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Factors Affecting the Establishment of Teledermatology in Iran; A Mixed-Method Study

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Abstract

Background and objective: One of the important and common applications of telemedicine is the diagnosis and treatment of skin diseases. However, teledermatology requires further commitments to provide standard services and appropriate electronic data transfer for reliable diagnostics to comply with technical standards and legal requirements. The present study aimed to determine the factors affecting the establishment of Teledermatology in the qualitative and quantitative sections.

Methods: A mixed-method study (including quantitative and qualitative sections) was conducted in 2018. In the qualitative section, experts were selected by purposive sampling and the data were collected through 2 focus group discussions and 6 semi-structured interviews. The content of sessions and interviews were transcribed and then analyzed by the content analysis method. In the quantitative section, 384 participants were selected randomly. The data were collected using a researcher-made questionnaire whose validity and reliability were confirmed. Data analyses were performed in SPSS.

Results: A total of 8 categories and 58 subcategories were extracted. The 8 categories of the factors affecting the establishment of teledermatology in Iran included service provider, service recipient, structural, technological, economic, policymaking, legal, and cultural. Cultural factors (3.95±0.77) and policymaking factors (3.22±0.84), respectively, had the highest and the lowest effects on the establishment of teledermatology in Iran.
Conclusion: Factors affecting the establishment of Teledermatology are diverse and extensive, which the most effective factors were cultural factors, technological factors and factors related to service providers. These findings can help the policymakers and managers interested in the establishment of teledermatology in Iran.

Keywords: Telemedicine; Teledermatology; Mixed methods study

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Introduction

The term “telemedicine” was first introduced to the medical literature in 1920[1]. As defined by the World Health Organization (WHO), telemedicine refers to the provision of health services by all health care professionals using telecommunication technologies to exchange credible information for the diagnosis, treatment and prevention of diseases and injuries, research, evaluation, and continuous training of health care providers when distance is considered a vital factor [2]. Increased access to health care services, increased and continuous provision of health care, patient training, timely treatment, increased access to medical information, and continuous development of education are some advantages of telemedicine [3]. One of the major and common applications of telemedicine is teledermatology [4]. The application of teledermatology to provide specialized skin services can lead to a faster access to specialized medical services regardless of geographical location, reduce the waiting time to receive services, and reduce the costs of specialized services (visitation fee, transportation, and accommodation) [5]. Teledermatology can be employed in real time using video conferencing systems [6], a method in which medical images are received and stored by the physician and sent to the specialist [5]. Teledermatology can improve access to specialized skin services by overcoming existing barriers [7]. With slight changes over time, teledermatology is still defined as the application of telecommunication technologies to provide virtual communication between the applicants for skin healthcare services and dermatologists [8]. In teledermatology, clinical information and images of skin lesions can be communicated between a general practitioner and a dermatologist, between dermatologists, or even between a patient and a dermatologist for obtaining diagnostic and therapeutic recommendations [9]. It has been shown that teledermatology is an effective tool of triage that can reduce the waiting time for the initial intervention in specialized skin services in patients with skin cancer [10]. Numerous studies have been conducted on teledermatology in different countries of the world. The results of a study showed that the establishment of teledermatology reduced the waiting time of patients for skin healthcare services from 84.6 days to 6.7 days. In addition, the number of patients examined through this system increased to 901 per year and 2.63 per hour, on average [11]. In a study in Botswana, the results indicated that teledermatology was considered an appropriate option for HIV-positive patients as an alternative to face-to-face consultations [12]. Moreover, the increased waiting time for skin healthcare services and visitation costs can endanger the patient's health and reduce the quality of therapeutic outcomes [13]. Despite the obvious benefits of teledermatology for widespread access to skin healthcare services, this system has not gone through a period of uniform growth and development [14]. Most cases of skin diseases are chronic conditions that require a long time for care, treatment, and follow-up. The trips made to visit a dermatologist in a hospital, a specialized clinic or his/her office can be both costly and time-consuming [15]. Considering the increasing tendency of various fields of medical sciences to apply this technology in providing healthcare services, the visual nature of such diseases is an ideal area for the introduction and application of telemedicine, as well as an opportunity to change and

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transform the traditional way of communication between physician and patient, especially after the advent of digital photography [16]. The ultimate goal of this technology is to increase the effectiveness of healthcare services by increasing the continuity and accuracy of healthcare services and reducing the time required to provide diagnoses. In fact, teledermatology has attracted the attention of patients and healthcare providers and policymakers due to its capability to provide high-quality and less expensive specialized healthcare services. Since, recognizing the factors influencing the establishment of teledermatology can lead to more efficient and effective implementation, present study hence aims to determine these factors to establish teledermatology in Iran. In this regard, a mixed method was applied to provide a stronger interpretation because quantitative and qualitative methods reinforce each other's strengths and remove each other's weaknesses.By combining quantitative and qualitative findings, a general view of the findings can be obtained that is not possible by any of the quantitative or qualitative methods alone. Using both types of data allows researchers to generalize the results of the sample to the Society and gain a deeper understanding of the phenomenon.

