

Teleconsultation and Clinical Decision Making: a Systematic Review

Kolsoum Deldar¹, Kambiz Bahaadinbeigy², and Seyed Mahmood Tara³

¹Student Research Committee, Department of Medical Informatics, Faculty of Medicine, Mashhad University of Medical Sciences, Mashhad, IR Iran

²Medical Informatics Research Center, Institute of Futures Studies in Health, Kerman University of Medical Sciences, Kerman, IR Iran

³Department of Medical Informatics, Faculty of Medicine, Mashhad University of Medical Sciences, Mashhad, IR Iran.

Corresponding author. Seyed Mahmood Tara. Department of Medical Informatics, Faculty of Medicine, Mashhad University of Medical Sciences, Mashhad, IR Iran Email: Taram@mums.ac.ir, Phone: +98 915 806 1511

doi: 10.5455/aim.2016.24.286-292

ACTA INFORM MED. 2016 AUG; 24(4): 286-292

Received: MAR 18, 2016 • Accepted: APR 15, 2016

© 2016 Kolsoum Deldar, Kambiz Bahaadinbeigy, and Seyed Mahmood Tara

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/4.0/>) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: The goal of teleconsultation is to omit geographical and functional distance between two or more geographically separated health care providers. The purpose of present study is to review and analyze physician-physician teleconsultations. **Method:** The PubMed electronic database was searched. The primary search was done on January 2015 and was updated on December 2015. A fetch and tag plan was designed by the researchers using an online Zotero library. **Results:** 174 full-text articles of 1702 records met inclusion criteria. Teleconsultation for pediatric patients accounts for 14.36 percent of accepted articles. Surgery and general medicine were the most prevalent medical fields in the adults and pediatrics, respectively. Most teleconsultations were inland experiences (no=135), and the USA, Italy and Australia were the three top countries in this group. Non-specialists health care providers/centers were the dominant group who requested teleconsultation (no=130). Real time, store and forward, and hybrid technologies were used in 50, 31, and 16.7 percent of articles, respectively. The teleconsultation were reported to result in change in treatment plan, referral or evacuation rate, change in diagnosis, educational effects, and rapid decision making. Use of structured or semi-structured template had been noticed only in a very few articles. **Conclusion:** The present study focused on the recent ten years of published articles on physician-physician teleconsultations. Our findings showed that although there are positive impacts of teleconsultation as improving patient management, still have gaps that need to be repaired.

Key words: remote consultation, telemedicine, teleconsultation, decision making

1. INTRODUCTION

Teleconsultation is defined as synchronous or asynchronous consultation using information and communication technology to omit geographical and functional distance. Its goals are for diagnostics or treatment between two or more geographically separated health providers (for example physicians or nurses) or between health providers and patients (1). “Remote consultation” is the superior term of teleconsultation in MeSH (Medical Subject Headings) and is defined as “Consultation by remote telecommunications, generally for the purpose of diagnosis or treatment of a patient at a site remote from the patient or primary physician”(2). A closer look at published articles in this field shows that authors use the “teleconsultation” for 3 reasons:

- Both sides are health providers [e.g., who may need a second expert opinion]

- Physician–physician consultation (3-5)
- Physician–primary care provider (PCP) communication, like nurses (6)
- One side is health provider and another side is the patients [e.g., for tele-monitoring or tele-visiting]
- Physician – patient relationship (7)
- PCP–patient relationship (8, 9)
- Tripartite communication among physician – PCP – patient (10).

In this review, we are going to distinguish between these types of teleconsultations and focus only on the remote consultation between two or more physicians. The goals of these teleconsultations are different and include second expert opinions, tele-management, referrals, and so on.

If teleconsultation is established cor-

rectly, good outcomes like timely access to correct medical information, quality improvement of the diagnosis and treatment process, increased physician trust, and significant improvement in the total quality of health care will result. Similar to every other type of consultation, the requesting physician, who is present at the patient's location, must collect sufficient and correct information for the remote consultant physician (11). Good and optimum communication between these physicians consists of exchanging related clinical information as well as patient preferences and values (12). This is of great importance especially in resident – supervising physician communication and is considered a critical factor of patient safety (13, 14). Due to the lack of the physical presence of the consulted expert, his/her final diagnostic or treatment decision is based only upon information received from the consulting physician. Hence, the quality of the decision depends directly on the quantity and quality of information received. Some researchers have suggested solutions such as sending medical documents like photographs and video images (15) or improving the quality of images (16) to increase the definiteness of timely diagnosis.

Review studies in the field of teleconsultation have been done. Verhoeven (2007) assessed benefits and deficiencies of teleconsultation and video conference regarding clinical, behavioral, and care coordination outcomes of diabetes care for inpatient-caregiver interaction (17). Brebner (2006) also has reviewed studies for technical feasibility, clinical effectiveness, cost effectiveness, and level of local management in accident and emergency teleconsultation (18). The effect of telemedicine on diagnostic and therapeutic decisions (19, 20), e-mail based telemedicine articles (21) and evidence on electronic communications between health care providers (22) were reviewed as well. According to authors' knowledge, there is no systematic review on physician-physician teleconsultations with a focus on the decision making process. So the purpose of present study is to review these types of teleconsultation and to cover the following topics: type of technologies that have been used, specialty level of physicians, time and geographical distribution, medical field, and teleconsultation outcomes and structure.

2. METHOD

Database: The PubMed electronic database was searched. As Bahaadinbeigy (2010) mentioned, this database covers a considerable amount of published articles in the field of telemedicine. Three top specialized journals of the telemedicine field: "The Journal of Telemedicine and Telecare", "E-Health and Telemedicine Journal", and "International Journal of Telemedicine", as well as IEEE journals are indexed in MEDLINE (23).

The primary search was done on January 2015 and was updated on December 2015. Furthermore, review articles that were primarily about teleconsultation had their reference lists searched for additional relevant articles. A hand search of the table of contents of "The Journal of Telemedicine and Telecare", "E-Health and Telemedicine Journal", and "International Journal of Telemedicine" was also done to identify relevant papers, concurrently. An attempt was made to contact a particular expert in the telemedicine field if any other related paper was available. Concepts and keywords that were used

to perform the search tasks are listed in Table 1.

Target concepts	Matching keywords
Teleconsultation	Teleconsultation, Teleconsultation, Remote consultation Electronic consultation, Econsultation, E-consultation, Email consultation Real time consultation, Real-time consultation
Telemedicine	Telemedicine, Telehealth, Tele health, Telecare, Tele care

Table 1: Concepts and keywords

Search script is described in Table 2.

