

Published papers on telepathology projects

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ABSTRACT

Introduction: Although many studies have been conducted in the telepathology field in recent years, a systematic review that examines studies in a comparative manner has not yet been undertaken. This paper aims to review the published papers on telepathology projects and compare them in several aspects such as telepathology method, telecommunication method, clinical outcome, etc.

Method: This is a systematic review study. PubMed database was used to find the studies published in the past ten years (2004–2014). The 71 final related papers were evaluated. Data were extracted from these studies based on the following items: country, national (in country) or international (between countries), frozen section or slide, body part, type of camera used, telecommunication method, telepathology method, clinical outcome, cost evaluation, satisfaction evaluation and the description of consultation providers and receivers. Data were analyzed using descriptive analysis.

Results: Results showed that most of the studies were performed in developed countries on a national level, on slide and on a specific body part. In most studies, a Nikon camera was used to take images. Online methods were the most used telecommunication method in the studies, while store and forward was the most used telepathology method. Clinical outcome of many studies showed that telepathology is a reliable and accurate method for consultation. More than half of the studies considered the cost, and most of them showed that a telepathology system is cost effective. Few studies evaluated satisfaction of the participants. In most studies, the telepathology project was undertaken between pathologists.

Conclusion: Although there is enough evidence to suggest that telepathology is an effective way of consultation between pathologists, there are still some areas that should be addressed and for which there is a lack of convincing evidence. For example, pathologist satisfaction, cost evaluation, legal issues and ethical issues still need to be addressed.

Keywords: Telepathology, Systematic review, Teleconsultation

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Introduction

Recent advances in computer, digital devices and telecommunications continue to lead to developments in areas of telemedicine, including telepathology.(1)The first appearance of the word ‘telepathology’ in a scientific paper was in 1986.(2) Since then, research in telepathology has advanced and different subdomains, including static and dynamic telepathology and virtual microscopy have developed.(3) Static telepathology is the easiest method to capture digital images and transmit them electronically,(4) but it is also the least effective method due to possible sampling field errors.(5) Dynamic telepathology is the real-time transfer of an image from a light microscope to a remote with robotic control of the stage. Disadvantages of this method are high cost and unavailability of proper connection lines in many areas. A recent approach to

telepathology is hybrid systems that combine static and dynamic elements.(6) In these systems, a series of static images are captured, stored, and then sent during teleconsultation. Consequently, the time and cost of using robotic systems are reduced and the overall consultation time is decreased.

Many studies have been performed in the field of telepathology all over the world. One such study conducted by Peter Furness compared the diagnostic accuracy of internet-based virtual microscopy with conventional light microscopy. The results indicate that no significant difference in diagnostic accuracy could be detected between the diagnoses offered on the basis of virtual slides and conventional slides.(7) A study performed by Al-Janabi et al. tested the feasibility of using whole slide images in primary diagnostics of paediatric pathology specimens and placental tissue. The results of this study

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showed that the original diagnoses were concordant with whole-slide imaging and light microscopic diagnoses in 90 per cent and 93 per cent of cases respectively, which was not significantly different.(8) A study conducted by Speiser et al. combined a dynamic non-robotic system with a tablet PC to provide a novel and cost-efficient method to diagnose dermatopathology cases remotely. The result of this study showed that 98.8 per cent of the telediagnoses were concordant with the original.(9)

Due to numerous studies in the field of telepathology and its effect on diagnostic accuracy, carrying out a systematic review in this field seems important and necessary. In the systematic review performed by Della, studies were analyzed from a bibliographic aspect(3) However, comparative systematic review has not been conducted in this field and many aspects of this domain have not been discussed yet. Thus, we decided to conduct a comprehensive review of telepathology projects available in the published literature. This paper sought to perform a systematic review of papers published in the telepathology field and answer the following questions:

1. In which countries did telepathology projects originate?
2. Were they national (in country) or international (between countries)?
3. Were they frozen section or slide-based consultations?
4. What part of the human body was consulted?
5. What type of digital microscope camera was used?
6. Which telecommunication method was used to connect the participants?
7. Was a static, dynamic or real-time telepathology system used?
8. What was the clinical outcome?
9. Were participant satisfaction and cost evaluations performed?
10. Who were the participants in the consultation process?

