**INTRODUTION**

Background Review

Tele is a prefix meaning “at a distance” and it is used in phrase which includes telescope or telemetry. Hence in health care system the prefix tele often takes several meanings. For instance, telemetry which is the process of recording and transmitting readings of instrument which can also be referred to as electronic device related to task remote measuring and reporting of information of interest.

Telemedicine can be traced back to the mid to late 19th century with one of the first published accounts occurring in the early 20th century when electrocardiograph data were transmitted over telephone wires. Telemedicine, in its modern form, started in the 1960s in large part driven by the military and space technology sectors, as well as a few individuals using readily available commercial equipment. Examples of early technological milestones in telemedicine include the use of television to facilitate consultations between specialists at a psychiatric institute and general practitioners at a state mental hospital, and the provision of expert medical advice from a major teaching hospital to an airport medical centre.

Today, quality problem in health care systems still exist and can account for the frustration level of both patients and clinicians, as well as the routine failure of the health care system to deliver its potential benefits. As such, and there exists not just a gap, but a chasm between the health care we have and the care we could have. For this reason, a committee on the quality of health care in America was formed in June 1988, and charged to develop a strategy that would result in a threshold improvement in the quality of health care over the next ten years.

Telemedicine is the process taken by health care professionals to evaluate, diagnose and treat patients at a distance using telecommunication technology. This approach has been through a striking evolution in the last decade and it is becoming an increasingly important part of the American healthcare infrastructure.

**Case Study of the Current System**

Prospective patient with congestive heart failures, chronic disease, weight loss, smoking cessation, missing appointment and patient outcomes after treatment which are major cause of death in our country. This situation seems to be getting out of the system since hospitals are now deploying telemedicine.

In Aniniwah Medical Centre patients will always have to be at the hospital before they could receive treatment from the doctor.

This telemedicine system is whereby intended to solve the current challenges facing Aniniwah Medical Centre and most Hospitals/Health centers in Ghana. Not only will it improve the current situation of Aniniwah Medical Centre but will also trigger other health center to turn to telemedicine thereby enhancing the growth of technology in Ghana.

**Case Study of an Existing System**

A research done by Computerized literature searches were performed using the MEDLINE (1966–April 2000), HEALTHSTAR (1975–January 2000), EMBASE (1988–February 2000) and CINALH (1982–January 2000) databases and the search strategy described in Table 1. In addition, the HSTAT database (Health Services/Technology Assessment Text, US National Library of Medicine), the Database of Abstracts of Reviews of Effectiveness (DARE, NHS Centre for Reviews and Dissemination, United Kingdom), the NHS Economic Evaluation Database and the Cochrane Controlled Trials Register were searched using the search term “telemedicine.” Some articles were also identified by reading reference lists of published review articles and by consulting experts in the field of telemedicine. Inclusion criteria were the following: articles had to consider, in a scientifically valid manner, the outcomes of a form of telemedicine in terms of administrative changes, patient outcomes or economic assessment. In addition, studies were required to include a comparison between a telemedicine application and a conventional alternative. Criteria for scientific validity were that the non-telemedicine alternative was related to the same application and health system as the telemedicine project and that sufficient data were included to permit comparison of the outcomes of the telemedicine and non-telemedicine alternatives.

Articles that were duplicates of the same authors’ other published studies were also excluded; the most representative of the studies was included for further consideration. Initial screening of the articles that were identified was based on their abstracts. All abstracts were read independently by at least 2 of the authors, who recorded their opinions. The selection of the relevant articles was based on the information obtained from those abstracts, which gave some expectation that inclusion criteria would be met, and was agreed upon in consensus meetings among the reviewers. Full-text articles that were obtained for closer inspection were again evaluated independently by 2 of the authors who, in a consensus meeting, made the final decision on whether or not an article should be included in the final review. Abstracts and full-length papers were examined by the same criteria. The strength of the evidence in each of the studies included, other than those concerned only with economic analysis, was judged according to the classification system drawn up by Jovell and Navarro-Rubio,9 in which study design is specified as one of 9 levels in descending order of strength (Table 2). Each level is further qualified by conditions of scientific rigour for the study. Each selected article was described using the strength of evidence according to the 9-level classification, the objectives of the study, approach, setting and subjects, type of economic analysis, and the results and conclusions of the authors. Original descriptions by the authors were mainly used, although in some cases they appeared to be misleading.