("Remote consultation"[MeSH Terms]) AND (teleconsultation OR tele consultation OR econsultation OR e consultation OR email consultation OR electronic consultation OR real time consultation OR telemedicine OR telehealth OR tele health OR telecare OR tele care) Filters: published in the last 10 years; Humans; English

Table 2: Search script

Study selection criteria: Studies were included in this review if they: (1) focused on physicians, both as the consultation requester (solely or with other health care providers) and consultant, (2) reported a real-not simulated-medical consultation for real patients that occurred between two or more physicians, (3) published within the recent 10 years, (4) were in English, and (5) had an available abstract. Retrieved studies were excluded if they were: (1) review studies, expert opinions, editorials, or repeated articles from the same authors, or interventions (only the most updated or final version was included), (2) only a telephone-consultation, and (3) published only as an abstract (as for a conference proceeding).

Paper Selection: A fetch and tag plan was designed by the researchers to manage the screening process. According to this plan, an online Zotero library was created and shared among the researcher. Then, the result from the search script injection into PubMed was inserted into the library. The scan and select process was conducted by two independent investigators (K.B. and K.D.) and was based on titles and abstracts of articles. If there was a conflict about inclusion and exclusion in this process, the full text document was assessed. All retrieved records were tagged with pre-planned keywords (for example: tag "Ti_Rej" used as equal to reject by title). Then, the full text version of all possibly-relevant records were analyzed. The inclusion and exclusion criteria described above were applied more strictly in this level again, and disagreements were resolved by the third researcher's decision (M.T.). Using the Zotero library again, all the accepted records were tagged for geographical location, medical fields, type of technology, specialty level of physicians, type of consultation effect, and the presence of a structured template for consultation.

Data extraction strategy: The concept and data extraction process was conducted using a Microsoft Excel-based form listing all the required information, including first author, year, geographical location, medical domain, consulting person/group, consultant person/group, and specialty level of physicians, type of consultation effect, and the presence of a structured template for consultation. The first author (K.D.) extracted the required information from the included articles into this form using Zotero tags. Other authors reviewed the completed form and made corrections when required.

3. RESULTS

A bibliometric review process was performed to analyze the articles. The primary search was done using MeSH terms and a list of suggested keywords. But the primary results indicated lack of sufficient specificity. The researchers iteratively improved the script and assessed the new results until the status in which everybody was satisfied. Total number of retrieved records was 1544 at the beginning and 1702 after the search update. Finally, 174 full-text articles were selected and analyzed. The selection process is shown in Figure 1 and titles of selected articles are listed in Appendix 1.

Time:

The most retrieved records belong to the years 2011 and 2013, but the most accepted articles belong to the years 2012 and 2013. Number of accepted articles in 2015 is less than others; it may be due to the time consuming process of article indexing in PubMed (Figure 2). In overall, although the ten year trend shows a slight eventual rise in both numbers of publication types, we did not find any specific pattern, justifying some rises and falls.

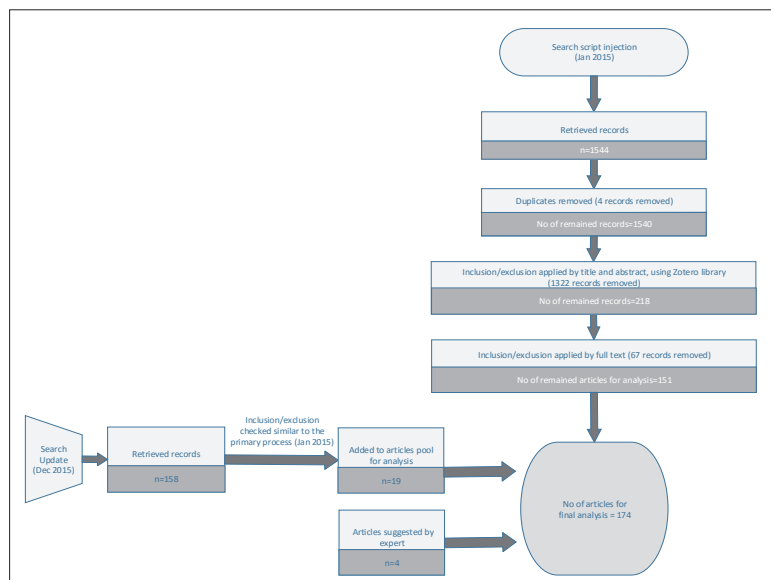


Figure 1 – Selection process of articles

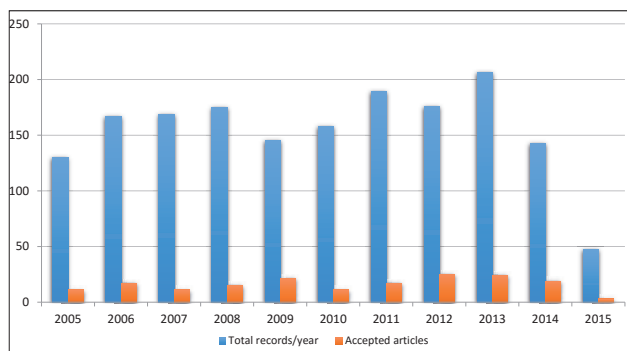


Figure 2 – Time distribution of total retrieved records and accepted articles per year

Medical fields:

Teleconsultation for adult and pediatric patients accounts for 85.63 and 14.36 percent of accepted articles, respectively. Surgery, general medicine, mixed consultations, and stroke were the most prevalent medical fields in the adult group, and general medicine as well as cardiology was the most prevalent

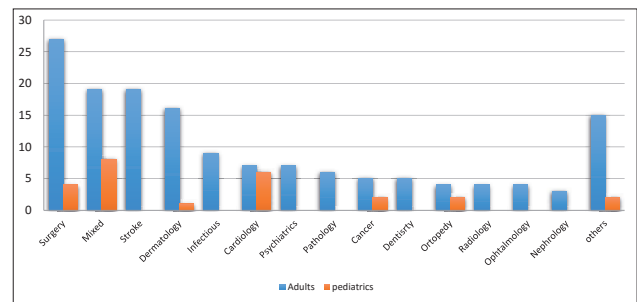


Figure 3 – Medical fields in adult and pediatric group

in pediatrics (Figure 3).

