International Journal of Women's Dermatology 2 (2016) 70–73

Contents lists available at ScienceDirect

International Journal of Women's Dermatology

Original Research

Patient and practitioner satisfaction with tele-dermatology including Australia's indigenous population: A systematic review of the literature

Emily K. Kozera [a,b,c], Anes Yang, MD, BMed, MPH [a,b], Dedee F. Murrell, MA BMBCh FAAD MD FACD FRCP(Edin) [a,b,c,*]

[a] Department of Dermatology, St George Hospital, Sydney, NSW, Australia
[b] Faculty of Medicine, University of New South Wales, Sydney, Australia
[c] Poche Institute, Faculty of Medicine, Sydney University, NSW, Australia

ARTICLE INFO

Article history:
Received 2 June 2016
Received in revised form 22 June 2016
Accepted 22 June 2016

Keywords:
tele-dermatology
patient management
tele-medicine
dermatology
rural health
health technology

ABSTRACT

Background: Australia's health disparity, combined with evolving technologies, has evoked increasing interest and funding in health services that could address inequities. One such emerging service is tele-medicine.
Objective: The purpose of this report is to discuss and evaluate the current literature regarding patient and practitioner satisfaction with tele-medicine, and more specifically tele-dermatology.
Methods: We searched for literature relevant to tele-dermatology use among Australia's indigenous population. We synthesized the literature in our report and identified elements of tele-dermatology not yet researched.
Results: Most significantly, all available research is currently based on descriptive studies and there is no validated tool to assess the efficacy of tele-dermatology.
Limitations: No published research currently exists on the use of tele-dermatology among Australia's indigenous population.
Conclusion: A review of the literature shows that tele-dermatology is considered a valuable service, particularly to patients living in rural areas who might not otherwise have access to specialist care.

Introduction

With a large proportion of Australia's population living outside metropolitan areas, many citizens have limited access to specialist health care services, including dermatology. This is one of the primary causative factors for gaps in Australia's population health, with one gap between the health of city and country dwellers and the other between indigenous and non-indigenous populations. This disparity, combined with evolving technologies, has evoked increasing interest and funding in health services that could address these inequities. One such emerging service is tele-medicine, and specifically tele-dermatology. This report synthesizes current information identified through a systematic literature review.

Tele-medicine

Tele-medicine is the use of information and communication technologies to diagnose and treat patients with disease or ill-health. Currently, two methods of tele-medicine communication exist: synchronous and asynchronous systems (Wilson and Maeder, 2015). Synchronous systems, also known as real-time systems, use a video-conferencing platform where a medical specialist, general practitioner (GP), and patient interact and are thus separated by space, but not time. The main advantage of this method is the opportunity to refine details or request additional information relevant to patient management during the consultation (Wilson and Maeder, 2015). Additionally, the patient can ask the specialist questions, building a relationship between specialist and patient.

This is not the case for asynchronous or store-and-forward systems where the patient and specialist are separated by both space and time. With store-and-forward systems, the GP sends information about the patient, their presenting complaint and medical history, and any relevant imaging to the specialist. The specialist reviews the information at a convenient time and then responds with their diagnosis and management opinions. The key advantage of an asynchronous system is that it provides flexibility in consultation schedules (Lasierra et al., 2012).

Both asynchronous and synchronous tele-medicine systems have a significant impact on the diagnosis and management of patients

* Corresponding author.
E-mail address: d.murrell@unsw.edu.au (D.F. Murrell).

http://dx.doi.org/10.1016/j.ijwd.2016.06.004

who are located geographically remote from traditional medical services. Thus, in a country such as Australia where more than two-third of the population live in metropolitan centers, tele-medicine services are paramount to address the health care needs of the those living in inner regional areas (20%), outer regional areas (9%), and remote and very remote areas (2.3%) (Baxter et al., 2011). Not only does tele-medicine assist in overcoming geographical barriers to health care, it also has the potential to decrease the gap between the health of indigenous and non-indigenous Australians. This gap is largely due to the high proportion of indigenous people living in rural and remote areas, which is 68% according to the most recent census (Australian Bureau of Statistics, 2012).

