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Research Article

Measuring the Knowledge and Attitudes of Healthcare Professionals Towards Telemedicine: A Step Towards Improving Medical Training

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Abstract

Telemedicine leverages information and communication technologies for remote healthcare delivery, enhancing access to medical services, improving consultation efficiency, and coordinating care. In Morocco, its integration aims to optimise access to healthcare, especially in remote areas. To maximise the benefits, it is essential to train health professionals in telemedicine, which requires an assessment of their current knowledge and attitudes. This study aims to assess these aspects. This cross-sectional study engaged medical staff from the Faculty of Medicine, Pharmacy, and Dentistry and Hassan II University Hospital in Fez. Data were collected online using a standardized questionnaire covering socio-demographic and professional information, knowledge, experience, and satisfaction with telemedicine. Data analysis was conducted using SPSS V25, adhering to ethical standards of participant anonymity and data protection. Among 145 participants (mean age 24.99 years, 69.7% female), 95.8% were Moroccan, predominantly medical students (76.6%). While 81.7% were familiar with telemedicine concepts, 96.5% were unaware of public telemedicine programs in Morocco. Notably, 94.6% had never experienced a telemedicine consultation, though 46.8% supported its use for non-urgent cases. Most participants relied on the internet for information, with 90.9% unaware of existing regulations. Furthermore, 61% advocated for incorporating telemedicine into medical curricula, emphasizing its significance for future practice. Enhancing telemedicine knowledge and integration in Morocco's healthcare system is vital. Systematic training in medical education will prepare future professionals, improve healthcare access, and underscore the strategic importance of telemedicine in evolving healthcare practices.

Keywords: Telemedicine; Knowledge; Attitudes; Medical Professionals; Healthcare System.

INTRODUCTION

Telemedicine, defined as the use of information and communication technologies to deliver healthcare services remotely, has revolutionized access to medical services [1]. Telemedicine is being introduced in response to a global context characterised by the need to improve access to healthcare, particularly in remote or poorly served regions, while at the same time optimising the efficiency of healthcare systems [2]. Indeed, several studies have shown that telemedicine can reduce diagnosis times, increase healthcare coverage and promote more coherent and efficient patient management [3, 4]. However, despite these benefits, the adoption of telemedicine remains limited in some countries, mainly due to technological and regulatory barriers, as well as barriers related to the training of healthcare professionals [5].

Numerous studies have explored the clinical and organisational benefits of telemedicine, as well as its impact on patient and professional satisfaction. However, these studies often highlight healthcare professionals' lack of knowledge or reluctance to use this technology, as well as a lack of specific training [6, 7]. In addition, most research has focused on the evaluation of clinical or technical outcomes, with little attention given to the state of knowledge and attitudes of future or current health professionals towards telemedicine.

It is therefore important to understand the perceptions of health professionals, particularly in the Moroccan context where the integration of telemedicine is in full development [8, 9]. It is therefore necessary to study more closely the level of knowledge, attitudes and possible reticence of healthcare professionals towards this technology in order to effectively adapt training and implementation strategies.

The aim of this study is to assess the knowledge and attitudes of Moroccan healthcare professionals towards telemedicine. More specifically, we would like to identify the factors that influence their perceptions, as well as any barriers to larger adoption. We also ask if improved knowledge of telemedicine is associated with more favourable attitudes, which could inform recommendations for the introduction of appropriate training programmes.

This research is crucial as it will help identify training needs and develop strategies to overcome the barriers to integrating telemedicine into the Moroccan healthcare system. It will also contribute to a better understanding of the levers for encouraging wider adoption of this technology, which is essential for responding to current and future health issues, particularly in the context of challenges such as the pandemic [10].

Finally, the approach adopted in this study is based on a quantitative questionnaire survey designed to collect accurate and representative data from healthcare professionals. This approach will make it possible to provide a reliable assessment of the current situation in order to guide awareness-raising and training initiatives at national level.

MATERIALS AND METHODS

Study Design and Target Population

This is a cross-sectional study conducted among the medical staff of the Faculty of Medicine, Pharmacy, and Dentistry of the FES (FMPDF) and Hassan II University Hospital of the FES (CHU). The target group included students, residents, interns, and professors of the FMPDF and the CHU.

Data Collection and Questionnaire Development

Data were collected online from the participants using a standardized questionnaire developed using Google Forms. The questionnaire was distributed via email to all students, residents, interns, and professors. It was created based on a review of the literature and subsequently validated through expert review. This questionnaire is composed from 42 questions and is presented as follows.