Geographical aspects

Transboundary teleconsultations

Some teleconsultations were not limited within a specific country's borders; rather they took place as consultations between two or more countries. These account for 22.5 percent (no = 39) of accepted articles. About half of the articles in this class (no=21), belonged to teleconsultations between physicians of a specific country as the requesting consultees and physicians of the responding country as the respondent consultants. Requesting consultants belonged to a wide range of countries; from developing to developed. Teleconsultations that occurred between European or European-American countries were mainly second opinions between experts like tumor boards (5), remote neuro-monitoring during aortic surgery (24), and to identify anatomic landmarks (25). All of them were of real time (RT) teleconsultation type. In one case, the consultation was performed as a multicenter cooperation to obtain second opinions about cancer (26).

Another class in this group was teleconsultations that were established between physicians of developing countries and experts from developed countries. Requesting countries in one third of the articles in this class were from Africa varying in medical fields like pediatrics (27, 28), orthopedics (4), surgery (29), and infectious disease (30). In addition, experiences of teleconsultation between Antarctic stations with their supporting countries (31-33) or geographically remote islands with other countries were reported (34-37).

Sometimes the requesting countries were more than one. For example, Italian hospitals located in 22 different countries were connected to a network of health centers in Italy (38) or physicians working in resource-limited settings who submitted their diagnostic or management queries form to ITM (–Institute of Tropical Medicine) experts by email or in a discussion forum (39). About one third of articles in this class were related to teleconsultations that occurred to support deployed health care providers who were located in austere combat environments and served as military or non-military personal in different countries (e.g., Iraq and Afghanistan) (40-46)

In some teleconsultations, more than one country acted as responders. In one case, several surgery, oncology, and pathology experts from one African country sent their queries and experts of the same or related medical fields from around

Medical Fields	Adult				Pediatrics			
	RT	SF	Both (RT and SF)	NS	RT	SF	Both (RT and SF)	NS
Burn	--	--	1	--	--	--	--	--
Cancer	3	2	--	--	2	--	--	--
Cardiology	4	1	2	--	5	--	1	--
Chronic	1	--	--	--	--	--	--	--
Dentistry	4	1	--	--	--	--	--	--
Dermatology	2	12	2	--	--	1	--	--
EMS	--	--	1	--	1	--	--	--
Endoscopy	1	--	--	--	--	--	--	--
ethics	1	--	--	--	--	--	--	--
gynecology	1	--	--	--	--	--	--	--
Infectious	6	3	--	--	--	--	--	--
metabolic	--	1	--	--	--	--	--	--
microbiology	1	--	--	--	--	--	--	--
Mixed	5	6	7	2	4	2	2	--
N/s	1	--	--	--	--	--	--	--
Nephrology	--	2	1	--	--	--	--	--
Occupational medicine	--	--	1	--	--	--	--	--
Ophtalmology	--	4	--	--	--	--	--	--
Ortopedy	2	2	--	--	--	1	1	--
pathology	3	2	1	--	--	--	--	--
psychiatrist	5	--	2	--	--	--	--	--
Pulmonology	1	1	--	--	--	--	--	--
Radiology	1	1	1	1	--	--	--	--
Speech pathology	1	--	--	--	--	--	--	--
Stroke	17	--	1	--	--	--	--	--
Surgery	11	10	4	1	3	--	1	--
toxicology	--	1	--	--	--	--	--	--
Transplantation	--	1	--	--	--	--	--	--
ENT	--	--	--	--	1	--	--	--
Total	71	50	24	4	16	4	5	0

Table 3: Frequency and technology method used for teleconsultations based on medical fields in adult and pediatrics

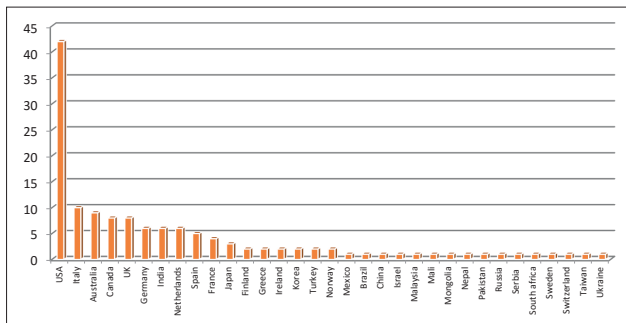


Figure 4: Geographical distribution of Inland TCs

the world responded to them (47). In another case, teleconsultation was performed to identify the anatomic landmarks during surgery (25).

Some of the experiences were international teleconsultations, in which several countries participated as requesting or as responding countries. More often, the queries were from physicians of resource-limited origins and were responded to by a network of international experts. All of such cases were asynchronous and web-based teleconsultations (48-51).

Inland TCs

A considerable amount of teleconsultations were inland experiences (77.5%, no=135), and the USA, Italy and Australia were the three top countries in this group (Figure 4).

Specialty level of requesting physicians

Non-specialists (GPs, medical residents, PCPs, deployed health care providers, and general dentists) or general hospitals were the dominant group who requested teleconsultation (74.7%, no=130). Specialist-specialist consultations account for 25.3% of teleconsultations cases we found across the literature.

Technology

Real time, store and forward, and hybrid technologies were used in 50, 31, and 16.7 percent of articles, respectively. Stroke (in adults) and cardiology (in pediatrics) were the medical fields with the most use of RT technology. On the other hand, dermatology (in adults) and mixed consultations (in pediatrics) mostly used SF technology (Table 3).

Teleconsultation effect on the decision of requesting physician

The effect of teleconsultation on the decision of the requesting physician was mentioned clearly only in 45 percent of articles. The teleconsultation were reported to result in change in treatment plan, referral or evacuation rate, change in diagnosis, and educational effects (Figure 5). High quality and rapid decision making (16), shortening diagnosis time, faster and better patient management (52, 53), diminishing the length of hospitalization and intensive care stay (53), improving the accuracy of triage (54), anxiety reduction, educational value (55), increasing the confidence (56-58), and reducing the amount of unnecessary procedures (59) were some of the effects of teleconsultation on the requesting physician side.