Results

The use of this approach enabled us to identify 1124 articles dealing with telemedicine. One hundred and thirty-three full-text articles were obtained for closer inspection. Of these, 50 were to fulfill the inclusion criteria of the review and are listed and briefly described in Tables 3. Fourteen of the studies considered the application of telemedicine to medical consultation of various types, and 7 dealt with patient monitoring or counselling. A further 13 were concerned with teleradiology, and the remainder with emergency department care, psychiatry, dermatology, cardiology, ophthalmology and pathology. Thirty-four of the articles assessed at least some clinical outcomes; the remaining 16 were mainly economic analyses. Some kind of economic analysis was included in 30 (60%) of the studies. In terms of study design, the quality of the clinical studies ranged in most cases from fair to poor.

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| Table 2: Classification of study design |
| 1. Meta-analyses of randomized controlled trials  2. Large-sample randomized controlled trials  3. Small-sample randomized controlled trials  4. Nonrandomized controlled prospective studies  5. Nonrandomized controlled retrospective trials  6. Cohort studies  7. Case–control studies  8. Noncontrolled clinical series, descriptive studies, consensus methods  9. Anecdotes or case reports |

According to the Jovell and Navarro-Rubio classification were randomized controlled trials (RCTs),Conditions of scientific rigour varied considerably. In many papers, procedures for the selection of patients and for the reading and interpretation of clinical findings were not adequately described. The outcome measures used were sometimes vaguely defined or clinically not very relevant. Although RCTs provide the strongest study design, the strength of the evidence obtained will also be dependent on the quality of the study. The 6 papers that were located that described RCTs provide an illustration of the variation in study quality and reported outcomes. Two of the larger RCTs were well described in terms of the randomization and subsequent procedures. The first of these, which considered automated telephone calls and management of diabetes, showed improvement in glycemic control and other benefits through the use of a telemedicine approach. However, no effect on health-related quality of life (HRQOL) was demonstrated. The second, which considered real-time teledermatology, indicated that there was no significant clinical difference from conventional consultations. A linked economic analysis indicated that teledermatology was not cost effective under the conditions of the trial. A further report of a large RCT28 had a more limited description of randomization but showed that telemedicine using a telephone-based system improved compliance with medication and led to a significant decrease in blood pressure. Of the papers about smaller RCTs, that by Brennan and colleagues45 appeared to have been well performed; the authors found that clinical outcomes were similar for telemedicine and for the alternative approach in an emergency department setting. Another paper, which described a pilot project for a larger RCT, indicated time savings for patients as a result of video consultations, but no significant difference in HRQOL between groups. This study appeared to be more limited in quality, with substantial dropping out of patients and possibly insensitive outcome measures. The third small RCT found no significant difference between tele–exercise monitoring and a hospital-based program. The power of the study was low, and further investigations would be needed to assess this application. The nonrandomized clinical studies also varied in their quality, as judged by the descriptions in the articles, and in their outcomes. Some would have provided useful indications to decision-makers in the health systems concerned. For example, the study by Trippi and colleagues showed that 72% of patients scheduled for hospital admission had normal results in dobutamine stress tele-echocardiography and could, therefore, be discharged instead of being admitted to hospital. Giovas and colleagues reported that pre-hospital diagnosis by electrocardiography, using a telemedicine link to the ambulance, took place 25 minutes before hospital diagnosis for a control group.

Table 3: Telemedicine applications to medical consultations

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| Application studied | Effect size or outcome |
| Patient consultations in a general medical clinic | NSD in outcome measures among TV, hands-free telephone, face-to-face consultations |
| Interactive cable TV in pediatric primary care | Cost of consultation via TV two-thirds that of a physician providing direct care |
| Telemedicine in a prison system | 95% of telemedicine consultations saved trips to clinics, at 30% of cost of transportation |
| Telemedicine for HIV-positive prison inmates | Increased access to care, cost savings in transportation and care delivery |
| Clinical decision-making for patients with urolithiasis | Recommendation in 37.5% of initial consultations altered after telemedicine consultation |
| General hospital consultations, electronic referral; video conferencing for outpatient services | Direct outpatient costs of internal medicine 20% lower with electronic referrals. Outpatient visits reduced by 67% |
| Video-conferencing system, medical centre, remote primary site | System saved about US$102 per hour |
| Video consultation, GP referral for hospital consultation17 [RCT] | No difference in patient well-being; time to visit surgery 20% of conventional consultations |
| Consultations for ENT problems, primary care centre and university clinic | Cheapest options were patient travel for < 56 patients per year, teleconsultation for > 56 and < 325 patients per year, visiting specialist at > 325 patients per year |
| Teleoncology for patients in a medically underserved area | Costs per patient US$149, US$897, US$812 for conventional, outreach and telemedicine clinics |
| Web site pro forma to aid management plans in rheumatology clinic | No changes in tests requested in 62% of cases; suggested treatment remained same in 74% |
| Outpatient care via telemedicine | Break-even point 1449 consultations per year |
| Prison telemedicine program | Break-even point 1575 consultations per year |