Materials and Methods

A mixed-method study (including quantitative and qualitative sections) was conducted in 2018.

Qualitative study

The statistical population in this section consisted of provincial and national managers of the Center for Statistics and Technology Management of the Ministry of Health, dermatologists, professors and faculty members in the field of health care management, and faculty members from research centers.

The participants were selected based on purposive sampling method. Accordingly, those who met the preset criteria were identified, and then their views were elicited to identify the experts. The criteria set for the selection of participants were familiarity and mastery over the research subject, having a managerial background in the health system, at least ten years of work experience, employment in public and private medical centers, familiarity with information technology and its importance in the health system and electronic services in the health system, and having a relevant university degree.

The data were collected through 2 sessions of focus group discussion and 6 semi-structured interviews. Main question of interview guide was “In your opinion, what factors are effective in establishing a telematology trap in Iran”. The research team prepared and sent invitations to experts to participate in the focus group discussion. The invitation contained information about the title, objectives, time, and place of sessions. Before the beginning of the focus group discussion, the participants were briefed on the research nature, objectives, and procedure. Then 2 sessions of focus group discussion were held for 2.5 and 3 hours. During these sessions, the participants freely expressed their opinions and the meeting coordinator tried to direct the session and maintain its dynamicity. The interviews were also conducted in a quiet place away from any distraction. The participants were interviewed during 35- 55 minutes.The interviewees were also briefed on the research objective. The interviews and focus group discussions were finished

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whenever data saturation was achieved. Data saturation refers to the point in the research process when no new information is discovered in data analysis. The participants were assured that their information will be kept confidential and the content of interviews and focus group discussion will be used for data analysis anonymously. The transcribed content of interviews and focus group discussion were provided to the participants and they were asked to confirm the accuracy of data.

To increase the research acceptance, combinative methods and the observer review technique were employed. Accordingly, sufficient time was allocated to data collection and the subject was considered from different aspects. Moreover, complementary views were collected and the review of manuscripts was provided by colleagues. To increase the data transferability, data collection and analysis were simultaneously performed on appropriate samples. To add to the data consistency, the data were analyzed by various researchers and external observers. To increase verifiability, the whole research process was explained from beginning to end[17-19].

The data obtained from interviews were analyzed using thematic analysis. In this regard, First, all the transcripts were carefully read several times and Important relevant parts were identified. Then, the subgroups were assigned to each category. After making sure that the created categories represent all the data, the themes were extracted and the data was merged[20].

Quantitative study

In this section, a cross-sectional descriptive-analytical study was performed. The research population included two groups of experts in information technology and dermatologists in all universities of medical sciences. Due to the lack of accurate statistics information from the target population, the Cochran's formula was used to determine the maximum required sample. Based on the tendency of 50%, the error rate of 5% and the confidence interval of 95% (= 0.05, d = 0.05, p = 0. 5a), the sample size was determined 384 people.

$$n = \frac{z^2pq}{d^2} = 384$$

The sampling method was cluster sampling. Given that the research society has 10 clusters, which corresponds to the ten national poles of the country's medical universities, in order to achieve the best estimates of the target society, first 6 clusters were randomly selected. Therefore, the sample size allocated to each cluster was 64 people. Selection of samples within clusters has been done by convenient sampling.

To develop the research questionnaire, the results of the qualitative section were extracted and then their content validity was investigated by quantitative and quantitative methods. To assess the qualitative validity, the questions were provided to a panel of 10 professionals, including professors of health care management, dermatologists, IT experts, and health policymakers, to make their corrective comments on the grammar, sentence structure, and phrases. The quantitative content validity was assessed by using Content Validity Ratio (CVR) and Content Validity Index (CVI). For CVR, members of the above-mentioned panel were asked to review all questions and categorize them as “necessary”, “useful but unnecessary”, and “unnecessary”. Finally, CVI was calculated by using the following formula:

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$$CVR = \frac{n_E - \frac{N}{2}}{\frac{N}{2}}$$

The reliability of the questionnaire was assessed by using the test-retest method. Based on the opinions of 50 experts, the correlation coefficient in a 10-day interval was reported to be 0.934.