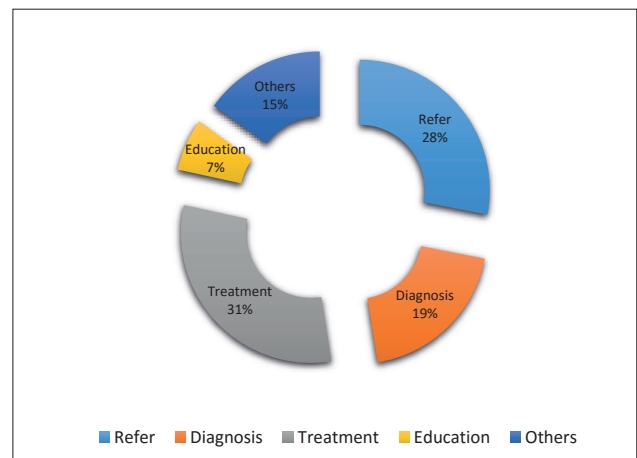


Figure 5: Reported effects of teleconsultation on requesting physician

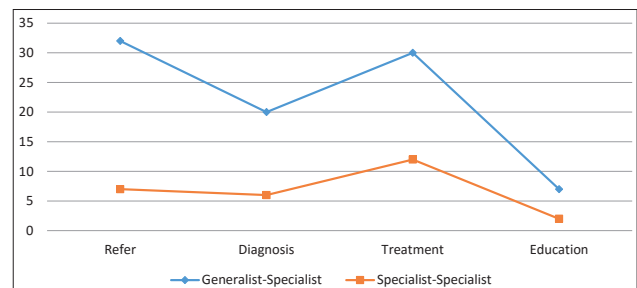


Figure 6: Reported effects based on specialty level of teleconsultation parties

As seen in Figure 6, teleconsultation between two levels of centers/experts (general physician or hospital with a specialist center/physician) was more effective for referrals (mostly reducing referrals) and treatment decisions, respectively. How-

ever, when specialist-specialist teleconsultation occurred, teleconsultation affected and changed the treatment and then referral decisions.

Teleconsultation structure

Use of structured template for teleconsultation had been noticed only in five articles. Of them, two were in the teledermatology areas that used a semi-structured form (60) and an online structured pre-consultation questionnaire (mostly to educate medical trainees) (61). In another case, a web-based structured format to upload patient-related information was established to determine the effect of teleconsultation in cases of strabismus (48). In two other cases, a structured interview was performed in acute stroke care by telephone consultation (62) and a standardized query form (including all relevant clinical information) were designed for teledermatology consultation (52).

4. DISCUSSION

In this review, 174 physician-physician teleconsultation articles were analyzed. The results showed that there was widespread distribution in the time, location, and medical field of the selected articles.

We expected to find an upward trend in the number of published telemedicine and teleconsultation articles during the recent 10 years; however, no such trend was found.

Although teleconsultations were performed for patients of different age groups, less than 15 percent of them were for pediatrics. Surgery, general medicine, and mixed fields were the most frequent topics in adult teleconsultations. This was valid for general medicine and pediatric cardiology. Surgery teleconsultations were performed mainly by sending the radiology images, videos, or clinical pictures in order to reduce unnecessary patient transfer or travel and other related costs, and also aid rapid decision making in some cases. In the stroke field, the goals of teleconsultations were often reduction in the pre/in-hospital time interval to start treatment interventions and prevention adverse outcomes. Positive results of teledermatology teleconsultations were cost-effectiveness, good decision triage, and high diagnostic accuracy.

More than two thirds of teleconsultation studies were inland experiences, but there was no meaningful relationship between the number of final articles and geographical distribution of the linked countries. Transboundary teleconsultations were classified into consultations between two specific countries (about half of them), one country with several other countries, or several countries with several other countries.

In some articles, both the requesting and responding physicians were on the same specialty level (specialist-specialist consultations); however, more frequently this was a generalist-specialist relationship (GPs/medical residents/general hospitals with specialist physician/third level hospitals). This finding was expected because access to expert opinions is one of the most important purposes of teleconsultations. Some of the specialist-specialist teleconsultations were done as group discussions and teleconferences.

Stroke (in adults) and cardiology (in pediatrics) teleconsultations used only RT technologies and this may be due to the urgent nature of diagnosis and treatment in these medical fields. Hersh (2006) believed that using videoconferencing and RT technologies are more effective in medical fields

that need verbal interactions (20). Our findings indicate that adult teledermatology consultations were done using store and forward methods mostly due to the non-urgent nature of this field and simplicity of the store and forward method. This finding is in accordance with Hersh's study (2006) that showed store and forward methods have been used in several specialties; the most common being dermatology and wound care (20). A systematic review by Caffery et al. (2010) also showed that e-mail based telemedicine has been commonly used in many medical fields that needed low-bandwidth Internet and were image-based for tele-diagnosis as dermatology, pathology, wound care, and so on (21). Validity of diagnosis and improvement of patient management are some of the outcomes of image-based telemedicine systems for injury emergency care, too (63).

Less than half of the studies (45%) reported explicit effects of teleconsultation on the decision of the requesting physician. The most common effects included changes in the treatment/management plan, referral/evacuation rate, and in primary diagnosis, respectively. A few studies have indicated the educational effects of teleconsultations on requesting physicians. The mentioned effects were more obvious when there was a training-learning relationship between teleconsultation parties (4, 61, 64) such as medical residents and the supervising expert. Confidence improvement of the requesting physician (in diagnosis or caring) was one of the most important reported effects. Confidence rate was reported up to 90 percent in telephone consultations (58) and 96 percent for video conferences (56). Quality of exchanged data like images had a notable impact on achieved confidence (57). High quality and rapid decision making was another effect that referring experts reported in the teleconference experience (16). Reducing the length of hospitalization and intensive care stay were some of the other impacts of teleconsultations, which were mentioned in a prospective, multicenter cohort study (53). Shortened diagnosis time, faster and better patient management (52, 53), improving accuracy of triage (54), reduces anxiety, educational value (55), Increased confidence (56-58), reduced amount of unnecessary procedures and improved level of patient management (59) were some of other effects of teleconsultation on requesting physician.

It is important to consider that in this section, we only assessed the studies that particularly noted the clear effects of teleconsultations on physicians. There were several studies that did not report a specific effect or were focused on topics such as user/patient satisfaction (38, 60, 64-69) or cost (34, 70-73). As such papers were mostly based on subjective judgments, authors decided not to represent them in this paper.

And finally, while both requesting and responding physicians demonstrated their dissatisfaction from the current consultation/referral process and unstructured, low-quality of exchanged data (74-76), there were few studies that mentioned the structured format for teleconsultations (77-79). In addition, inadequacy of information is one of the main problems that was highlighted by specialists to provide an opinion. So using a more structured clinical template might improve this process (51).