Questionnaire:

Socio-demographic Data

1. Age:

   _____

2. Sex:
   - Female
   - Male
3. Marital Status:
   - Single
   - Married
   - Divorced
   - Widowed

   _____

4. Nationality:
   - Moroccan
   - Tunisian
   - Malian
   - Chadian
   - Other: _____
5. Geographic Origin:

   _____

6. Status:

- Student
- Intern
- Resident
- Faculty
- Other: _____

7. Level of Study:

_____

8. Year of Study:
    - 1st year
    - 2nd year
    - 3rd year
    - 4th year
    - 5th year
    - 6th year
    - 7th year
9. Field of Study:
    - Medicine
    - Dentistry
    - Pharmacy
10. Specialty:

_____

_____

Knowledge Section

11. Have you heard about any of the following? (multiple answers possible)
    - Telemedicine
    - Teleconsultation
    - Tele-expertise
    - Telemonitoring
    - Tele-assistance
    - Medical regulation
12. In your opinion, which of the following describe an act of telemedicine? (multiple answers possible)

- It is the provision of healthcare services remotely.
- It uses information, communication, and technology to deliver healthcare services.
- Only phone calls are considered telemedicine, not video calls, messaging, or email.
- The exchange of information between doctors to provide healthcare is considered telemedicine.
- It allows remote patient follow-up.
- It allows continuous monitoring of the patient.
- It enables benefiting from the expertise of a distant healthcare professional.

13. What are your sources of knowledge about telemedicine? (multiple answers possible)

- Training
- Internet
- Social networks
- Multimedia (radio, television)
- Colleagues
- Scientific journals
- Other: _____

14. Are you aware of telemedicine programs conducted in Morocco's public sector?

- Yes
- No

If yes, please specify (institution, specialty, telemedicine act, etc.):

15. Are you aware of telemedicine programs conducted in Morocco's private sector?

- Yes
- No

If yes, please specify (institution, specialty, telemedicine act, etc.):

16. Are you aware of any regulatory law related to telemedicine in Morocco?

- Yes

- No

17. Have you heard of Decree 2-18-378 related to telemedicine?
    - Yes
    - No
18. If yes, how well do you know it?
    - All articles
    - Some articles
    - No articles

Benefits of Telemedicine

19. Please indicate your agreement with the following statements about telemedicine benefits (choose one per line):

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
It is useful in managing chronic diseases					
It allows a sufficient understanding of a patient's problem					
It enables capturing and storing medical information for future use					
It reduces the cost of disease management					
It improves interaction and relationship between doctors and patients					
It reduces medical errors					
It reduces medical visits					
It improves emergency medical care					
It increases the number of treated patients					
It improves clinical decisions					
It facilitates effective and efficient medical diagnosis					

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
It ensures security and confidentiality of electronically collected health data					

Challenges and Drawbacks of Telemedicine

20. Please indicate your agreement with the following statements about telemedicine challenges (choose one per line):

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
It threatens medical practice					
It implies major organizational changes in healthcare delivery					
It adds extra responsibility for healthcare providers					
It is not cost-effective in medical practice					
It wastes clinicians' time					
It threatens patient information confidentiality					
Adoption and use of telemedicine is a tedious and stressful process					
Using telemedicine requires a lot of mental effort					
Its use alters the doctor-patient relationship					

Experience with Telemedicine

21. Have you ever seen an act of telemedicine (YouTube, series, etc.)?
    - o Yes
    - o No
22. Have you ever witnessed a telemedicine act?
    - o Yes

- No

If yes, please specify in what context:

_____

23. Have you encountered telemedicine in the public sector?
    - Yes
    - No

    If yes, please specify (institution, specialty, telemedicine act, etc.):

    _____

24. Have you encountered telemedicine in the private sector?
    - Yes
    - No

    If yes, please specify (institution, specialty, telemedicine act, etc.):

    _____

25. Have you encountered telemedicine abroad?
    - Yes
    - No

    If yes, please specify (institution, specialty, telemedicine act, etc.):

    _____

26. Have you ever practiced telemedicine?
    - Yes
    - No

    If yes, please specify in what context:

    _____

27. Have you practiced telemedicine in the public sector?
    - Yes
    - No

    If yes, please specify (institution, specialty, telemedicine act, etc.):

    _____

28. Have you practiced telemedicine in the private sector?

- Yes
- No

If yes, please specify (institution, specialty, telemedicine act, etc.):