The research questionnaire consisted of two parts: the demographic information of the participants and the factors affecting the establishment of teledermatology. The questionnaire was scored based on a 5-point Likert scale (1: totally disagree, 2: disagree, 3: no common, 4: agree, 5: totally agree). Considering the geographical distribution of the participants, the questionnaires were sent to the participants as a web form. The electronic version of the questionnaire was sent to those whose email address was available and those who were willing to receive and fill out the questionnaire electronically. The questionnaire delivery, completion, and return were followed up through three remainders: telephone, email, and SMS. The obtained data were statistically analyzed in SPSS-21.

Results

Qualitative study

A total of 8 categories and 58 subcategories were extracted. The 8 categories of the factors affecting the establishment of teledermatology in Iran included service provider, service recipient, structural, technological, economic, policymaking, legal, and cultural (Table 1).

Table 1: The factors affecting the establishment of teledermatology in Iran

Main categories	Sub-categories	CVR		Mean	Standard deviation
		Score	Result		
Service provider	Interaction between general practitioners and specialists	0.8	Confirmed	3.27	1.03
	Increasing the awareness and knowledge of service providers	0.8	Confirmed	3.20	0.96
	Increasing the individual and professional skills of service providers	1	Confirmed	3.31	0.88
	Unequal geographical distribution and lack of specialists in remote areas	0.8	Confirmed	3.20	0.98
	Stockholders' understanding of the results of using technology in the service delivery process	0.8	Confirmed	3.28	0.98
	Determination of an acceptable level of patient safety	0.8	Confirmed	3.23	0.04
	Accuracy of diagnosis	1	Confirmed	3.27	0.96
	Patient-physician relationship regarding adherence to the treatment plan	-0.8	Rejected	-	
	Need for distance medical training	0.8	Confirmed	3.30	0.97

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	Validation of service providers	-0.8	Rejected	-	
Service recipient	Burden of visits	0.8	Confirmed	3.59	0.93
	Patient satisfaction	0.8	Confirmed	3.63	0.93
	Waiting time between preventive care and treatment	0.8	Confirmed	3.49	0.98
	Unpredictable behavior of patients in decision-making	-0.8	Rejected	-	
	Accessibility	0.8	Confirmed	3.59	0.89
	Interface-free connection between users and the system	0.8	Confirmed	3.54	0.95
	Information access through secure encryption	0.8	Confirmed	3.54	0.96
	Expansion of high-quality medical services	0.8	Confirmed	3.52	0.95
	Direct access of patients to their medical records	0.8	Confirmed	3.61	0.91
	Adequate access of the physician to the patient's medical records	0.8	Confirmed	3.47	1.009
	Quality of services	0.8	Confirmed	3.47	0.96
	Continuous provision of care	1	Confirmed	3.54	0.94
	Promotion of preventive care	-0.8	Rejected	-	
Structural factors	Accurate information security and privacy	1	Confirmed	3.70	0.96
	The role of universities and determining the scope of authority	1	Confirmed	3.66	0.89
	Distribution of equipment between different centers	1	Confirmed	3.94	0.84
	No access of patients to their medical records	-1	Rejected	-	
	Insufficient access of the physician to the patient's medical records	-1	Rejected	-	
	International restrictions on information sharing	1	Confirmed	4.02	0.85
	Lack of medical guidelines in telemedicine	0.8	Confirmed	3.35	1.09
	Barriers to technology adoption, such as complex and time-consuming administrative processes	-1	Rejected	-	
	Continuity of supply and credit	0.8	Confirmed	3.58	0.95
Technological factors	Computer system usability	0.8	Confirmed	4.22	0.87
	Reliability of technology (responsibility and training) and computer system	0.8	Confirmed	3.98	1.03
	User-friendliness of telemedicine	0.8	Confirmed	3.89	0.91