5. CONCLUSION

The present study focused on the recent ten years of published articles on physician-physician teleconsultations.

Increasing access of remote patients to specialized health care is one of the goals of using telemedicine. Hence, we assumed more teleconsultations occurred between general physicians/centers with specialized experts/centers. This assumption was confirmed according to our results.

Despite our efforts to identify a clear pattern of data and information exchange between consulting parties, only in a few articles a semi-structured or structured template was used. In addition, there were no descriptions on the fields' selection process or definition of fields' format and so on.

Our findings have shown that although there are positive impacts of teleconsultation as an educational influence, improving patient, still have gaps that need to be repaired.

- **Acknowledgments:** We are grateful to Research deputy of Mashhad University of Medical Sciences for financial support of this research as part of a PhD thesis.
- **Competing interests:** None declared
- **Funding:** This work was funded by Mashhad University of Medical Sciences, Mashhad, Iran. This study was part of PhD thesis of KD.

REFERENCES

1. Bove AA, Homko CJ, Santamore WP, Kashem M, Kerper M, Elliott DJ. Managing hypertension in urban underserved subjects using telemedicine—a clinical trial. *American heart journal*. 2013 Apr;165(4):615-21. PubMed PMID: 23537980. Epub 2013/03/30. eng.
2. Remote Consultation—MeSH—NCBI [updated 2016/04/18/05:55:49]. Available from: <http://www.ncbi.nlm.nih.gov/mesh/Db=mesh&term=Remote+Consultation files/350/mesh.html>.
3. Agarwal S, Day DJ, Sibson L, Barry PJ, Collas D, Metcalf K, et al. Thrombolysis delivery by a regional telestroke network—experience from the U.K. *National Health Service. Journal of the American Heart Association*. 2014;3(1):e000408. PubMed PMID: 24572251. Pubmed Central PMCID: PMC3959696. Epub 2014/02/28. eng.
4. Engle X, Aird J, Tho L, Bintcliffe F, Monsell F, Gollgoly J, et al. Combining continuing education with expert consultation via telemedicine in Cambodia. *Tropical doctor*. 2014 Apr;44(2):62-8. PubMed PMID: 24322763. Epub 2013/12/11. eng.
5. Seeber A, Mitterer M, Gunsilius E, Mazzoleni G, Giovannetti R, Farsad M, et al. Feasibility of a multidisciplinary lung cancer videoconference between a peripheral hospital and a comprehensive cancer centre. *Oncology*. 2013;84(3):186-90. PubMed PMID: 23328311. Epub 2013/01/19. eng.
6. Kwak MJ, Kim JM, Shin IH, Shin SD, Song KJ, Suh GJ, et al. Real-time medical control using a wireless audio-video transmission device in a pre-hospital emergency service in Korea. *Journal of telemedicine and telecare*. 2009;15(8):404-8. PubMed PMID: 19948707. Epub 2009/12/02. eng.
7. Reed-Fox A. Patient Online: putting patients in the driving seat of their care. *British journal of community nursing*. 2015 Apr;20(4):181. PubMed PMID: 25839876. Epub 2015/04/04. eng.
8. Sorknaes AD, Bech M, Madsen H, Titlestad IL, Hounsgaard L, Hansen-Nord M, et al. The effect of real-time teleconsultations between hospital-based nurses and patients with severe COPD discharged after an exacerbation. *Journal of telemedicine and telecare*. 2013 Dec;19(8):466-74. PubMed PMID: 24227799. Epub 2013/11/15. eng.
9. Savenstedt S, Zingmark K, Hyden LC, Brulin C. Establishing joint attention in remote talks with the elderly about health: a study of nurses' conversation with elderly persons in teleconsultations. *Scandinavian journal of caring sciences*. 2005 Dec;19(4):317-24. PubMed PMID: 16324054. Epub 2005/12/06. eng.
10. Torppa MA, Timonen O, Keinanen-Kiukkaanniemi S, Larivaara P, Leiman M. Patient-nurse-doctor interaction in general practice teleconsultations—a qualitative analysis. *Journal of telemedicine and telecare*. 2006;12(6):306-10. PubMed PMID: 17022839. Epub 2006/10/07. eng.
11. Nerlich M, Balas EA, Schall T, Stieglitz S-P, Filzmaier R, Asbach P, et al. Teleconsultation Practice Guidelines: Report from G8 Global Health Applications Subproject 4. *Telemedicine Journal and e-Health*. 2002 2002/12/01;8(4):411-8.
12. Epstein RM. Communication between primary care physicians and consultants. *Archives of family medicine*. 1995 May;4(5):403-9. PubMed PMID: 7742962. Epub 1995/05/01. eng.
13. Belyansky I, Martin TR, Prabhu AS, Tsirlin VB, Howley LD, Phillips R, et al. Poor Resident-Attending Intraoperative Communication May Compromise Patient Safety. *Journal of Surgical Research*. 2011 12//;171(2):386-94.
14. Loo L, Puri N, Kim DI, Kawayeh A, Baz S, Hegstad D. "Page Me if You Need Me": The Hidden Curriculum of Attending-Resident Communication. *Journal of Graduate Medical Education*. 2012 07/22/received, 12/10/revise, 02/11/revise, 02/25/accepted;4(3):340-5. PubMed PMID: PMC3444188.
15. Akkoyun I. The advantages of using photographs and video images in telephone consultations with a specialist in paediatric surgery. *African journal of paediatric surgery* : *AJPS*. 2012 May-Aug;9(2):128-31. PubMed PMID: 22878761. Epub 2012/08/11. eng.
16. Walsh C, Cosgrave J, Crean P, Murray D, Walsh R, Kennedy J, et al. Synchronized, interactive teleconferencing with digital cardiac images. *Journal of digital imaging*. 2006 Mar;19(1):85-91. PubMed PMID: 16249837. Pubmed Central PMCID: PMC3043953. Epub 2005/10/27. eng.