Methods

Data Source

We searched MEDLINE through PubMed only in February 2014, because some studies showed that the majority of telemedicine studies are indexed in the PubMed database.(10)

Search Strategy

The keyword combinations used when searching the PubMed database were as follows: Telepathology OR (Telemedicine AND pathology) OR (Telehealth AND pathology) OR (Teleconsultation AND pathology) OR (Remote consultation AND pathology).

Inclusion Criteria

The studies were included in this systematic review if they met the following criteria: a telepathology project had been performed, i.e. we included only telepathology papers in which a teleconsultation had been performed; and at least one method of telecommunication was used. Papers with abstracts were included, and only those written in the English language were selected.

Exclusion Criteria

We excluded letters to editors, short communications and articles without abstracts. Due to rapid advances in digital microscope cameras and telecommunication

technology, our search was limited to the past ten years (2004–2014). We also excluded papers that had not used a telecommunication method. For example, papers that only compared telepathology and conventional diagnosis without performing a teleconsultation act were removed from the final list.

Data Extraction

Data were extracted from relevant articles based on a checklist designed with the opinion of two specialists in the telemedicine field. The checklist included the following items: country, national (in country) or international (between countries), frozen section or slide, body part, type of camera, telecommunication method, telepathology method, clinical outcome, cost evaluation, satisfaction evaluation and teleconsultation participants.

After retrieving the first list of papers extracted from PubMed using the above-mentioned keyword combinations, all papers were read and assessed by two of the authors of this paper, in three steps (see Figure 1). First, the papers were read by a telemedicine professional who was also a medical doctor with grounding in the pathology domain and expertise in the telemedicine field. Second, papers were read and assessed by the first author of this paper. Then all retrieved papers were read and assessed based only on their titles, followed by an assessment of their abstracts. In the final step, the full texts were read and assessed to select the final list of papers for this study. After finalising the list of papers to be reviewed, all of them were read and assessed by the first author and corresponding author of this paper and data were extracted based on the questions mentioned in the introduction section of this paper.

Results

The PubMed search resulted in 1,440 hits. Among them, 286 articles were relevant to telepathology and were written in the English language. After reviewing the abstracts and titles of these articles, 215 of them were excluded because they did not meet the inclusion criteria (see Figure 1). Seventy-one papers were reviewed using the checklist outlined in the Data Extraction section above and provided the following results (see Table 1).

Country

Thirty-four per cent of the studies were performed in the United States (n=24) and seven per cent in Austria (n=5). The remaining studies were performed in other countries (n=42).

International or National

Most papers (n=52, 73 per cent) were carried out on a national level, while 27 per cent were on an international level (n=19).

Frozen Section or Slide

In most papers, the study was performed on slide (n=59, 83 per cent), while 14 per cent (n=10) of the studies were performed on frozen section. One paper was performed on both (1 per cent).

Body Part

Among 52 per cent (n=37) of papers in which a specific part of the body was studied, skin (n=11), breast (n=5) and nerve (n=5) were the most frequently used ones. In the

remaining papers, samples were from different parts of the body (n=32, 45 per cent).

Type of Camera Used

Fifteen papers stated images were taken with a Nikon camera (21 per cent), nine papers stated an Aperio camera was used (13 per cent), and nine used an Olympus camera (13 per cent). Ten papers (14 per cent) did not specify the type of camera used.

Telecommunication Method

Thirty-nine papers (55 per cent) used an online method (i.e. e-mail, Skype or local services), 19 used a web-based method (27 per cent), and three papers used both methods (4 per cent). Five papers (7 per cent) used different methods such as satellite, mail, multimedia messaging service, optic fibre or work station.