_____

29. Have you practiced telemedicine abroad?

    - Yes
    - No

    If yes, please specify (institution, specialty, telemedicine act, etc.):

_____

_____

Teleconsultations

30. Have you ever consulted a doctor by phone?

    - Yes
    - No

31. Have you ever consulted a doctor via an internet application? (multiple answers possible)

    - In Morocco
    - Abroad
    - Never

    If yes, please specify which application:

_____

32. Have you ever practiced telemedicine through an internet application? (multiple answers possible)

    - In Morocco
    - Abroad
    - Never

    If yes, please specify which application:

_____

_____

Satisfaction and Acceptability

33. Would you recommend a phone consultation to your family and friends? (multiple answers possible)
    - Routine consultations
    - Emergency
    - Never
34. Would you recommend the use of a telemedicine app to your family and friends? (multiple answers possible)
    - Routine consultations
    - Emergency
    - Never
35. Should the medical curriculum in Morocco include telemedicine?
    - Mandatory modules
    - Optional training
    - Not necessary
36. Are continuous training sessions on telemedicine necessary throughout your medical practice?
    - Yes
    - No
37. Does telemedicine fit well with your working style?
    - Yes
    - No
38. Do you plan to use telemedicine in your future clinical career?
    - Occasionally
    - Frequently
    - No

Telemedicine as a Replacement

39. Please indicate your agreement with the following statements about telemedicine replacing in-person care (choose one per line):

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Telemedicine should replace all healthcare services when feasible					
Telemedicine should replace all non-urgent healthcare services					
Telemedicine should replace emergency healthcare services					
Telemedicine should replace some services if the patient desires					

40. Are you satisfied with the current level of telemedicine use in Morocco?
    - Not at all satisfied
    - Not satisfied
    - Satisfied
    - Very satisfied
41. Are you satisfied with telemedicine practice in your University Hospital Center (CHU)?
    - Not at all satisfied
    - Not satisfied
    - Satisfied
    - Very satisfied
42. Do you have any additional comments?

Content and Dimensions of the Questionnaire

This questionnaire included five dimensions: socio-demographic data, professional data (staff status, level of education, specialty), knowledge, experience, satisfaction, and acceptance of telemedicine.

Question Types and Response Modalities

The nature of the questions included in the questionnaire presented in the above subsection can be categorized into several types. Some questions require dichotomous responses, meaning answers of "yes" or "no," while other questions allow respondents to select one or more options from a predefined set of choices. Finally, some questions are

formulated to collect graded responses, using a Likert scale ranging from "strongly disagree" to "strongly agree."

Data Analysis

Data were exported and processed in Excel, followed by analysis using SPSS V25 statistical software. Qualitative variables were expressed as percentages, while quantitative variables were presented as means with standard deviations (SD).

Ethical Considerations

Throughout the study, strict attention was paid to ethical considerations, in particular respect for the anonymity and confidentiality of participants. Procedures were designed to ensure the protection of personal data in accordance with the ethical principles of medical research.

RESULTS

Participant demographic and professional characteristics

In our survey, we collected data from 145 participants, with a mean age of 24.99 years (SD = 5.46) and a female predominance of 69.7%. The vast majority (95.8%) of the participants in this study were of Moroccan nationality. The sample included different profiles, mainly medical students (76.6%), and residents (15.2%) as shown in Table 1. The distribution of students by year of study showed that 30.1% were in their sixth year, making it the most represented year, followed by the first year with 26.7%.

Table 1: Characteristics of the sample

		mean ± DS / Percentage (%)
Age		24.29±5.46
Sexe	Men	30.3
	Women	69.7
Nationality	Morocco	95.8
	Other	4.2
Profile	student	76.6
	intern	2.8
	resident	15.2
	Teacher	4.1

	Other	1.3
Year of study	1st year	26.7
	2nd year	4.4
	3rd year	6.2
	4th year	8.8
	5th year	12.4
	6th year	30.1
	7th year	11.5

Knowledge and perceptions of telemedicine

In terms of understanding telemedicine, 83.2% of respondents identified it as the provision of healthcare services at a distance, 81.8% identified it as enabling remote patient monitoring, 72.7% identified it as ensuring continuous patient monitoring, and 65.7% identified it as using information and communication technologies to deliver healthcare services. In addition, 65.7% felt that it allowed remote access to the expertise of health professionals.