17. Verhoeven F, van Gemert-Pijnen L, Dijkstra K, Nijland N, Seydel E, Steehouder M. The contribution of teleconsultation and videoconferencing to diabetes care: a systematic literature review. *Journal of medical Internet research*. 2007;9(5):e37. PubMed PMID: 18093904. Pubmed Central PMCID: PMC2270420. Epub 2007/12/21. eng.
18. Brebner JA, Brebner EM, Ruddick-Bracken H. Accident and emergency teleconsultation for primary care—a systematic review of technical feasibility, clinical effectiveness, cost effectiveness and level of local management. *Journal of telemedicine and telecare*. 2006;12 Suppl 1:5-8. PubMed PMID: 16884562. Epub 2006/08/04. eng.
19. Hersh W, Helfand M, Wallace J, Kraemer D, Patterson P, Shapiro S, et al. A systematic review of the efficacy of telemedicine for making diagnostic and management decisions. *Journal of telemedicine and telecare*. 2002;8(4):197-209. PubMed PMID: 12217102. Epub 2002/09/10. eng.
20. Hersh WR, Hickam DH, Severance SM, Dana TL, Pyle Krages K, Helfand M. Diagnosis, access and outcomes: Update of a systematic review of telemedicine services. *Journal of telemedicine and telecare*. 2006;12 Suppl 2:S3-31. PubMed PMID: 16989671. Epub 2006/09/23. eng.
21. Caffery LJ, Smith AC. A literature review of email-based telemedicine. *Studies in health technology and informatics*. 2010;161:20-34. PubMed PMID: 21191155. Epub 2010/12/31. eng.
22. Walsh C, Siegler EL, Cheston E, O'Donnell H, Collins S, Stein D, et al. Provider-to-provider electronic communication in the era of meaningful use: a review of the evidence. *Journal of hospital medicine*. 2013 Oct;8(10):589-97. PubMed PMID: 24101544. Pubmed Central PMCID: PMC4030393. Epub 2013/10/09. eng.
23. Bahaadinbeigy K, Yogesan K, Wootton R. MEDLINE versus EMBASE and CINAHL for telemedicine searches. *Telemedicine journal and e-health : the official journal of the American Telemedicine Association*. 2010 Oct;16(8):916-9. PubMed PMID: 20925566. Epub 2010/10/12. eng.
24. Greiner A, Mess WH, Schmidl J, Debus ES, Grommes J, Dick F, et al. Cyber medicine enables remote neuromonitoring during aortic surgery. *Journal of vascular surgery*. 2012 May;55(5):1227-32; discussion 32-3. PubMed PMID: 22341581. Epub 2012/02/22. eng.
25. Tamariz F, Merrell R, Popescu I, Onisor D, Flerov Y, Boanca C, et al. Design and implementation of a web-based system for intraoperative consultation. *World journal of surgery*. 2009 Mar;33(3):448-54. PubMed PMID: 19123027. Epub 2009/01/06. eng.
26. Ryskal O, Muschinskaja M, Gobel U, Loose KH, Brand H, Nikonova O, et al. Telemicroscopic conferences for children of the Perm territory with suspected or proven malignant solid tumors. *Klinische Padiatrie*. 2010 May;222(3):199-202. PubMed PMID: 20514632. Epub 2010/06/02. eng.
27. Bertani A, Launay F, Candoni P, Mathieu L, Rongieras F, Chauvin F. Teleconsultation in paediatric orthopaedics in Djibouti: evaluation of response performance. *Orthopaedics & traumatology, surgery & research : OTSR*. 2012 Nov;98(7):803-7. PubMed PMID: 23040542. Epub 2012/10/09. eng.
28. Froehlich W, Seitaboth S, Chanpheaktra N, Pugatch D. Case report: an example of international telemedicine success. *Journal of telemedicine and telecare*. 2009;15(4):208-10. PubMed PMID: 19471034. Epub 2009/05/28. eng.
29. Mora F, Cone S, Rodas E, Merrell RC. Telemedicine and electronic health information for clinical continuity in a mobile surgery program. *World journal of surgery*. 2006 Jun;30(6):1128-34. PubMed PMID: 16736347. Epub 2006/06/01. eng.
30. Shanks L, Masumbuko EW, Ngoy NM, Maneno M, Bartlett S, Thi SS, et al. Treatment of multidrug-resistant tuberculosis in a remote, conflict-affected area of the Democratic Republic of Congo. *The international journal of tuberculosis and lung disease : the official journal of the International Union against Tuberculosis and Lung Disease*. 2012 Aug;16(8):1066-8. PubMed PMID: 22565108. Epub 2012/05/09. eng.
31. Ohno G, Watanabe K, Okada Y, Higuchi K. Practical experience of telehealth between an Antarctic station and Japan. *Journal of telemedicine and telecare*. 2012 Dec;18(8):473-5. PubMed PMID: 23209273. Epub 2012/12/05. eng.
32. Otto C, Shemenski R, Scott JM, Hartshorn J, Bishop S, Viegas S. Evaluation of tele-ultrasound as a tool in remote diagnosis and clinical management at the Amundsen-Scott South Pole Station and the McMurdo Research Station. *Telemedicine journal and e-health : the official journal of the American Telemedicine Association*. 2013 Mar;19(3):186-91. PubMed PMID: 23480714. Epub 2013/03/14. eng.
33. Otto CA, Shemenski R, Drudi L. Real-time tele-echocardiography: diagnosis and management of a pericardial effusion secondary to pericarditis at an Antarctic research station. *Telemedicine journal and e-health : the official journal of the American Telemedicine Association*. 2012 Sep;18(7):521-4. PubMed PMID: 22822790. Epub 2012/07/25. eng.
34. Callahan CW, Malone F, Estroff D, Person DA. Effectiveness of an Internet-based store-and-forward telemedicine system for pediatric subspecialty consultation. *Archives of pediatrics & adolescent medicine*. 2005 Apr;159(4):389-93. PubMed PMID: 15809396. Epub 2005/04/06. eng.