Telepathology Method

Thirty-two percent of the papers (n=23) used store and forward telepathology, 29.5 per cent (n=21) used real-time, 25 per cent (n=18) used virtual, and 11 per cent (n=8) used the two methods.

Clinical Outcome

Ninety-nine percent of papers (n=70) showed that telepathology is a reliable and accurate method for consulting. However, one of them showed that the form of telepathology they used was not accurate.

In 37 papers (52 per cent), the issue of cost was considered and most of these papers (n=35) showed that a telepathology system is cost-effective.

Satisfaction Evaluation

Nine papers (13 per cent) measured the satisfaction of those who used telepathology and found all participants were satisfied with the telepathology system.

Telecommunication Participants

In 60 percent of papers (n=43), the telepathology project was completed between pathologists, 18 per cent (n=13) between pathologists and other specialists, and 9 per cent (n=7) between assistant and expert pathologists.

Figure 1. Flow diagram showing the selection of studies included in the present systematic review

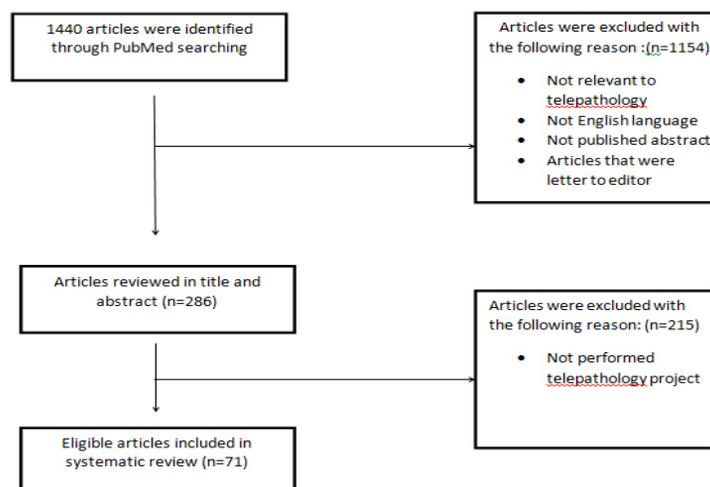


Table 1. Characteristics of studies

	Country	International/national	Frozensession /slide	Body part	Camera	Telecommunication method	Telepathology method	Clinical outcome	Cost	Satisfaction	Telecommunication participants
Brauchli et al.(11)	Solomon Islands	international	slide	general	Coolpix 990 Nikon	Email/web-based	Store and forward	reduce the median time from submission of the request to a report from 28 h to 8.5 h for a preliminary diagnosis and 13 h for a final report	Cost effective		Pathologists and surgeons
Ferrara et al.(12)	Austria-Italy	international	slide	Skin	Derma- pho, Heine Op- totechnik, Herrsch- ing, Germany	Telepathology work station	Store and forward	The diagnostic accuracy was 83 % for telederm- moscopy and 100 % for telederm- matopa- thology			A dermoscopy consultant, a histo- pathology consultant and an expert in dermo- scopic pathological

Lanschuetzer et al.(13)	Austria	International	slide	Skin	AxioCamMRc camera/Nikon Super Cool scan 8 000 ED slide scanner/ Nikon Coolpix 990 camera	email	Store and forward	There was agreement on the diagnoses made by the local and both remote centers by physicians experienced in IF/ IP microscopy in 14 of 17 cases (82%)	Cost effective		Physicians
Mireskandari et al.(14)	Iran/Germany	International international	slide	general		Web base	Store and forward	The results showed that telepathology is feasible for requesting pathologists working in a developing country or in an industrialized country			referring pathologist and expert pathologist
Nordrum et al.(15)	Nordland	international	slide	general	Sony DXC-107AP CCD color video camera/ Polaroid SprintScan 35 Film Scanner	email	Store and forward	The diagnosticians achieved roughly the same diagnostic concordance with OSODs from still images (68%) and from direct light microscopy (69%)			Pathologist
Burthem et al.(16)	UK	national	slide	Blood	DN100 and Net Cam Control Unit digital system(Nikon)	web base	virtual	The results revealed substantial concordance of observations made using digital slides with those reported in previous glass slide surveys that used identical cases	satisfaction		unknown
Kerr et al.(30)	USA	national	slide	general	Olympus	DP71	online	realtime	We found 97% diagnostic concordance and 99% accuracy Cost effective		resident and faculty pathologist
Li et al.(31)	China	national	slide	general	Motic MC 2000	Web base	realtime	telepathologic diagnosis was concordant with the gold standard and with direct microscopy, with a mean of 94.2% and 99.26%	Cost effective		Pathologist

