare to underprivileged and remote areas?					
27	In your opinion, to what extent can telemedicine technology provide doctors with instant access to patient information?					
28	In your opinion, to what extent are national standards essential for telemedicine technology implementation?					

#### Clinicians' perception of the telemedicine technology ease of use

29	In your opinion, to what extent does the ease of use of telemedicine technology make it practical for the clinical staff?					
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30	To what extent do easy-to-understand software programs make it easy for clinicians to apply telemedicine technology?					
31	To what extent does easy-to-use telemedicine technology increase the efficiency of clinical users?					
32	To what extent does ease of use of telemedicine technology reduce clinicians' errors?					
33	To what extent does ease of use of telemedicine technology facilitate its learning?					
34	To what extent does ease of use of telemedicine increase clinicians' skills?					

#### Clinicians' perception of the security of telemedicine technology

35	In your opinion, to what extent is authorized access necessary for the implementation of telemedicine?					
36	To what extent are security policies and guidelines necessary for the use of telemedicine technology?					
37	To what extent does telemedicine need to be supported by the medical community?					
38	To what extent should a framework be created to prevent breaching data confidentiality when using telemedicine?					
39	To what extent does telemedicine technology require legal clarification for patients?					
40	To what extent does telemedicine technology require a formulated and clear framework for access to medical information?					

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