REVIEW

The application of telemedicine to geriatric medicine

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Abstract

Background: telemedicine has the potential to improve access to the specialty of geriatric medicine, particularly in rural and remote settings. While telemedicine is widely used in some specialities, this is not yet the case in geriatric medicine.

Objective: to review the current literature to identify proven and potential strategies for application of telemedicine in geriatric medical practice.

Method: a comprehensive review of literature pertaining to the application of telemedicine in geriatric medicine and relevant related sub-specialties was undertaken.

Results: a large number of small studies of limited quality, and a small number of robust studies including randomised trials, were identified.

Conclusions: there is evidence to suggest that a variety of telemedicine techniques can be applied effectively and safely in geriatric medicine across a variety of clinical settings. Patient satisfaction is generally reported as high. However, caution is advised due to the paucity of robust studies in the literature.

Keywords: telemedicine, geriatrics, elderly, remote consultation

Introduction

Geriatric medical expertise is not universally available, even in industrialised countries. This is usually a result of inadequate supply of practitioners or remoteness. In rural or remote communities, there may be insufficient caseload to warrant the full-time presence of a geriatrician. As a consequence, this important capability is often not available.

Telemedicine strategies have been applied in response to similar challenges in other medical disciplines. Telemedicine has the possible advantage of being able to offer a service at marginally increased cost, depending on volume, and eliminating travel costs for the doctor and the patient [1].

In this paper, the literature that supports acceptable, reliable and cost-effective application of telemedicine strategies to geriatric medicine is reviewed. Reports of randomised clinical trials of telemedicine strategies with substantial numbers of elderly are very few, and no papers report by age subgroup. The wide variety of clinical areas covered, and areas not covered, by these trials diminishes the value of further analysis. In order to include lessons learnt from closely associated health disciplines, a literature search must be less restricted, but as a consequence, less amenable to systematic analysis [2]. As concluded by a 2002 review [3], the reports are of variable quality, and their claims about utility and efficacy may not be founded on strong evidence. Cost effectiveness has more recently been addressed also in a systematic review which concluded [4] that ‘good quality studies are still scarce’. Due to the scarcity of reports specific to geriatric patients and the large number of feasibility or pilot studies, this review set aside the intended systematic approach and draws on that broader search, adding reference to recent reviews in telemedicine, and emphasises important themes in modern geriatric medical practice in a commentary narrative.
The literature search

Reported experience of telemedicine and geriatric medicine was sought from databases of health and related publications. The search applied the terms telemedicine, telehealth, e-health, telecare, teleconsulting or remote consultation (all spellings) AND geriatric, aged over 65, ageing, elder and elderly. References to publications after 1990 with an abstract, in English, were collected. The search included, PubMed, Medline, CINAHL, Psycinfo, Web of Science and TIE (Telemedicine Information Exchange). The AMI (Australasian Medical Index) was searched to include any local publications possibly not included in the major databases. The search was conducted in April 2005.

The extracted references were combined and duplicates removed, resulting in 233 separate publications. These were then reviewed in abstract form to ensure relevance and categorised (MJB) according to the type of technology used, clinical practice and level of evaluation. Three articles proved not to be telemedicine, leaving 230 for further review. Fifty-six papers were reviews, or opinions, leaving 174 clinical studies. They covered a wide range of clinical activity, with variable relevance to clinical geriatrics. Elements of a geriatric service were therefore considered separately to seek out reported experience and evaluation. A further six papers were accessed for background material, or as a result of secondary following of cited references. Articles which reported work in allied clinical practice, such as psychiatry and neurology, which included older patients, and which were considered relevant to geriatric medical practice, were emphasised in the review.

The clinical papers were categorised according to whether:

- the contact was in real time (156 reports) or ‘store and forward’ (18 reports);
- objective patient data was transferred (101) or referred to voice or video interaction only (73);
- the patient participated in the use of the technology (168), or contact was between health workers only (6);
- control groups were compared (74);
- costs were reported (30);
- available technology (telephone or PC/internet) (45) or specialised /purpose built equipment was used;
- patients used the technology in a clinical care setting (86) or in their own home (85);
- whether substantial numbers of patients were involved \( (n \geq 100) \) (61).

