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Telemedicine and Advances in Urban and Rural Healthcare Delivery in Africa

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ABSTRACT

Telecardiology holds great promise for Africa, from tele-echocardiography and tele-ECG s, to home monitoring and text messaging for medication adherence monitoring. The burden of disease is great and there is an extreme shortage of health professionals. Telemedicine can provide access to scarce specialist care, improve the quality of care in rural areas and reduce the need for rural patients to travel to seek medical attention. International cross border service can alleviate the shortage of doctors. But telecardiology, and telemedicine uptake in general, has been poor in Africa. Legal and ethical issues around local and cross border telemedicine have not been resolved. The literature was reviewed and obstacles to telemedicine in Africa and current telemedicine activities in Africa, are described. There are few sustained telemedicine services in Africa with the exception of tele-education. There is an expectation that mobile phones will facilitate a range of telemedicine activities in Africa. Africa needs telemedicine.

Why the belief that telemedicine will benefit the world? The problems facing the developed world of ageing populations, a shift from infectious to chronic disease and the ever rising cost of health care are different to those of the developing world, but both can be partially addressed through judicious use of telemedicine. In the developing world the problems are access to care and more specifically specialist care. Poverty is rife. As a result tax bases are low and Governments have less to spend on healthcare and the provision of information and communication technology (ICT) infrastructure for eHealth solutions such as telemedicine. Poverty is also linked to disease and the burden of disease is great.

The World Health Report of 2006 summarised the problem, "Africa has 24% of the [World's] burden [of disease] but only 3% of health workers commanding less than 1% of world health expenditure."[1] The problem is exacerbated by the fact that the median age in sub-Saharan Africa is 18 years,[2] and 43% of people in the African region of the WHO live on less than US$1 per day (purchasing power parity).[3] Population growth is outstripping the production of doctors, with the population of Africa forecast to more than double in the next 40 years.[2] With 60% of Africa's people living in rural areas[4] telemedicine is seen as a means of improving the quality of rural healthcare, increasing access to scarce specialists, reducing transportation of patients to doctors, supporting rural doctors, overcoming the shortage of doctors, delivering education and facilitating research. But is this achievable in Africa?

Telemedicine is defined by the American Telemedicine AssociationTelemedicine as "the use of medical information exchanged from one site to another via electronic communications for the health and education of the patient or

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Abbreviation and Acronym
ICT = information and communication technology

healthcare provider and for the purpose of patient care".[5] It is a subset of eHealth, which is "the use of ICT for health."[6] eHealth encompasses clinical services, hospital information systems, electronic medical records, education in the health sector, research, and surveillance or data acquisition as in district health information systems. mHealth or mobile health is the focus of much current attention as the mobile telephone market continues to grow and eHealth activities make use of its widespread availability and coverage.

Telemedicine is divided into two broad categories, asynchronous or store and forward telemedicine and synchronous or real-time telemedicine. In store and forward telemedicine, data are gathered and sent electronically to another health professional for diagnosis or a second opinion at a later date. An example is attaching photographs of an ECG or a skin lesion to an email containing the patient's relevant history and clinical findings and sending an encrypted email to a colleague, or uploading the information to a secure Web site. Synchronous telemedicine is live and interactive and is usually undertaken by videoconference with the audio and visual consultation augmented by distant examination using peripheral devices such as electronic stethoscopes, videootoscopes etc. Home monitoring is a growing area of telemedicine with data acquisition, storage and interpretation occurring synchronously or asynchronously from remote devices, smart clothes that acquire and transmit physiological data and smart homes that monitor people's activity. Nano-telemedicine is still to come.

The promise of eHealth and telemedicine was clearly enunciated in resolution WHA 58.28 of the 2005 World Health Assembly which called on member nations to among other things, develop long term strategic plans for developing eHealth services, provide appropriate legal, regulatory and standards environments, develop the necessary infrastructure and establish national centres and networks of excellence.[7] The WHO Global Observatory for eHealth went a step further in 2006 and suggested that "eHealth for all by 2015" be added to the Millennium Development Goals.[8]

Why is telemedicine uptake in Africa low?

While much has been written about the potential benefits of telemedicine in Africa, uptake has been limited. There are many obstacles not least of which are the shortage of doctors and the unfortunate reality that most telemedicine activities add extra steps into the routine clinical workflow, adding burden to already overworked doctors and nurses.