Hitchcock et al.(17)	USA	national	Frozen section	breast	Panasonic GP-KS 1000 and an Olympus PMTV camera	A local area network distributed the MedMicro software(online)	realtime		This study demonstrates that the routine use of telepathology compares well with conventional microscopy in the assessment of both frozen sections and fine needle aspirates of breast lesions	Cost effective	Pathologist
Johnston et al. (18)	Ireland	national	slide	breast		ReplaySuite (online)/ CD ROM	virtual	the Replay-Suite to be beneficial in evaluating the diagnostic trace of an examination		satisfaction	Pathologist
Abdirad et al.(19)	Iran	international	slide	general	coolpix 2500 Nikon	Web base	Store and forward	The comparison between the final diagnosis in these cases and the primary diagnosis of institute pathologists revealed 28% discrepancy between them	Cost-effective		Pathologist
Hutarew et al.(20)	Austria	national	Frozen section	nerve	KPD20AP Hitachi/ HV-C20A, Hitachi	online	Real time	the diagnostic accuracy for telepathology was 97.9%			Neuropatologists
Jialdasani et al(21)	India	national	slide	general		email	Store and forward	A clinically useful diagnosis was rendered in 91% cases with 74% complete concordance			Pathologist
Leinweber et al.(22)	Austria	national	slide	Skin	Sony CCD video camera	online	Store and forward	Histopathologic diagnoses showed an accordance with the original diagnoses in 97.7%([kappa] = 0.954) of cases	Cost effective		dermatopathologists
Odze et al.(23)	USA	national	slide	Colon	Sony 3CCD camera	online	Real time	the use of dynamic TP for consultation in CUC-associated dysplasia has a poor level of interobserver agreement, but does not differ significantly from that obtained by the evaluation of the cases by microscopic slide analysis	Cost effective		Pathologist

Kldiashvili et al.(39)	USA	international	slide	cervix	camera (Sony DSC P10)	Web base	virtual	Telepathology is a very useful and applicable tool for consulting on difficult pathology cases.	Not cost effective		healthcare professionals and medical doctors/ anatomic/ clinical pathologist
Lopez et al.(40)	USA	national	slide	breast	DMetrix DX-40 ultrarapid virtual slide scanner(Tocson)	UltraClinics service(online)	virtual	There was complete concurrence with the primary diagnosis in 139 (90.3%) of cases		satisfaction	Physicians and pathologists
Slodkowska et al.(41)	Poland	national	Frozen section	lung	Coolscope (Nikon)/ ScanScope SC	Email/ Skype/web base	Realtime/ virtual	The telepathology diagnoses compared with conventional showed very high concordance for the Coolscope (87.5%) andAperio Virtual Slide modality (100%)			Pathologist
Wienert et al.(42)	Germany	national	slide	breast	scanners (Olympus Slide, Zeiss Mirax, HamamatsuNanozoomer)	T.Konsult – Server (online)	virtual	There was accordance of 94,56% between conventional and WSI diagnosis			Pathologist
Alsharif et al.(43)	USA	national	slide	general	Nikon digital camera system, Digital Sight series	online	realtime	There were no significant differences in the final cytology diagnoses between the 2 groups	Cost effective		cytopathologists
Angelini et al.(44)	Italy	international	slide	heart	Aperio Image Scope system	ISHLT 2004 system(online)	store	The combined kappa value of all grades diagnosed by all 18 pathologists was 0.31 for the 1990 system and 0.39 for the 2005 system	Cost effective		Pathologist
Georgoulakis et al.(45)	Greece	national	slide	thyroid	Hamamatsu C47 42-95 digital camera	file transfer protocol (online)	Store and forward	No significant difference in diagnostic accuracy among initial and review diagnoses			Cytopathologists
Harnden et al.(46)	UK	national	slide	prostate	AperioScanscope	CDs that mailed	virtual	Circulation of virtual images of biopsy material is a suitable alternative to glass slide schemes.			unknown
Intersimone et al.(47)	Italy	international	slide	general	D MD10 8 digital microscope	email	Realtime/ store and forward	No discrepancies between local and remote diagnoses have been identified			Pathologist
Jukic et al.(48)	USA	national	slide	general	InterScope Technologies, Pittsburgh, Pennsylvania	web base	Store and forward	We identified significant clinical and therapeutic discrepancies in 13 of 296 cases (4.4%)			Pathologist