Other studies indicated important clinical benefits through avoiding the unnecessary transfer of patients. For example, Goh and colleagues reported that the use of teleradiology in the management of neurosurgical patients reduced both numbers of transfers and adverse events during transfer and also increased the number of therapeutic measures before transfer was undertaken.

In most of the studies, effectiveness was defined in clinical terms. Only 2 studies included standardized HRQOL measures. No studies employed quality-adjusted life-year (QALY) calculations. Given the diversity of the studies in terms of design, topics covered, populations and health care settings, calculation of a notional average for effect size was not feasible. Indications of effect sizes for some of the studies are given in Tables 3–6.

Table 4: Telemedicine applications to patient monitoring and counselling Application studied

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| Application studied | Effect size or outcome |
| Home exercise program, telephonic exercise monitoring [RCT] | NSD between groups before or after training |
| Self-monitoring, dietetic education in diabetes management | Dietetic knowledge and some biologic parameters improved. No significant decrease in HbA1c |
| Transtelephonic arrhythmia monitoring | Appeared more effective than ambulatory ECG |
| Electronic information system (telephone), diabetes management | Diabetes-related crisis fell 3-fold. HbA1c fell 1.0%–1.3% |
| Automated telephone patient monitoring, counselling in hypertension management[RCT] | 50% improvement in adherence to medication. Greater decrease in diastolic BP (5.2 v. 0.8 mm Hg) |
| Automated telephone disease management, self-care education in management of diabetes [RCT] | Follow-up HbA1c levels 0.3% lower, better glycemic control, fewer symptoms. No difference in measures of anxiety and HRQOL |

Table 5: Telemedicine applications to radiology

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| Regional neuroradiology department, referring hospitals | Significant change in management in 81% of cases |
| Image transmission in management of neurosurgical emergencies | Significantly reduced interhospital transfer of patients |
| Teleradiologic case conference system for oncologists | Changes in treatment planning and outcomes equivalent to in-person sessions |
| Rural radiology services: teleradiology, examinations at remote and host sites | The teleradiology option did not seem to be cost-saving |
| Teleneuroradiology, district hospital and neurosurgical centre | Images transferred in only 25% of cases; with this usage, cost of avoided patient transfer was high (French Fr 10 800) |
| Teleradiology network for neurologic surgery | Of 100 patients, 33 did not require transportation; savings of US$502 638 |
| Teleradiology in management of neurosurgical patients | Unnecessary transfers reduced (21%), more therapeutic measures before transfer (27% v. 20%), adverse events during transfer reduced (8% v. 32%) |
| Teleradiology in the context of neurosurgical emergencies | 16%–50% of unnecessary patient transfers avoided |
| Comparison of teleradiology with a visiting radiologist service | Break-even point was 1576 patients per year. With an equipment of 4 years rather than 6 years, threshold value was 2320 patients per year. |
| Primary MRI interpretation of examinations generated at distant sites | At 2000 cases per year, cost US$470 per case using teleradiology, US$544 using film and courier |
| Teleradiology system in 3 scenarios | Teleconferencing within the hospital or with an external PC broke even at 1817 and 528 consultations per year |
| Emergency CT service provided to a remote hospital by teleradiology | Cost per examination by teleradiology DM 372, films by taxi for reporting DM 156, patient to nearest central hospital DM 524 by road or DM 4667 by helicopter |
| Conversion of videotape review network to one based on telemedicine | Net monthly savings in nonfixed costs US$7405–US$8585 |

Most of the economic analyses were variants of cost analysis. Cost–benefit analysis was said to have been carried out in 3 studies.However, these were methodologically more like cost-analysis studies, because the benefits were estimated as savings (mainly the cost of travel) compared with the conventional alternative. Demonstrated savings in costs of transportation varied considerably among the different health care situations described in the papers, from a 40% reduction to no savings as a result of telemedicine. Three of 4 studies of the transmission of diagnostic images indicated that telemedicine was costlier than the cheapest alternative. Economic analyses have mostly shown that teleradiology, especially transmission of CT images, can be cost-saving, although one of the studies, which was of good quality, did not find this to be the case. An important contribution to the discussion about the cost-effectiveness of teleradiology is the study by Bergmo,which explicitly provides a measure of the workload that has to be exceeded in order to achieve cost savings by using teleradiology (break-even analysis).