The increasing ability of tele-medicine to address Australia's health care needs is supported by Australia's Federal Government, which promised in 2010 to allocate A$392 million of funding towards the development of tele-medicine (Indraratna, 2011). Currently, 700 medical practitioners in Australia are affiliated with the national tele-medicine database (Cameron et al., 2015) and this number is expected to grow as additional funding and technologies allow for the expansion of telecommunication infrastructure, education and practice. Growth in the tele-health industry is not limited to Australia but is a global phenomenon, with predictions that global implementation of tele-health will increase ten-fold between 2012 and 2018 (Wilson and Maeder, 2015).

Tele-dermatology

Tele-dermatology is a specialized extension of tele-medicine, utilizing both the synchronous and asynchronous systems. Specifically, tele-dermatology is the use of digital photographs, dermatoscopy, and video in a general practice setting (Livingstone and Solomon, 2015). Tele-dermatology is utilized by medical practitioners globally, and particularly in developed countries, to overcome geographical barriers and consult colleagues about rare or difficult conditions. Tele-dermatology also serves poorer countries through programs such as Doctors Without Borders. As a result, plethora of research has been published in reputable journals investigating the efficacy, advantages and disadvantages of this service. The two primary systems, however, have different barriers and areas of satisfaction to consider when designing new tele-dermatology programs.

Synchronous systems

The primary advantage of synchronous tele-dermatology systems is the increased interaction between patient and dermatologist, and closely resembles a face-to-face dermatology consultation. Synchronous tele-dermatology provides an opportunity for the dermatologist to inquire about new details, or clarify existing ones, related to the patient's presenting complaint, medical history and other relevant information.

This advantage has been demonstrated in several studies. Whited (2006) showed that both patients and consultant dermatologists reported that their tele-dermatology experience was just as good as clinic visits and that a good rapport was developed. However, some complaints were reported about the inability to perform a full body examination, leading many clinicians to feel less confident in their diagnoses (Whited, 2006).

Other studies discuss the unique difficulties of synchronous systems compared to asynchronous systems. Not only does video conferencing via a synchronous system rely on the treating doctor, dermatologist, and patient being available simultaneously, it also requires additional and more complicated infrastructure to function (Byrom et al., 2016). Most notably, wide bandwidth communication and expensive video conferencing technologies (e.g., cameras,) are both necessary to achieve a consultation of adequate quality.

Asynchronous systems

Asynchronous tele-dermatology is considered significantly more convenient than synchronous because the treating dermatologist has the discretion to schedule an appropriate consultation time (Lim et al., 2012). This is likely the reason that store-and-forward tele-dermatology has been more extensively utilized and researched in Australia. In fact, a national online consultation and education service, Tele-derm, has been operating since 2005, providing asynchronous dermatological care with a 24-hour turnaround time. This service is extensively monitored and considered to be a valuable health service overall (Wilson and Maeder, 2015).

The primary complaint from those involved with asynchronous tele-dermatology is that image quality is often not sufficient. A 2-year study published in 2012 reported that in 66% of cases, the treating dermatologist was unable to offer a confident diagnosis and require higher quality images (Lasierra et al., 2012). This concept is further supported by Baba et al. (2005), who conducted a 3-month study in 2003 and found that diagnostic accuracy increased from 66% with images of poor quality to 87% with images of adequate quality.

Good quality dermatological images are critical to improve diagnostic accuracy. For photos to be of good quality, they must be clear, demonstrate the anatomical distribution of lesions, and include a close-up to show the detail required for an accurate diagnosis (Byrom et al., 2016). The frequency of poor quality images used in asynchronous tele-dermatology systems has led many researchers to suggest that imaging training programs and guidelines be introduced (Lasierra et al., 2012; Landow et al., 2014; Wilson and Maeder, 2015).

Overall efficacy

There is no doubt that tele-dermatology will never replace the role of conventional face-to-face consultations, particularly for the assessment and management of specific dermatological conditions. Research indicates it is an efficient and appropriate health service, with two of the most recently published studies citing the accuracy of diagnosis rates at 80% (Wilson and Maeder, 2015). However, some studies have reported the diagnostic accuracy of tele-dermatology as low as 43% (Lasierra et al., 2012). Similarly, clinical concordance rates vary from 35% (See et al., 2005) to 61% (Thind et al., 2011) for synchronous systems, and from 41% to 95% (Whited, 2006) for asynchronous systems.