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	Connection between telemedicine network and the government system to confirm the identity of patients	0.8	Confirmed	3.82	1.03
	Risk of equipment failure	0.8	Confirmed	3.88	1.01
	Infrastructure	0.8	Confirmed	3.47	1.14
	Integration of heterogeneous systems	0.8	Confirmed	3.47	1.06
	Development of intelligent systems	1	Confirmed	3.24	1.11
	Messaging standards	1	Confirmed	3.76	1.01
Economic factors	Less costly methods in financial, social and environmental interactions	1	Confirmed	3.49	1.10
	Reduction of hospitalization costs	1	Confirmed	3.47	1.08
	Medical equipment costs	1	Confirmed	3.44	1.07
	Specialist payroll	1	Confirmed	3.28	0.94
	Threatening insurance companies to pay premiums	0.8	Confirmed	3.52	0.92
	Market forces and competitors	1	Confirmed	3.42	1.01
	Budget constraints	0.8	Confirmed	3.42	0.99
	Private insurance coverage	0.8	Confirmed	3.51	0.98
Legal factors	Determination of a framework and issuance of third-party certificates for patients to access their medical records	0.8	Confirmed	3.42	0.95
	Framework of instructions and validation	0.8	Confirmed	3.57	0.88
	Reliability and variety of clinical guidelines and regulations	1	Confirmed	3.42	0.97
	The role of the Ministry of Health and Medical Education in e-health	1	Confirmed	3.48	0.96
	Focus on public health services	1	Confirmed	3.47	0.92
Policymaking factors	Insurance supervision	1	Confirmed	3.22	0.92
	Necessary framework for formulating rules and guidelines	1	Confirmed	3.51	0.98
	Concerns about the system's user-friendliness	-1	Rejected	-	
	Insurance responsibility protocols	1	Confirmed	3.53	0.93
	Development of care delivery guidelines	1	Confirmed	3.56	1.007
	Necessary rules for encrypting patients' security information	1	Confirmed	3.22	0.95

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	Documents contained in clinical cases for judicial barriers	1	Confirmed	3.47	1.03
Cultural factors	Technology-based trust and cooperation between partners without knowing each other	0.8	Confirmed	3.11	0.96
	Transparency and security of all exchanges in general	0.8	Confirmed	3.05	1.03
	Necessary tools for interaction and implementation	0.8	Confirmed	3.26	1.10
	The degree of cooperation and high scale in the health system	0.8	Confirmed	3.52	1.03
	Interaction between experts at the national and international levels	0.8	Confirmed	3.14	1.03
	Improvement of communication skills and proper interaction	-1	Rejected	-	

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Quantitative study

Of the 384 participants of this study, 226 participants (58.9%) were female and the rest of them were male. Most of the participants aged 41-45 years (27.6%), has a master's degree (50%), and had 10-15 years of work experience (41.9%). Among the factors related to service providers, the highest mean belonged to "increasing the individual and professional skills of service providers" (3.31±0.88) and the lowest mean was related to "unequal geographical distribution and lack of specialists in remote areas" (3.20±0.98). Among the factors related to service recipient, the highest mean was related to "patient satisfaction" (3.63±0.93) and the lowest mean belonged to "adequate access of the physician to the patient's medical records" (3.47±1.001). Among the structural factors, the highest mean was related to "international restrictions on information sharing (4.02±0.85) and the lowest mean belonged to "lack of medical guidelines in telemedicine" (3.35±1.09). Among the technological factors, the highest and the lowest mean scores were related to "reliability of technology (responsibility and training) and computer system" (4.22±0.87) and "development of intelligent systems" (3.24±1.11), respectively. Among economic factors, the highest mean was related to "private insurance coverage" (3.51±0.98) and the lowest mean belonged to "specialist payroll" (3.28±0.94). Among legal factors, the highest mean was related to "framework of instructions and validation" (3.57±0.88) and the lowest mean belonged to "reliability and variety of clinical guidelines and regulations" (3.42±0.97). Among policymaking factors, the highest and the lowest mean scores were related to "development of care delivery guidelines" (3.56±1.007) and "confidence and rules required to encrypt patient security information" (3.22±0.95), respectively. Among cultural factors, the highest mean belonged to "degree of cooperation and high scale in the health system" (3.52±1.03) and the lowest mean was related to "transparency and security of all exchanges in general" (3.05±1.03) (Table 2).

In general, cultural factors (3.95±0.77) and policymaking factors (3.22±0.84), respectively, had the highest and the lowest

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effects on the establishment of teledermatology in Iran.

Table 2: Frequency distribution of the factors affecting the establishment of teledermatology in Iran

Variable	Mean	Standard deviation	Minimum	Maximum
Service provider	3.56	0.74	1.5	5
Service recipient	3.44	0.83	1.36	5
Technological factors	3.63	0.74	1.89	5
Economic factors	3.25	0.83	1	5
Structural factors	3.41	0.78	1	5
Policymaking factors	3.22	0.84	1	5
Cultural factors	3.95	0.77	1.6	5
Legal factors	3.48	0.88	1	5

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Discussion

The increasing burden of skin diseases in developing and developed countries has caused the demand for dermatology services to be more than the current supply. Teledermatology seems to be able to settle some of the health care differences. Moreover, many patients in developing countries do not have access to a dermatologist [21]. These items emphasize the need for the establishment of teledermatology.