Table 6: Telemedicine applications to other services

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| Application studied | Effect size or outcome |
| Emergency department Dobutamine stress tele-echocardiography (DSTE)44 | 72% of patients scheduled for hospital admission because of cardiac risk factors discharged after normal DSTE results |
| Emergency department telemedicine45 [RCT] | Equal to face-to-face consultations in terms of return visits within 72 hours, additional care |
| ECG transmission from an ambulance | Pre-hospital ECG diagnosis took place 25 minutes before in-hospital diagnosis |
| Psychiatry  Videoconferencing in rural psychiatric services | Break-even point 396 consultations per year |
| Telepsychiatry for remote communities | 40% reduction in patient transfers. Savings A$85 380 in first year, A$112 790 in subsequent years |
| Dermatology |  |
| Store-and-forward teledermatology, in care of nursing home residents | Correct treatment plan seen in 70%, 87% and 90% of the patients given history alone, image alone, and both |
| Real-time teledermatology consultations, low-cost equipment | Management plan the same in 64% of cases, suboptimum in 8%, inappropriate in 9%, unable to recommend in 20% |
| Simple teledermatology system, management of rural patients | Teledermatology increased the number of referrals for specialist evaluation |
| Real-time teledermatology[RCT] | No major differences in clinical outcomes or reattendance rates Net societal cost £132.10 for teledermatology, £48.73 for conventional consultation Cardiology |
| Cardiology |  |
| Transmission of echocardiographic image | 1% cost savings; unnecessary patient transfer avoided in 23% of cases |
| Telemedicine use in NICU | Cost per test US$33 higher with telemedicine; NSS 5.4-day reduction in length of stay |
| Transmission of echocardiograms | Little evidence of reduction in the use of respiratory therapy |
| Pediatric cardiography | NSD in rates of use of additional studies. Missed diagnosis in 10% of cases |
| Ophthalmology |  |
| Teleophthalmology for patients presenting in emergency department | department57 400% reduction in referrals for urgent assessment, 37% reduction in nonurgent referrals |
| Pathology |  |
| Processing of histopathology specimens | Cost of telepathology 15% more than courier, 18% less than on-site pathology at a small centre |

A similar study, also undertaken by Bergmo, has shown that specialist consultations in the field of otorhinolaryngology can be performed in a cost-saving way when the workload exceeds a certain number of patients. Pilot projects in telepsychiatry, the provision of orthopedic and dermatology services via telemedicine and the evaluation of the costs and benefits of a prison telemedicine program used a similar approach. Such studies that give a clear number needed to treat by the telemedicine option are helpful for decision-makers when faced with the question of whether or not to start a new telemedicine service. Teledermatology, with short distances (26 km) between sites, appeared not to be cost-saving in one study. The quality of the economic analysis in the papers was relatively low, with a few exceptions. The papers by Bergmo,Agha and colleagues, Stensland and colleagues, Halvorsen and colleagues and Wootton and colleagues provide examples of better-quality economic studies. The costs included varied significantly among studies, so that comparison of the cost estimates may not be feasible in many cases. There were also several economic studies that did not give detailed information about the empirical background of the costs or benefits, or both, included in the calculations. Teleradiology cost–benefit analysis was excluded because the theoretically good economic model did not make use of the empirical cost and benefit estimations made at specific sites by the study group.

**Conclusion**

Telemedicine offers great opportunity as an alternative method of health service delivery to rural area. There are many examples of successful telemedicine application in a wide range of clinical practice settings, more research is required to prove clinical and cost effectiveness. While considering a new telemedicine application, it is important to consider a range of logistical factor. A common and expensive mistake for telemedicine service developer is to focus entirely on the technology. It is essential that one considers the Signiant organizational changes that are required for telemedicine to be integrated as a mainstream health service. There should always be clear reason for doing telemedicine, such as proven clinical problem where online communication technologies may be helpful for the delivery of health service. Telemedicine service should be subject to robust evaluation to determine the benefits over conventional services for the health service provider, the consumer and for the society as a whole.it is important that new services be piloted on a small scale and gradually developed if proven beneficial. For a successful telemedicine. it is important that all sites involved are well resourced with the appropriate personnel, equipment, telecommunications, technical support and training.