Khurana et al.(49)	USA	national	slide	thyroid	digital color camera (Olympus DP20)	web base	Realtime	The accuracy rate between the final cytology and preliminary telecytopathology diagnosis was 94%	Cost effective		cytotechnologist to a nd pathologist
Kldiashvili et al.(50)	Georgia	national	slide	cervix	2.0 universal serial bus (USB) digital eyepiece microscope camera With resolution 3.0	email	Store and forward	The kappa values for interobserver variation between first and second glass slide diagnoses and first and second digital image diagnoses showed good to excellent agreement	Cost effective		cytologists
Nassar et al.(51)	USA	national	slide	breast	ScanScope XT instruments (Aperio) ScanScope XT System(online)	Store and forward	Comparable percentages of agreements were obtained for manual microscopy and manual digital slide reading (ER: MM, 91.3%-99.0%/ MDR, 91.3%-100.0%; PR: MM, 83.8%-99.0%/MDR, 76.3%-100.0%.				Pathologist
Pagni et al.(52)	Zambia	international	slide	general	Aperio Scanner ScanScope CS	satellite	virtual	There was no discordance between the 2 techniques in the diagnoses rendered for cytologic specimens.	Cost effective		Pathologist
Tsang et al.(53)	Botswana	international	slide	skin		Web base	Store and forward/real time	Clinicopathological concordance between submitting clinician and biopsy results occurred in 32 out of 55 cases (58%)	Cost effective		healthcare providers and dermatopathologists
Wamala et al.(54)	Uganda	international	slide	general	Coolscope, (Nikon)	Email and Skype	realtime	In 92 of the specimens (97%), the pathologists at the two hospitals agreed exactly about the diagnosis.			Pathologist
Wiley et al.(55)	USA	national	Frozen section	nerve	robotic microscope with a four-slide loader (Zeiss AxioImager M1 with 3 chip camera)	Email/VPN connection	realtime	The result was an effective means of distributing neuropathological expertise while at the same time preserving a professional center of excellence.	Cost effective		Neurosurgeon and surgical Pathologist
Zembowicz et al.(56)	USA	national	slide	skin	Web base		Store and forward	Web-based communication facilitates rapid turn-around time and reduces costs and barriers to second opinion consultation.	Cost effective		pathologists
Al-Janabi et al.(57)	Netherlands	national	slide	skin	ScanScope XT scanners (Aperio)	pathology reporting system (U-DPS, PALGA, Utrecht, The Netherlands) (online)	virtual	The light microscopy and the WSI based diagnosis were concordant in 94% of the cases			Pathologist
Gifford et al.(58)	Australia	national	Frozen section lymph nodes	Nikon	Coolscope	online	realtime	The accuracy of remote FS was equivalent to that of in-house FS(88.2% versus 89.9%)	Cost effective		Pathologist and surgeon
Gimbel et al.(59)	USA	international	slide	skin	Digital cameras (Olympus Q -color 3)/SPOT Insight	Web base	Store and forward	Diagnostic accuracy between static image and glass slide diagnosis in 22 cases was 91%.	Cost effective		Pathologist and dermatopathologists