The study results showed that technological factors are among the most important variables affecting the establishment of teledermatology in Iran. Manarao (2018) [22], Fogel (2016) [23], Al-Jalani (2013) [24], Elahi (2013) [25], Martin (2012) [26], Oikonomomo (2009) [27], and Maya (2006) [28] also reported that technology is one of the factors influencing the establishment of teledermatology. These findings indicate that the establishment of teledermatology requires sufficient infrastructure such as high-speed Internet and remote medical hardware. In addition, hospitals should provide the necessary equipment for teledermatology.

Structural factors are another variable affecting the establishment of teledermatology in Iran. The studies conducted by Young (2018) [29], Manarao (2018) [22], Rajeda (2018) [15], Fogel (2016) [23], Nevilo (2016) [30], Cande (2013) [31], Al-Jalani (2013) [24], Martin (2012) [26], and Van Derberg (2012) [32] demonstrated that structural factors are among the factors affecting the establishment of teledermatology.

The factors related to service providers are also among other variables affecting the establishment of teledermatology in Iran. Young (2018) [29], Chang (2018) [33], Tol (2017) [34], Agnisarman (2017) [35], Van Derberg (2012) [32], and Oikonomu (2009)

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[27] reported that the factors related to service providers affect the establishment of teledermatology. Holding training workshops and on-the-job courses for the medical staff can be effective in increasing the awareness of service providers and the familiarity with teledermatology equipment.

Another variable affecting the establishment of teledermatology in Iran are the factors related to service recipients. The studies conducted by Rajda [15], Chang [33], Manarao (2018) [22], Tol (2017) [34], Campaigna (2017) [36], Livit (2016) [35], and Neuilu (2016) [30] showed that the factors related to service recipients also affect the establishment of teledermatology. The results of this study indicated that the most important factor in this regard was patient satisfaction. Patient satisfaction is one of the major goals of Iran's Ministry of Health and Medical Education and Iranian universities of medical sciences [37]. The provision of high-quality services to patients not only motivates the patients to continue their treatment but also brings individual and social benefits [38].

Economic factors are among the variables affecting the establishment of teledermatology in Iran. Raja [15], Campagna [36], Tol [34], Van Derberg [32], and Oikonomou [27] reported that economic factors are among the variables affecting the establishment of teledermatology. When implementing new technology in organizations, it should be taken into account that the initial investment and financial resources must be combined with the human resources and experienced and technical staff because providing equipment without proper and efficient users will not be effective [39].

Another group of variables affecting the establishment of teledermatology in Iran is cultural factors. Kimberly et al. (2015) emphasized the significance of organizational culture as a prerequisite for the successful establishment of telemedicine [40]. Salehahmadi and Hajaliasghari stated that cultural, linguistic, and literacy differences are a major barrier to the effective establishment of telemedicine in Iran. They also argued that linguistic and cultural differences between patients and incompatible cultural services and subsystems are the main challenges for the transfer of knowledge from a cultural environment to another [3]. Mortazavi et al. stated that one of the problems is the poor culture patients in using such systems. Accordingly, most patients are reluctant to be examined remotely and prefer to have a face-to-face visit with the physician [41]. A study conducted by Dargahi et al. showed that most participants emphasized the need for the existence of a clear executive culture for the successful establishment of telemedicine [42]. In this regard, public and private educational systems are recommended to try to improve the literacy level, bridge cultural gaps, and employ modern technologies such as distance learning to pave the way for the replacement of traditional methods of service with telemedicine [43].

Some of the limitations of this study were as follows. It was difficult to convince the members of the study population to participate in the study. This problem was resolved through academic correspondence, continuous follow-up, and justification of the study's significance. Since a few studies have been conducted about the establishment of teledermatology in Iran, the study findings were compared with the results of similar studies conducted in other countries. Considering the hectic work schedule of interviews, the time and place of interviews were set in consultation with themselves so

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that they could attend the interview when they had fewer mental concerns. In the quantitative section, the cross-sectional nature of the study was one of the main limitations of this study. Also, the geographical distribution of the study population and delay in the completion of questionnaires made the authors use several remainders.

In order to conduct future studies, it is recommended to design a model of Establishment of Teledermatology. Also, feasibility study and pilot study is done to implement Teledermatology in Iran.

Conclusion

Effective Factors on the establishment of teledermatology were extracted in the study. This can help the policymakers and managers interested in the establishment of teledermatology to identify top-priority factors in this regard to save time and money in teledermatology implemention.Therefore,it is recommended that These infrastructural factors to use in different parts of the establishment.

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