Familiarity with telemedicine concepts

Our results showed that 81.7% of the participants were familiar with the basic concepts of telemedicine. Approximately 75.4% and 38.7% had knowledge of teleconsultation and telemonitoring or tele surveillance, respectively.

Awareness of Telemedicine Programs in Morocco

Our study shows that 96.5% of participants were unaware of public telemedicine programs in Morocco, and 93.8% were unaware of private programs. In addition, 89.5% of participants had never received a telemedicine consultation, and 94.7% had never practiced telemedicine.

Knowledge of Moroccan Telemedicine Legislation

Regarding Moroccan Decree No. 2.18.378 on the practice of telemedicine, 95.1% of participants had never heard of it. Of those who had been informed, only 1.7% were familiar with all the articles of the decree and 6.8% with some of them.

Opinions on Telemedicine

Regarding opinions on telemedicine, 85.51% of respondents either agreed (35.17%) or strongly agreed (50.34%) that telemedicine is useful for managing chronic diseases. Only

29.65% felt that it provided a sufficient understanding of patients' problems. 73.79% either agreed (40%) or strongly agreed (33.79%) that it allows medical information to be recorded and stored for future use, and 67.59% believed that it reduces the cost of disease management. In contrast, only 13.79% agreed that it helps to reduce medical errors.

Impact of Telemedicine on Healthcare Practices

Some 78.62% either agreed (46.21%) or strongly agreed (32.41%) that telemedicine reduces the number of visits to the doctor, and 66.21% felt that it increases the number of patients treated. On the other hand, 64.83% of participants felt that the use of telemedicine increased the responsibility of the healthcare provider and 66.90% felt that its use involved a significant change in the organisation of healthcare. In addition, a quarter of participants felt that the use of telemedicine resulted in a significant loss of time for clinicians, 26.90% felt that its use threatened the confidentiality of patient information, and 38.62% felt that its use changed the doctor-patient relationship.

Sources of Information and Legal Awareness

The internet and social media were identified as the main sources of information about telemedicine for this population. However, a large majority (90.9%) were not aware of specific regulations and laws regarding telemedicine in Morocco.

Experience and intention to use telemedicine

Although 94.6% of participants had never experienced a telemedicine consultation, approximately 46.8% were in favour of using telemedicine applications for non-urgent consultations, and 33.8% for managing emergencies. However, around a quarter of participants had no intention of using telemedicine for any purpose.

Educational Perspectives on Telemedicine

In the educational field, 61% of participants supported the inclusion of telemedicine as an optional module in the medical curriculum in Morocco, and 30.5% as a mandatory module, highlighting the perceived importance of this competency in future medical practice, with only 8.5% stating that there was no need to include such a module.

Association between student characteristics and correct understanding of telemedicine definition

The study assessed healthcare students' knowledge of telemedicine, focusing specifically on their ability to correctly identify it as the use of information and communication technologies to provide healthcare services remotely. As shown in Table 2, no statistically significant differences were observed based on sex ($p = 0.444$), nationality ($p = 0.788$), level of study ($p = 0.851$) or academic field ($p = 0.428$). Similarly, various sources of information, such as formal training ($p = 0.787$), internet use ($p = 0.600$), colleagues ($p = 1.000$) and scientific journals ($p = 0.661$), did not significantly influence students' understanding of the correct definition. However, exposure to telemedicine through social

media was significantly associated with a better understanding: 76.1% of students who used social media correctly identified the definition, compared to 47.4% of those who did not (p = 0.001).

Table 2: Association between student characteristics and correct understanding of telemedicine definition

		Telemedicine uses information and communication technology to provide healthcare services remotely.		**P_value**
		No n (%)	Yes n (%)	
Sex	Women	33 (32.7%)	68 (67.3%)	0.444
	Men	18 (40.9%)	26 (59.1%)	
Nationality	Morocco	50 (36.2%)	88 (63.8%)	0.788
	Other countries	1 (20%)	4 (80%)	
Study level	student	40 (36%)	71 (64%)	0.851
	≥ intern	11 (32.4%)	23 (67.6%)	
Branch	Medicine	50 (36.5%)	87 (63.5%)	0.428
	pharmacy	1 (14.3%)	6 (85.7%)	
Source of knowledge about telemedicine:				
Training	No	45 (36%)	80 (64%)	0.787
	Yes	6 (30%)	14 (70%)	
Internet	No	17 (39.5%)	26 (60.5%)	0.6
	Yes	34 (33.3%)	68 (66.7%)	
Social networks	No	30 (52.6%)	27 (47.4%)	0.001
	Yes	21 (23.9%)	67 (76.1%)	
Colleagues	No	37 (35.6%)	67 (64.4%)	1.000
	Yes	14 (34.1%)	27 (65.9%)	
Scientific journals	No	46 (36.2%)	81 (63.8%)	0.661
	Yes	5 (27.8%)	13 (72.2%)	