In addition to variation in the literature about the diagnostic accuracy of tele-dermatology, variation also exists in reports on practitioner and patient satisfaction with the service. One publication reported that 100% of patients involved in the study would recommend tele-dermatology to others (Livingstone and Solomon, 2015). This conflicts, however, with other research stating that 38% of patients would prefer a face-to-face consultation to discuss their condition with a dermatologist (Collins et al., 2004).

The latter statistic is better aligned with the majority of publications citing patient satisfaction rates at approximately 80%. Hsueh et al. (2012) reported that while 66% of patients actually preferred the tele-dermatology experience over face-to-face consultations, 83% of patients were satisfied enough with the service they would recommend it to others. Although this study had very positive results, other papers reported patients discontent with the replacement of a patient-centric approach by technology-centric care (Moreno-Ramirez and Ferrandiz, 2015). It should be noted that the primary reasons for patient dissatisfaction were central to the patient feeling their health issues were not adequately addressed or they did not receive adequate follow-up care (Hsueh et al., 2012). Additionally, a 2007 study by Mofid et al. discovered that patients who regularly required dermatologic care (i.e., more than twice in a 12-month period) were much more likely to pursue conventional consultations.

In the majority of available literature assessing participant satisfaction with tele-dermatology, practitioner satisfaction was consistently greater than patient satisfaction. This may be the result of a variety of reasons. Tele-dermatology offers an educational benefit to GPs, as evidenced by van der Heijden et al. (2011) who found that 85% of GPs reported increased knowledge of dermatology following tele-consults. In addition, not only GPs believed that tele-dermatology should be incorporated into regular clinic routine (Lasierra et al., 2012), dermatologists also noted that tele-dermatology decreased the number of face-to-face referrals by up to 74% (van der Heijden et al., 2011). Such a reduction in referrals saved health care resources and practitioner time, but this is a point of contention among researchers. Other dermatologists reported that due to the high sensitivity and low specificity of tele-dermatology, there were excess referrals to the service (Wilson and Maeder, 2015).

Some factors have been repeatedly associated with practitioner satisfaction with tele-dermatology, including effective pre-selection of patients for tele-consultation, use of high quality images, dermoscopy for pigmented lesions, appropriate infrastructure, and access to continued educational courses (Landow et al., 2014; McFarland et al., 2013).

A benefit of tele-dermatology appreciated by patients and practitioners alike is the reduction in waiting time for the initial appointment, with an average turnaround time for a store-and-forward tele-dermatology consultation ranging from 4.6 hours to 71 hours and 58 minutes (Moreno-Ramirez et al., 2007; van der Heijden et al., 2011). In comparison, an average waiting period in the United States for a face-to-face consultation is 90 days (Whited, 2006). Although patient waiting time was reduced, dermatologist consult time reportedly increased by 10 minutes per consultation when using synchronous tele-dermatology (Lasierra et al., 2012).

Economics

The successful implementation of a tele-dermatology program is associated with a number of expenses. These include the cost of equipment (e.g., dermatoscopes, cameras with high pixilation, good quality video cameras, computers with capacity to store and process data), training of staff (e.g., GPs, dermatologists, imagers) to use the equipment efficiently, and various technological expenses (e.g., high speed broadband connection, software to synchronize electronic medical records with tele-dermatology care). All are important expenses to facilitate communication between different medical providers (Rubin and Kovarik, 2015).

Despite these expenses, many researchers have argued that the implementation and maintenance of tele-dermatology programs reduces costs over time compared to regular consultation methods. Livingstone and Solomon (2015) conducted a 3-year retrospective analysis of 248 patients and reported that referring all patients directly to a face-to-face dermatology appointment cost £42,160. Setting up and using tele-dermatology for all 248 patients cost £29,700, saving £12,460 over the 3-year period.