Of the 230 papers, 78 were published in one of the two major journals of telemedicine. In papers reporting randomised control trials with substantial numbers, 26 reports referred specifically to the elderly. These included 17 reports of costs from 11 separate clinical trials. In the following sections related to practice environments and issues, published papers considered by the authors to be most important and relevant are referenced.

Practice environments

When the broad field of geriatrics is considered, there are patterns of clinical activity, which may be compared with other disciplines. Important elements of hospital work, which can be considered are inpatient management (hospital or nursing home), consultation or triage for admission or transfer purposes. Community work can involve chronic disease or disability management, home visits, clinic/office practice and care planning. Service planning involves consideration of logistics, equity, efficacy and cost of clinical processes and systems. When the literature is reviewed with these elements in mind, many examples of reported experience of telemedicine will have relevance. The following is a discussion of these elements in order.

Inpatient management

It is difficult to take full responsibility for hospital type care from a distance. Many practitioners are unwilling to provide care or advice without face-to-face contact. Most precedents relate to extremes of urgency or remoteness. Specialists may advise local health practitioners, however, having received information about the patient. There is a widely established practice of telephone conversation for informal advice in many disciplines, which is not reported in detail in the literature of telemedicine. Where more technology or a formal telephone protocol is used, there are reports from telemedicine projects serving a range of disciplines.

Consultation opinions about hospital patients are a routine activity, which contributes to better outcomes. Medical consultation for hospital patients by telemedicine from an offsite location is less widely used, but has become routine in electrocardiography and radiology, and is reported in neurology [5], orthopaedics [6], minor injuries [7], wound care [8], biopsy cytology [9], psychiatry [10], otorhinolaryngology [11] and urolithiasis [12]. There are isolated examples of remote reporting of objective data only, obtained and transmitted in digital form in echocardiography [13, 14] and polysomnography [15]. Offsite consultation for nursing home residents has been reported by geriatric teams [16] and psychiatry [17].

Because consultation work can be a major component of hospital geriatric practice, it seems likely to be a focus for telemedicine developments.

Triage by telemedicine for admission, or face-to-face attendance, has been reported from neurosurgery [18] and urology [12] (using teleradiology), geriatrics [16, 19] and podiatry [20] in a nursing home, nurse practitioners in family medicine [21] and medical assistance subscribers using a help line [22]. Universally, these studies report that a proportion of contacts can be managed without transfer, and in the case of head injury, greater safety. When the distances or hazards of transfer are greater, the likely utility of telemedicine increases. A project in nursing homes in Singapore proposed to use an electronic medical record, in combination with videoconference, but no patient data was reported [19]. A Hong Kong experience linking a community
geriatric assessment team to a local nursing home to provide management advice instead of a clinic or outreach visit, resulted in 9% fewer ED attendances and 11% fewer utilised hospital days [16]. Both studies reported on the introduction of videoconference to an existing clinical relationship, where workers from several disciplines were known to staff in the same region, but stated that it enhanced clinical interaction and support for the nursing home staff.

Providing non-urgent advice and opinions from allied health practitioners has been reported from Australia where videoconference links to nursing homes were used [23]. The outcomes were reported in terms of user satisfaction and also adequacy of assessment, by five disciplines. The workers were often uneasy about the clinical assessment, but the opportunity to revise recommendations after seeing the patient in person resulted in only minor changes to plans.

**Ambulatory geriatrics**

Office practice or ambulatory care would require the patient to be introduced to the remote specialist by a local health facility or worker. There are many reports of successful clinics providing specialist advice by telemedicine. Detailed analysis of patient outcomes, satisfaction levels [24, 25] and costs are reported. Neurology clinic reports from Northern Ireland demonstrate feasibility and efficacy, but that telemedicine may generate more investigations [26]. In further work, they were able to show that costs of the service were critically dependent on the type of consultant, telecommunication charges and the locally based health worker’s time. The cost-efficiency emerged when the service was compared with a broader usual care group, in ‘everyday practice’ [27], and increased as the distance increased. A large randomised trial of a virtual outreach consultation service [28] reported excess costs which were attributable to the initial consultation which included the patient and their local doctor, but patient satisfaction was higher in the telemedicine group.