35. Harley J. Economic evaluation of a tertiary telepsychiatry service to an island. *Journal of telemedicine and telecare*. 2006;12(7):354-7. PubMed PMID: 17059652. Epub 2006/10/25. eng.
36. Stutchfield BM, Jagilly R, Tulloh BR. Second opinions in remote surgical practice using email and digital photography. *ANZ journal of surgery*. 2007 Nov;77(11):1009-12. PubMed PMID: 17931268. Epub 2007/10/13. eng.
37. Syed-Abdul S, Scholl J, Chen CC, Santos MD, Jian WS, Liou DM, et al. Telemedicine utilization to support the management of the burns treatment involving patient pathways in both developed and developing countries: a case study. *Journal of burn care & research* : official publication of the American Burn Association. 2012 Jul-Aug;33(4):e207-12. PubMed PMID: 22249104. Epub 2012/01/18. eng.
38. Costanzo G, Monari P. Experience with asynchronous medical teleconsultation in the Alliance of the Italian hospitals worldwide. *Journal of telemedicine and telecare*. 2006;12(8):382-6. PubMed PMID: 17227601. Epub 2007/01/18. eng.
39. Zolfo M, Bateganya MH, Adetifa IM, Colebunders R, Lynen L. A telemedicine service for HIV/AIDS physicians working in developing countries. *Journal of telemedicine and telecare*. 2011;17(2):65-70. PubMed PMID: 21078680. Epub 2010/11/17. eng.
40. Blank E, Lappan C, Belmont PJ, Jr., Machen MS, Ficke J, Pope R, et al. Early analysis of the United States Army's telemedicine orthopaedic consultation program. *Journal of surgical orthopaedic advances*. 2011 Spring;20(1):50-5. PubMed PMID: 21477534. Epub 2011/04/12. eng.
41. Maddry JK, Sessions D, Heard K, Lappan C, McManus J, Berbarta VS. Wartime toxicology: evaluation of a military medical toxicology telemedicine consults service to assist physicians serving overseas and in combat (2005-2012). *Journal of medical toxicology* : official journal of the American College of Medical Toxicology. 2014 Sep;10(3):261-5. PubMed PMID: 24752493. PubMed Central PMCID: PMC4141918. Epub 2014/04/23. eng.
42. McManus J, Salinas J, Morton M, Lappan C, Poropatich R. Teleconsultation program for deployed soldiers and healthcare professionals in remote and austere environments. *Prehospital and disaster medicine*. 2008 May-Jun;23(3):210-6; discussion 7. PubMed PMID: 18702266. Epub 2008/08/16. eng.
43. Mines MJ, Bower KS, Lappan CM, Mazzoli RA, Poropatich RK. The United States Army Ocular Teleconsultation program 2004 through 2009. *American journal of ophthalmology*. 2011 Jul;152(1):126-32 e2. PubMed PMID: 21570049. Epub 2011/05/17. eng.
44. Rand ER, Lappan CM, Lee JC, Furgerson JL. Paging the worldwide cardiology consultant: the Army Knowledge Online Telemedicine Consultation Program in cardiology. *Military medicine*. 2009 Nov;174(11):1144-8. PubMed PMID: 19960820. Epub 2009/12/08. eng.
45. Schmidt T, Lappan CM, Hespenthal DR, Murray CK. Deployed provider satisfaction with infectious disease teleconsultation. *Military medicine*. 2011 Dec;176(12):1417-20. PubMed PMID: 22338358. Epub 2012/02/18. eng.
46. Waterman BR, Laughlin MD, Belmont PJ, Jr., Schoenfeld AJ, Pallis MP. Enhanced casualty care from a Global Military Orthopaedic Teleconsultation Program. *Injury*. 2014 Nov;45(11):1736-40. PubMed PMID: 24810665. Epub 2014/05/09. eng.
47. Kadaba V, Ly T, Noor S, Chhut SV, Hinsch N, Stauch G, et al. A hybrid approach to telepathology in Cambodia. *Journal of telemedicine and telecare*. 2013 Dec;19(8):475-8. PubMed PMID: 24197402. Epub 2013/11/08. eng.
48. Helveston EM, Neely DE, Cherwek DH, Smallwood LM. Diagnosis and management of strabismus using telemedicine. *Telemedicine journal and e-health* : the official journal of the American Telemedicine Association. 2008 Aug;14(6):531-8. PubMed PMID: 18729751. Epub 2008/08/30. eng.
49. Hu SW, Foong HB, Elpern DJ. Virtual Grand Rounds in Dermatology: an 8-year experience in web-based teledermatology. *International journal of dermatology*. 2009 Dec;48(12):1313-9. PubMed PMID: 20415672. Epub 2010/04/27. eng.
50. Massone C, Soyer HP, Hofmann-Wellenhof R, Di Stefani A, Lozzi GP, Gabler G, et al. Two years' experience with Web-based teleconsulting in dermatology. *Journal of telemedicine and telecare*. 2006;12(2):83-7. PubMed PMID: 16539755. Epub 2006/03/17. eng.
51. Patterson V, Wootton R. A web-based telemedicine system for low-resource settings 13 years on: insights from referrers and specialists. *Global health action*. 2013;6:21465. PubMed PMID: 24063752. PubMed Central PMCID: PMC3782613. Epub 2013/09/26. eng.
52. Borve A, Dahlen Gyllencreutz J, Terstappen K, Johansson Backman E, Aldenbratt A, Danielsson M, et al. Smartphone teledermoscopy referrals: a novel process for improved triage of skin cancer patients. *Acta dermato-venereologica*. 2015 Feb;95(2):186-90. PubMed PMID: 24923283. Epub 2014/06/14. eng.
53. Webb CL, Waugh CL, Grigsby J, Busenbark D, Berdusis K, Sahn DJ, et al. Impact of telemedicine on hospital transport, length of stay, and medical outcomes in infants with suspected heart disease: a multicenter study. *Journal of the American Society of Echocardiography* : official publication of the American Society of Echocardiography. 2013 Sep;26(9):1090-8. PubMed PMID: 23860093. Epub 2013/07/19. eng.
54. Wallace DL, Smith RW, Pickford MA. A cohort study of acute plastic surgery trauma and burn referrals using telemedicine. *Journal of telemedicine and telecare*. 2007;13(6):282-7. PubMed PMID: 17785024. Epub 2007/09/06. eng.
55. Desai S, Williams ML, Smith AC. Teleconsultation from a secondary hospital for paediatric emergencies occurring at rural hospitals in Queensland. *Journal of telemedicine and telecare*. 2013 Oct;19(7):405-10. PubMed PMID: 24218355. Epub 2013/11/13. eng.
56. Donnem T, Ervik B, Magnussen K, Andersen S, Pastow D, Andreassen S, et al. Bridging the distance: a prospective tele-oncology study in Northern Norway. Supportive care in cancer : official journal of the Multinational Association of Supportive Care in Cancer. 2012 Sep;20(9):2097-103. PubMed PMID: 22076621. Epub 2011/11/15. eng.