DISCUSSION

This survey provides valuable insights into the current state of knowledge and attitudes towards telemedicine. The familiarity with the basic concepts of telemedicine (81.7%) and teleconsultation (75.4%) among the participants is encouraging to suggest to build a deeper understanding. However, this knowledge is uneven, particularly in subcategories such as

telemonitoring, where only 38.7% of respondents were informed. These findings contrast with those of Wubante et Tegegne [11], who found that 65.8% of healthcare professionals had a good understanding of telehealth.

The results show that the internet and social media are the main sources of information about telemedicine for our study participants, in line with previous research by Shibabaw et al [12] and Mazandarani et al [13]. This highlights the important role of these platforms in raising awareness of telemedicine, particularly teleconsultation, which appears to be the most commonly used service. However, it is noteworthy that a large proportion (90.9%) of participants were not aware of the legal and regulatory aspects of telemedicine.

This indicates significant gaps in education and training in this area. Incorporating telemedicine content into medical education programmes may help to address these gaps and better prepare health professionals for its legal and practical aspects. Furthermore, a very high percentage of participants reported that they were not aware of both public (96.5%) and private (93.8%) telemedicine programmes available in Morocco. This lack of awareness highlights an urgent need for outreach, as suggested by the work of Datta et al. [14], where the majority of respondents were unaware of telemedicine practice guidelines.

In terms of personal experience with telemedicine, 89.5% of participants had never received a telemedicine consultation, which hinders their ability to assess its effectiveness. This is consistent with the findings of Bashir et al. [15], who showed that the majority of healthcare professionals had positive attitudes towards telemedicine despite limited knowledge. It is important to note that our study shows that 46.8% of participants support the use of telemedicine applications for non-urgent consultations, suggesting potential acceptance if information and access measures are put in place.

In terms of perceptions of the usefulness of telemedicine, 85.51% of participants thought it was useful for managing chronic conditions, although only 29.65% thought it was effective in understanding patient problems. These findings are consistent with the concerns highlighted by Goyal and Khatib [16] and Assaye et al. [17], who reported that, although telemedicine has the potential to improve access to care, many participants remain wary of its effectiveness compared to traditional face-to-face consultations.

Our study also shows that the majority of participants (61%) support the inclusion of telemedicine in the medical curriculum. This is in line with Chereka et al [18] who found that targeted education increased acceptance and understanding of telemedicine among healthcare professionals. These results emphasise the importance of integrating telemedicine education into medical training to support its wider adoption.

In order to support the effective integration of telemedicine into the Moroccan healthcare system, several measures should be considered. First, a structured telemedicine module should be included in undergraduate and postgraduate medical education. This module should include both theoretical knowledge and practical experience to ensure competence in the use of telemedicine tools.

In addition, awareness campaigns targeted at health professionals are needed to increase knowledge of available public and private telemedicine services and to promote their adoption. Continuing professional development programmes should also include specific sessions on telemedicine to support currently practising health care providers.

In addition, it would be valuable to conduct impact studies to assess how educational interventions influence knowledge, attitudes and acceptance of telemedicine among different health professional groups. Such evidence can guide the refinement of educational strategies.

Finally, the provision of practical training opportunities such as internships or pilot programmes can help professionals gain real-world experience with telemedicine, which may improve both their confidence and perceptions of its effectiveness.

CONCLUSION

While awareness of telemedicine is growing, further efforts are needed to strengthen its integration into the Moroccan healthcare system. By implementing the above recommendations, it is possible to create an environment that supports the effective use of telemedicine and improves access to healthcare. The generally positive attitudes of students and professionals and their interest in acquiring telemedicine skills highlight the potential of telemedicine to significantly improve healthcare delivery. A systematic approach to integrating telemedicine into medical and related health education is, therefore, essential to preparing future providers and strengthening the healthcare system as a whole. These findings underscore the need for integrating telemedicine into medical education to better prepare future healthcare professionals for its implementation.

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CONFLICT OF INTERESTS

All authors declare no conflict of interest

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