Gimbel et al.(59)	USA	international	slide	skin	Digital cameras (Olympus Q-color 3)/SPOT Insight	Web base	Store and forward	Diagnostic accuracy between static image and glass slide diagnosis in 22 cases was 91%.	Cost effective		Pathologist and dermatopathologists
Kern et al.(60)	Slovenia	national	slide	general	Coolscope II, Nikon	online	realtime	Rapid evaluation with the use of telecytology improves the diagnostic yield of guided fine-needle aspiration biopsies by decreasing the percentage of non-representative specimens.			clinician or radiologist and cytopathologist
Khurana et al.(61)	USA	national	slide	pancreas	digital camera (Olympus DP20)	online	realtime	The concordance between the preliminary and final diagnosis was 84% for telecytopathology and 87% for conventional microscopy.	Cost effective		Gastroenterologist and pathologists
Kumar et al.(62)	Kenya	international	slide	general	digital colour camera (Olympus Q-color 3)	Web base	Store and forward	Diagnostic accuracy rates between telecytology and histological diagnosis for individual pathologists were 65 – 88%.	Cost effective		Pathologist
Marotti et al.(63)	USA	national	slide	general	Olympus DP72 camera	online	realtime	Incorporation of telecytology for immediate assessment of EUS-FNA increased cytopathologist efficiency.	Cost effective		cytopathologists, cyto-technologists, and cytology fellows
Nakayama et al.(64)	Japan	national	slide	skin	Scan Scope CS scanner (Aperio)	online	virtual	The quickest diagnosis was received only 18 minutes after sending our data. This is much faster than in conventional consultation	Cost effective	satisfaction	Pathologist and dermatologists
Sirintrapun et al.(65)	USA	international	Frozen section	general	A SPOT Insight Wide-field 4 Mp CCD Scientific Color Digital Camera	Skype 5.0	realtime	Forty of forty-five cases (89%) were essentially concordant.	Cost effective		surgical pathologists
Sohani et al.(66)	Kenya-Tanzania	international	slide	general		Web base	Store and forward	Static images enabled a complete or partial diagnosis in 91.7% of cases.	Cost effective		Pathologist
Al-Janabi et al.(8)	Netherlands	national	slide	general	ScanScope XT scanners (Aperio)		virtual	The original diagnoses were concordant with WSI and light microscopic diagnoses in 90% and 93% of cases.			pathologists
Izquierdo et al.(67)	USA	national	slide	thyroid	digital color camera (Olympus DP20)	online	realtime	In the transmitted group, preliminary diagnosis concurred with the final diagnosis in 96% of cases	Cost effective		Pathologist
Kadaba et al.(68)	Cambodia	international	slide	general		Web base	Store and forward/ realtime	All 38 cases discussed had a final agreed diagnosis and firm management plans were made.			experts in the fields of pathology, oncology and orthopaedics