Some successes have been reported with assessment of cognitive function [29] and psychiatric interview [30], with clear parallels to wider geriatric practice. The use of videoconference was reported as acceptable for patients with mild dementia, but its utility is likely to decline as the patient is less able to comprehend the interview, or has significant sensory impairment. A specialist cognitive service [29] was able to show that standardised screening tools appear to perform reliably when used in video-conference to diagnose dementia, but this selected patient group required a clinician at the remote location, to enable specialist clinician assessment. Telephone assessment of cognition has also been validated in stroke follow-up [31].

Since cognitive function is an important component of comprehensive geriatric assessment, these reports provide valuable guidance, but the more impaired patients are less likely to tolerate unfamiliar technology, unless supported by skilled staff at the time, as in the nursing home experience. When there is a possibility of cognitive impairment, the capacity of the patient to cope with the technology becomes a confounding factor. In an approach that is not reliant on a remote clinician having direct interaction with the patient, the assessment outcome is likely to be less affected by cognitive impairment. The scope of assessment may be reduced, but reliability is likely to be greater. ‘Store and forward’ strategies, where a local clinician collects objective data and transmits it for an opinion, have this advantage, without the patient needing to adapt to the technology.

**Community care**

Chronic disease management has also been reported in a number of studies, which have relevance to geriatrics. Here the emphasis is often on direct links to patients’ homes, without the intermediary health worker. Passive monitoring of blood pressure with telephone transmission of recordings to a clinic improved control in a randomised control trial [32]. The control of heart failure, diabetes and chronic respiratory disease have been improved by an integrated approach, with non-invasive passive monitoring of various physiological data, support of a nurse case manager and an electronic medical record, resulting in less hospital bed and emergency department use and greater patient satisfaction [33]. Cost savings accrued largely from reduced hospital bed use, although the patient groups were not pre-matched for this variable. Since this randomised control trial involved Veterans’ Administration high resource users who had a mean age of 71 years (range 54–90), it is likely to be applicable to geriatric practice, but access to the monitoring technology may limit its widespread use. Those approaches which result in improvements in both efficacy and cost of care seem likely to revolutionise chronic disease management.

Ongoing care in the community has been augmented by telephone, with improvements in heart failure and patient satisfaction [34], and depression [35]. The addition of a video link [36] to usual home care has been shown to be well accepted [37] and cost-effective [38], not as an alternative to community nurses, but as a means of safely reducing or targeting their visits, after initial contact. Existing outreach and case management services are likely to improve efficacy and efficiency by introducing telehealth.

**Technology issues**

Different methods of data transfer have been compared in ambulatory clinics in dermatology, psychiatry and community care. Videoconferencing has been compared to review of stored images [39] and the clinical results were less satisfactory for the asynchronous technique in dermatology. On the other hand, it is clearly cheaper than either video conference or usual care, and less dependent on achieving economies of scale. For these reasons, store and forward strategies are attractive where the service is not substituting for existing service, and setup costs are of paramount concern. Some studies report purpose built equipment, especially for in-home monitoring, costing US$10,000 per client for mobile videoconference units [33]. The use of standard telephone lines for transmission of simple...
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measurements like blood pressure, pulse, weight, or blood sugar, downloaded from a small device, or reported by voice is now possible and clearly less expensive. An Internet connection will also allow keyboard data entry or the use of Web forms. As more patients already have Internet access at home, set-up costs are further reduced. This also raises the possibility of passive home monitoring via the Web, but clinical reports are still only in the pilot phase.

Limited video or voice over the Internet can be expected to become more readily available as connection speeds and bandwidth improve; however, evidence from the United Kingdom suggests that the cost of utilising ISDN lines can represent a substantial proportion of a service budget [40].