Similar findings were reported from a study conducted in North America at a similar time. This 9-month randomized clinical trial with 391 patients found that from a societal perspective, a tele-dermatology appointment was US$82 less expensive per patient than a conventional referral (Datta et al., 2015). These findings are statistically significant and well-supported by other publications (Armstrong et al., 2007; Bergmo, 2000).

Some literature, however, question the economic validity of using tele-dermatology over traditional consultations. Whited (2006) reported that tele-dermatology ranged from a cost-saving strategy to an intervention incurring greater costs than conventional care depending on the health care setting and economic perspective. A study from the United Kingdom of 102 randomized patients further illustrated the value of correlating incurred costs with measured outcomes to generate ratios to accurately assess the cost effectiveness of tele-dermatology. The study also demonstrated that while asynchronous tele-dermatology is the least expensive option, it is also the least effective one (Loane et al., 2000). Furthermore, Eminovic et al. (2010) concluded that in order to achieve the economic validity of tele-dermatology, the system should only be used for cases with a high probability of preventing a live consultation.

Lastly, it should be noted that in a systematic literature review published in 2015, de la Torre-Diez et al. found that few studies effectively analyzed the economic validity of tele-dermatology. They concluded that a need for more randomized control trials with larger sample sizes and appropriate tools of measurement must be completed before accurate conclusions can be made.

Privacy

Dermatology is a specialty that relies on visual observation and photographs of patient lesions to monitor disease progression. Privacy and confidentiality are not common patient complaints when evaluating tele-dermatology (Weinstock et al., 2002). However, the issue of patient privacy and practitioner medico-legal responsibility is important and was explored and published by Stevenson et al. (2016). Stevenson et al. discussed the growing use of smartphones to capture and transmit patient pictures and the legal and reputational consequences that may occur if practitioners breach such privacy.

The publication also listed two studies that evaluated the use of clinical photography in Australian hospitals. The studies reported that the use of personal smartphones and devices was common-practice and privacy practice and policy was inconsistent and inadequate (Burns and Belton, 2013).

Tele-dermatology among Australia's indigenous populations

No published research currently exists on the use of tele-dermatology among Australia's indigenous population. In fact, when the terms telemedicine, Australia, and indigenous were searched together in the MEDLINE® database, only eight search results were revealed. Upon review of these articles, none related specifically to indigenous tele-dermatology, but rather focused on other forms of tele-medicine. For example, a paper reported on the use of tele-oncology among indigenous populations, which found that 87% of patients were satisfied with the service (Mooi et al., 2012). These findings were supported by a more recent publication by Sabesan (2015).

Yet another publication evaluated the feasibility of a community-based tele-health screening service for indigenous children in Australia, with a focus on ear, nose, and throat (ENT) conditions (Elliott et al., 2010). The research concluded there was a 76% acceptance rate by the indigenous community, measured by the number of parents who consented for their children to be screened, and that tele-medicine was a useful tool in the assessment and management of ENT conditions. A secondary ENT tele-health paper reinforced these positive results (Reeve et al., 2014).

Lastly, research has been conducted into the use of tele-ophthalmology among Australia's indigenous population with a prospective audit study performed in Western Australia in 2014. Although the publication did not report positively on tele-medicine, it did conclude that tele-ophthalmology could one day be a useful tool to provide health care services in remote communities but that further investigations and financial incentives would be required (Johnson et al., 2015). Studies such as this support the idea there is potential for tele-dermatology to be successfully implemented among Australia's indigenous communities.

This notion is further supported by international research that found tele-medicine to be an effective means to provide health care to remote village populations in countries and outside Australia. Positive results have been demonstrated in Canada, Chile, and Alaska, USA among others (Gatica et al., 2015; Muttitt et al., 2004; Smith and Ferguson, 2004).

The lack of research on the use of tele-dermatology among Australia's indigenous populations is particularly significant given the unique indigenous culture recognized in the *National Statement on Ethical Conduct in Research Involving Humans* (National Health and Medical Research Council, 2015). Although there is great diversity across different indigenous communities, six core values have been identified: reciprocity, respect, equality, responsibility, survival and protection, and spirit and integrity. Thus, it is paramount that future research among indigenous people is guided by these principles.