Mammas et al.(69)	Greece	national	slide	Pancreas		OTE-TS via internet(online)	virtual	The VB of PG after retrieval is feasible and reliable for prevention of damaged PG.			unknown
Sawai et al.(70)	Japan	national	Slide/frozen section	general	ScanScope CS2(Aperio)	Web based(satellite)(WINDS)	Virtual/ realtime	No significant lag or inconvenience was experienced during diagnosis and conferencing.			Pathologist
Speiser et al.(9)	USA	national	slide	skin	video camera (Nikon DSL2, version 4.4)	online	virtual	Of the cases diagnosed immediately, 98.8% of the telediagnoses were concordant with the original.	Cost effective		dermatopathologist and pathologist
Desai et al.(71)	India	national	slide	general			Store and forward	Clinically unimportant minor discrepancy and hedged diagnoses were obtained in 90.2% of cases.			
Desai et al.(72)	India	national	slide	general			Store and forward	Clinically important or relevant diagnosis was achieved in 93.93% of cases.	Cost effective		
Bhele et al.(73)	India	national	slide	general			Store and forward	In 47% of the cases, the "probable" diagnosis on telepathology matched the final diagnosis.			pathologists
Fronza et al.(74)	Brazil	national									
Ayad et al.(75)	Italy/ Egypt	international	slide			online	Realtime/ virtual	we saved a lot of time and money while offering our patients a better medical service	Cost effective		pathologists
Goyal et al(76)	USA	national	slide	general	S97280, Optronics, Coleta, Calif., USA	Web base	realtime	There was 100% correlation between RFI and TeleCyP Assessment.	Cost effective		Cytopathologists
Santiago et al.(77)	Brazil	national	slide	general	Sony DKC-5000 or Nikon DXM1200 digital cameras/ Sony EVIPTZ single-chip camera	Web base	Store and forward/ realtime	The concordance between the telepathology and original diagnoses was 90.6%		satisfaction	trainee and the expert pathologist

Discussion

This study included 71 papers on telepathology projects. In this systematic review, results showed that 34 percent of the studies were performed in the United States (n=24). This indicates that although most of the world's population lives in developing countries where telemedicine services can be very useful in providing healthcare services, most of the studies in this field have been conducted in developed countries. We theorise this

could be because countries that are developed in terms of technology and use of telecommunication systems are much more advanced than developing countries. In 73 percent of the studies, telepathology projects were conducted on a national level. Despite the use of telepathology between countries having many advantages, particularly for developing countries, our results showed that the use of telepathology communication between countries is low, and most of the studies were performed on a national level.

Therefore, future research should focus on international telepathology projects.

About 52 per cent of papers studied a specific anatomical part. Since most articles that studied specific body parts used skin samples, this could indicate that dermatology is the field in which most pathologists need consultation. A study is required to determine which body parts are a priority for which there is a need to develop a telepathology system between young pathologists and experienced specialists.

Most studies used the store and forward method. This is probably because it is the simplest method, is more cost effective than other methods, and is suitable for use in areas with inappropriate connection lines. Despite its effect on reducing the cost and time spent in real-time methods, few studies have used the virtual telepathology method, perhaps because it is newer than other methods. In all studies except one, the results showed that telepathology is a reliable and accurate method for consulting. The contradicting results are probably due to limited bandwidth of internet connections in Iran.

Fifty-two per cent of papers considered cost. This indicates that although most of these articles have a positive theory about the cost effectiveness of telepathology, no study has specifically assessed the cost effectiveness of telepathology. It is surprising that few studies have assessed satisfaction (13 per cent), because assessment of the satisfaction of patients, pathologists and telepathology system's users is one criterion for evaluating these systems as usable. Therefore, researchers in future studies should consider satisfaction. Results indicated that in most papers (60 per cent) the telepathology project was completed between pathologists. This shows that, as in other pathology fields, general practitioner's consultation with other medical staff or specialists is not possible. Most teleconsultations in this field are completed between two pathologists with the same level of expertise, in cases when diagnosis is difficult. The limitation of this systematic review is that we did not have access to the full texts of four articles from Iran's medical universities network. Information was extracted from the abstracts of these articles.

Conclusion

This paper aimed to describe only the studies in the telepathology field to date. Our research showed that although there is enough evidence indicating that telepathology is an effective method of consultation between pathologists, there are still some areas that should be addressed and for which there is a lack of convincing evidence. For example, pathologist satisfaction, cost evaluation, legal issues and ethical issues still need to be addressed.

Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this article

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