Limitations

Inability to elicit physical examination findings [16] is a frequently stated issue limiting the utility of remote assessments. This was overcome in the neurology and emergency department studies cited earlier in this review by employing a junior doctor with the patient to elicit clinical signs, under direct observation by the remote physician. This strategy increases costs substantially over the use of a nurse or other health worker to chaperone the process, although these workers may become as effective as a junior doctor in these tasks with specific training. In dermatology, viewing only images and clinical notes appeared to result in inefficiency, with increased review appointments [39]. Where the clinical interaction is most dependent on physical contact with the patient, remote assessment will remain problematic.

Clinician users of telemedicine systems often reported dissatisfaction or uncertainty. An early report related this to gender differences in the need for touch, or the personal style of the physician [41]. There are no reports of significant gender differences in satisfaction with telemedicine. The higher degree of clinician uncertainty is predictable and may be inevitable with a single episode of clinical contact, but can be alleviated by ensuring that the ongoing management responsibility and plans are clear. For doctors, the uncertainty and reluctance may arise from less clinical control, and a change in the power relationships when working remotely with nurses [42]. The long-term links between clinicians of all disciplines within a telemedicine system may be the best source of greater clinical certainty, as they would be in conventional local referral systems. These clinical relationships are more difficult to establish over greater distances, but the successful introduction of a service may be enhanced by deliberate emphasis on the people as well as the technology [43], until the service is well established, and always emphasising the ongoing clinical relationship between the patient and the local health worker. The use of a combination of usual care and telemedicine strategies in a longer course of treatment or community care should also minimise any perceived limitations.

Implementation issues

The practice of telemedicine in geriatrics is not generally considered to be ‘mainstream’. A qualitative analysis of three UK studies [44] argued for stages in the normalising of telemedicine which depend on local organisation policy and politics in a way which is easily underestimated by its proponents. For this reason alone, there are likely to be difficulties in implementing strategies which have shown promise in well conducted clinical trials. A recent review recommends that to overcome the image that telemedicine is for ‘early adopters’ and enthusiasts, research projects should be linked to medical education where there is more acceptance of remote learning. It is also suggested that partnerships with health authorities will be essential to ensure access to the infrastructure [45]. Clinicians may also be reassured by the many reports of high satisfaction levels from patient surveys, but levels are generally high and most studies may be criticised on size and methods [46].

Learning by analogy

Given the scarcity of geriatricians, techniques which allow brief clinical interaction without ongoing management may be more practical. Remote consultation with a local health professional is attractive for this reason.

Assembling objective data according to an agreed protocol, and transmitting it in real time, or store-and-forward, is likely to be more time efficient. It should also enhance a consultation process by giving it more structure. The full development of the dataset would become part of an electronic medical record.

Minimising the demand for new technology beyond a PC with web access and email software, assists in controlling set-up costs. Both the equipment and the training will be less costly as a result.

In the hospital setting, existing staff are more likely to participate if the procedure is not too demanding of their time, substitutes for existing less integrated activity and provides a timely, clinically relevant response.

Conclusions

In areas where geriatrician expertise is currently unavailable, telemedicine has the capacity to allow remote consultation, which can be supported by a trained health worker locally, using a protocol for comprehensive geriatric assessment. It may be more feasible than relying on recruitment of a local geriatrician but overall geriatrician numbers will continue to limit the availability of expertise.

In chronic disease management, there are many reports of improved efficacy and patient satisfaction when compared with usual care. Geriatricians and other health workers can expect increasing use of telemedicine in this area as an enhancement of existing systems. It seems likely to improve clinical relationships, treatment efficacy and productivity, but further evaluation in the elderly is needed.
A predictable limitation to the introduction of new technology is start-up costs. When new systems can employ existing technology in novel ways, this constraint is less important. Since the PC, Internet and e-mail are available to most health workers in industrialised countries, telemedicine, using these modalities, is likely to be feasible and cost effective.

Key points
- Telemedicine can increase effectiveness and efficiency in geriatric medicine.
- Currently available technology may be all that is required.
- Novel remote clinical roles and relationships may need to be developed.
- Local health workers will continue to be the backbone of any system.
- Evaluation of telemedicine in the care of the frail elderly is required.

Conflicts of Interest
None

References