Conclusion

A review of the literature shows that tele-dermatology is considered a valuable service, particularly to patients living in rural areas who might not otherwise have access to specialist care. The present research has identified certain aspects of tele-dermatology not yet optimized, including the development of a validated survey instrument to assess tele-dermatology provider and patient satisfaction with the service. Currently, available literature is based entirely on descriptive studies.

Acknowledgments

The authors thank the independent learning program of UNSW Australia for EK to work with DFM.

References

Armstrong AW, Dorer DJ, Lugn NE, Kvedar JC. Economic evaluation of interactive teledermatology compared with conventional care. Telemed J E Health 2007;13:91–9.
Australian Bureau of Statistics. Demographic, social and economic characteristics overview: Aboriginal and Torres Strait Islander people and where they live; 2012 [cited 2016 March 20. Available from: http://www.abs.gov.au/AUSSTATS/abs@.nsf/lookup/4704.0Chapter210Oct+201].
Baba M, Seckin D, Kapdagli S. A comparison of teledermatology using store-and-forward methodology alone, and in combination with Web camera videoconferencing. J Telemed Telecare 2005;11(7):354–60.
Baxter J, Hayes A, Gray M. Families in regional, rural and remote Australia [Internet]; 2011 [cited 2016 March 19. Available from: https://aifs.gov.au/publications/families-regional-rural-and-remote-australia].
Bergmo TS. A cost-minimization analysis of a realtime teledermatology service in northern Norway. J Telemed Telecare 2000;6(5):273–7.
Burns K, Belton S. Clinicians and their cameras: policy, ethics and practice in an Australian tertiary hospital. Aust Health Rev 2013;37(1):437–41.
Byrom L, Lucas L, Sheedy V, Madison K, McIver L, Castrisos G, et al. Tele-Derm National: A decade of teledermatology in rural and remote Australia. Aust J Rural Health 2016;24(3):193–9.
Cameron M, Ray R, Sebesan S. Remote supervision of medical training via videoconferencing in Northern Territory Australia: a qualitative study of the perspectives of supervisors and trainees. BMJ 2015;5(3):1–6.
Collins K, Walters S, Bowns I. Patient satisfaction with teledermatology:Quantitative and qualitative results from a randomized controlled trial. J Telemed Telecare 2004;10(1):29–33.
Datta SK, Warshaw EM, Edison KE, Kapur K, Thottapurathu L, Moritz TE, et al. Cost and utility analysis of a store-and-forward teledermatology referral system: A randomized clinical trial. JAMA Dermatol 2015;151(12):1323–9.
de la Torre-Diez I, Lopez-Coronado M, Vaca C, Aguado JS, de Castro C. Cost-utility and cost-effectiveness studies of telemedicine, electronic, and mobile health systems in the literature: a systematic review. Telemed J E Health 2015;21(2):81–5.
Elliott G, Smith AC, Bensink ME, Brown C, Stewart C, Perry C, et al. The feasibility of a community-based mobile telehealth screening service for Aboriginal and Torres Strait Islander children in Australia. Telemed J E Health 2010;16(9):950–6.
Eminovic N, Dijkgraaf MG, Berghout RM, Prins AH, Bindels PJE, de Keizer NF. A cost minimisation analysis in teledermatology: model-based approach. BMC Health Serv Res 2010;10(1):251–61.
Gatica JL, Bertolo S, Morales E, Espinoza M, Contrerase C. Store-and-forward teledermatology in Chile: A contribution to primary health care. Piel. Formacion continuada en dermatologia, 30(3). ; 2015.
Hsueh MT, Eastman K, McFarland LV, Raugi GJ, Reiber GE. Teledermatology patient satisfaction in the Pacific Northwest. Telemed J E Health 2012;18(5):377–81.
Indraratna P. Telemedicine: The possibilities, practicalities and pitfalls. Aust Med Stud J 2011;2(1):11–2.
Johnson KA, Meyer J, Yazar S, Turner AW. Real-time teleopthalmology in rural Western Australia. Aust J Rural Health 2015;23(3):142–9.