57. Lasierra N, Alesanco A, Gilaberte Y, Magallon R, Garcia J. Lessons learned after a three-year store and forward teledermatology experience using internet: Strengths and limitations. *International journal of medical informatics*. 2012 May;81(5):332-43. PubMed PMID: 22425394. Epub 2012/03/20. eng.
58. Waldura JF, Neff S, Dehlendorf C, Goldschmidt RH. Teleconsultation improves primary care clinicians' confidence about caring for HIV. *Journal of general internal medicine*. 2013 Jun;28(6):793-800. PubMed PMID: 23371417. PubMed Central PMCID: PMC3663958. Epub 2013/02/02. eng.
59. Joseph B, Hadeed G, Sadoun M, Rhee PM, Weinstein RS. Video consultation for trauma and emergency surgical patients. *Critical care nursing quarterly*. 2012 Oct-Dec;35(4):341-5. PubMed PMID: 22948367. Epub 2012/09/06. eng.
60. Eminovic N, de Keizer NF, Wyatt JC, ter Riet G, Peek N, van Weert HC, et al. Teledermatologic consultation and reduction in referrals to dermatologists: a cluster randomized controlled trial. *Archives of dermatology*. 2009 May;145(5):558-64. PubMed PMID: 19451500. Epub 2009/05/20. eng.
61. Shaikh N, Lehmann CU, Kaleida PH, Cohen BA. Efficacy and feasibility of teledermatology for paediatric medical education. *Journal of telemedicine and telecare*. 2008;14(4):204-7. PubMed PMID: 18534955. Epub 2008/06/07. eng.
62. Handschu R, Scibor M, Willaczek B, Nuckel M, Heckmann JG, Asshoff D, et al. Telemedicine in acute stroke: remote video-examination compared to simple telephone consultation. *Journal of neurology*. 2008 Nov;255(11):1792-7. PubMed PMID: 19156491. Epub 2009/01/22. eng.
63. Hasselberg M, Beer N, Blom L, Wallis LA, Laflamme L. Image-based medical expert teleconsultation in acute care of injuries. A systematic review of effects on information accuracy, diagnostic validity, clinical outcome, and user satisfaction. *PLoS one*. 2014;9(6):e98539. PubMed PMID: 24887257. PubMed Central PMCID: PMC4041890. Epub 2014/06/03. eng.
64. Farber N, Haik J, Liran A, Weissman O, Winkler E. Third generation cellular multimedia teleconsultations in plastic surgery. *Journal of telemedicine and telecare*. 2011;17(4):199-202. PubMed PMID: 21508079. Epub 2011/04/22. eng.
65. Dehours E, Valle B, Bounes V, Girardi C, Tabyar J, Concina F, et al. User satisfaction with maritime telemedicine. *Journal of telemedicine and telecare*. 2012 Jun;18(4):189-92. PubMed PMID: 22604271. Epub 2012/05/19. eng.
66. Dharmar M, Romano PS, Kuppermann N, Nesbitt TS, Cole SL, Andrada ER, et al. Impact of critical care telemedicine consultations on children in rural emergency departments. *Critical care medicine*. 2013 Oct;41(10):2388-95. PubMed PMID: 23921273. Epub 2013/08/08. eng.
67. Ignatius E, Perala S, Makela K. Use of videoconferencing for consultation in dental prosthetics and oral rehabilitation. *Journal of telemedicine and telecare*. 2010;16(8):467-70. PubMed PMID: 21030487. Epub 2010/10/30. eng.
68. Jacob MK, Larson JC, Craighead WE. Establishing a telepsychiatry consultation practice in rural Georgia for primary care physicians: a feasibility report. *Clinical pediatrics*. 2012 Nov;51(11):1041-7. PubMed PMID: 22523276. Epub 2012/04/24. eng.
69. McFarland LV, Raugi GJ, Reiber GE. Primary care provider and imaging technician satisfaction with a teledermatology project in rural Veterans Health Administration clinics. *Telemedicine journal and e-health* : the official journal of the American Telemedicine Association. 2013 Nov;19(11):815-25. PubMed PMID: 24053115. Epub 2013/09/24. eng.
70. Armfield NR, Donovan T, Bensink ME, Smith AC. The costs and potential savings of telemedicine for acute care neonatal consultation: preliminary findings. *Journal of telemedicine and telecare*. 2012 Dec;18(8):429-33. PubMed PMID: 23148301. Epub 2012/11/14. eng.
71. Bagayoko CO, Traore D, Thevoz L, Diabate S, Pecoul D, Niang M, et al. Medical and economic benefits of telehealth in low- and middle-income countries: results of a study in four district hospitals in Mali. *BMC health services research*. 2014;14 Suppl 1:S9. PubMed PMID: 25080312. PubMed Central PMCID: PMC4108933. Epub 2014/08/01. eng.
72. Horner K, Wagner E, Tufano J. Electronic consultations between primary and specialty care clinicians: early insights. *Issue Brief (Commonw Fund)*. 2011 2011/10//;23:1-14. eng.
73. Mark DA, Fitzmaurice GJ, Haughey KA, O'Donnell ME, Harty JC. Assessment of the quality of care and financial impact of a virtual renal clinic compared with the traditional outpatient service model. *International journal of clinical practice*. 2011 Oct;65(10):1100-7. PubMed PMID: 21923849. Epub 2011/09/20. eng.
74. Bodenheimer T. Coordinating care—a perilous journey through the health care system. *The New England journal of medicine*. 2008 Mar 6;358(10):1064-71. PubMed PMID: 18322289. Epub 2008/03/07. eng.
75. Mehrotra A, Forrest CB, Lin CY. Dropping the baton: specialty referrals in the United States. *The Milbank quarterly*. 2011 Mar;89(1):39-68. PubMed PMID: 21418312. PubMed Central PMCID: PMC3160594. Epub 2011/03/23. eng.
76. O'Malley AS, Tynan A, Cohen GR, Kemper N, Davis MM. Coordination of care by primary care practices: strategies, lessons and implications. *Research brief*. 2009 Apr(12):1-16. PubMed PMID: 19452679. Epub 2009/05/21. eng.
77. Masic I, Novo A. Medical informatics education in Bosnia and Herzegovina. *Acta Inform Med*. 2005; 13(4): 184-8.
78. Masic I, Pandza H, Kulasin I, Masic Z, Valjevac S. Tele-education as method of medical education. *Med Arh*. 2009; 63(6): 350-3.
79. Masic I, Ciric D, Pulja A, Kulasin I, Pandza H. Quality assessment of medical education and use of information technology in Health Technologies and Informatics. 2009: 898-902.