Landow SM, Mateus A, Korgavkar K, Nightingale D, Weinstock MA. Teledermatology: Key factors associated with reducing face-to-face dermatology visits. J Am Acad Dermatol 2014;71(3):570–6.
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. Int J Med Inform 2012;81(5):332–43.
Lim D, Oaklet AM, Rademaker M. Better, sooner, more convenient: A successful teledermoscopy service. Australas J Dermatol 2012;53(1):22–5.
Livingstone J, Solomon J. An assessment of the cost-effectiveness, safety of referral and patient satisfaction of a general practice teledermatology service. Lond J Prim Care 2015;7(2):31–5.
Loane MA, Bloomer SE, Corbett R, Eedy DJ, Hicks N, Lotery HE, et al. A comparison of real-time and store-and-forward teledermatology: A cost benefit study. Br J Dermatol 2000;143(6):1241–7.
McFarland LV, Raugi GJ, Reiber GE. Primary care provider and imaging technician satisfaction with a teledermatology project in rural Veterans Health Administration clinics. Telemed J E Health 2013;19(11):815–25.
Mofid M, Nesbitt T, Knuttel R. The other side of teledermatology: Patient preferences. J Telemed Telecare 2007;13(5):246–50.
Mooi JK, Whop LJ, Valery PC, Sebesan SS. Teleoncology for Indigenous patients: The responses of patients and health workers. Aust J Rural Health 2012;20(1):265–9.
Moreno-Ramirez D, Ferrandiz L. A 10-year history of teledermatology of skin cancer management. JAMA Dermatol 2015;151(12):1289–90.
Moreno-Ramirez D, Ferrandiz L, Nieto-Garcia A, Carrasco R, Moreno-Alvarez P, Galdeano R, et al. Store-and-forward teledermatology in skin cancer triage: Experience and evaluation of 2009 teleconsultations. Arch Dermatol 2007;143(4):479–84.
Muttitt S, Vigneault R, Loewen L. Integrating telehealth into Aboriginal healthcare: The Canadian experience. Int J Circumpolar Health 2004;63(4):401–14.
National Health and Medical Research Council. National statement on ethical conduct in research in humans [Internet]; 2015 [cited 2016 April 22. Available from: https://www.nhmrc.gov.au/_files_nhmrc/publications/attachments/e72_national_statement_may_2015_150514_a.pdf].
Reeve C, Thomas A, Mossenson A, Reeve D, Davis S. Evaluation of an ear health pathway in remote communities: improvements in ear health access. Aust J Rural Health 2014;22(3):127–32.
Rubin CB, Kovarik CL. The nuts and bolts of teledermatology: Preventing fragmented care. J Am Acad Dermatol 2015;73(5):886–8.
Sabesan S. Specialist cancer care through telehealth models. Aust J Rural Health 2015;23(1):19–23.
See A, Lim AC, Le K, See JA, Shumack SP. Operational teledermatology in Broken Hill, Rural Australia. Australas J Dermatol 2005;46(3):144–9.
Smith E, Ferguson S. Telehealth in the Tundra. Remote northwest Alaskan villages encounter faster access to more sophisticated medical care. Health Manag Technol 2004;25(3):24–6.
Stevenson P, Finnane AR, Soyer HP. Teledermatology and clinical photography: safeguarding patient privacy and mitigating medico-legal risk. Med J Aust 2016;204(5):198–200.
Thind CK, Brooker I, Ormerod AD. Teledermatology: A tool for remote supervision of a general practitioner with special interest in dermatology. Clin Exp Dermatol 2011;36(5):489–94.
van der Heijden JP, de Keizer NF, Bos JD, Spuls PI, Witkamp L. Teledermatology applied following patient selection by general practitioners in daily practice improves efficiency and quality of care at lower cost. Br J Dermatol 2011;165(5):1058–65.
Weinstock MA, Nguyen FQ, Risica PM. Patient and referring provider satisfaction with teledermatology. J Am Acad Dermatol 2002;47(1):68–72.
Whited JD. Teledermatology research review. Int J Dermatol 2006;45(3):220–9.
Wilson LS, Maeder AJ. Recent directions in telemedicine: Review of trends in research and practice. Healthc Inform Res 2015;21(4):213–22.