Telemedicine requires information and communication infrastructure, the ability to use that infrastructure, a relatively stable supply of electricity and people to maintain and support the infrastructure. Currently only 6.7% of households in Africa have Internet access at home, 16.3% of people use the Internet, and fixed broadband penetration is 0.3%.[9] Internet penetration in Africa is half that of Asia and the Pacific and is the lowest of any developing world region. Web based solutions for patient centric healthcare, a developed World goal, are currently largely irrelevant. In poor communities, people are mostly computer illiterate and few of the over 2000 African languages are available on the Web. Mobile phone penetration is reported to be 64%,[9] a figure which is skewed because penetration is calculated on the number of subscriptions, that is the number of SIM cards in circulation and not the number of people using mobile phones. Telecommunication costs in Africa, when expressed as a percentage of per capita, monthly, gross national product are very high and 14 of the 20 most expensive countries are in Africa.[10]

Africa's telecommunication infrastructure is poor, in part due the continent's long history of civil unrest and war which set economies and infrastructure back by up to seven years for each year of unrest.[11] In rural areas, where telemedicine is needed the most by the poorest of the poor, it is least likely to be provided because of inadequate infrastructure and high connectivity costs. In addition there is limited awareness of telemedicine by healthcare workers and the patient community, and lack of government will.

It is within this setting that the use of telemedicine in Africa must be considered.

Legal, regulatory and ethical concerns

Offering patient care over distance and possibly from another country raises issues such as liability, licensure, jurisdiction, quality and continuity of care, confidentiality, data security, consent, authentication and remuneration. Current practice in many services is that the referring doctor remains responsible for the patient. The doctor consulted offers second opinion advice which the referring doctor can either accept or reject. Liability and jurisdiction reside therefore with the referring doctor and in the country of the referring doctor and patient in the case of cross border practice. Cross border practice raises the matter of licensure. Does the physician providing a telemedicine consultation from another country have to be licensed to practice in the country of the patient and referring doctor? Malaysian Law requires registration of the international consultant in Malaysia, under penalty of fine and or imprisonment.[12] Such regulations are clearly an impediment to cross border, international telemedicine. Developments in the United States to facilitate telemedicine across state lines may provide a future model, as will European Union Directives enabling cross border telemedicine in the member states. Pragmatic solutions are required if Africa is to truly benefit from telemedicine.

Quality of care can be addressed by the development of discipline specific guidelines for the practice of telemedicine covering clinical, operational, technical and legal and ethical issues.[13] This has been done for tele-psychiatry in South Africa and serves as a model for other disciplines.[14]

Regulators see telemedicine as something new, requiring regulation to protect patients and doctors, but may lack insight.[15] The Health Professions Council of South Africa has been working on draft "Guidelines for the Practice of

Telemedicine" for over seven years. Their definition of telemedicine omits the key words, information, communication, and technology and is too broad. As a result their proposed requirement for written informed consent for all aspects of a telemedicine encounter, with a copy to be kept by both parties would cover a patient taking a prescription from his or her GP to a pharmacy. What of a patient phoning his or her doctor for advice?[16] Who will check that the patient keeps a written record and how will the doctor get written informed consent? They also require a prior doctor patient relationship for a telemedicine consultation, except in an emergency. While well intentioned these requirements are impractical in many instances and defeat the aim of improving access to quality care for those in rural areas and communities.

In South Africa the Health Professions Council of South Africa has recently stopped a nurse to doctor telephone based telemedicine service, and at the same time condemned aspects of telemedicine as unethical.[17] Apart from a prior doctor patient relationship, a "hands on" physical examination is required, which cannot be performed in a telemedicine consultation.[18] This is an example of the teething problems that telemedicine practitioners face in countries where there is a lack of understanding of telemedicine and perhaps a fear that those who do not adopt telemedicine will lose patients to those who do. Again, pragmatic solutions are required.

History

Telemedicine is not new and certainly not new to cardiology. The telegraph was used to give advice on the management of the wounded following an attack on the Barrow Creek Telegraph Station in Australia in1874.[19] The first documented telephonic consultation was in 1879, just three years after its invention.[20] Einthoven transmitted electrocardiographs by telephone in 1905,[21] and cardiac tele-auscultation via telephone lines was performed in 1910.[20] The first clinical tele-ECG service was established in Lwow in the Ukraine in 1935.[22] Radio has been widely used to provide medical services to ships at sea and to people on remote islands since 1920. Teleradiology was achieved in 1948 and by the 1950's closed circuit television was being used for education and group therapy in the psychiatric service in Nebraska.[23]

In Africa, the first reported use of modern telemedicine was in 1984, when a diagnosis of Crouzon's syndrome was made via a satellite link using slowscan television transmission between Swaziland and London.[24] There is little doubt that radio was used prior to this to provide medical advice in Africa as was the telephone. By 1987, clinical case conferencing was taking place by satellite audio-conferencing between Canada, Kenya and Uganda[25,26] with EEGs transmitted from Mulago Hospital in Uganda to the Health Science Centre at St. John's Canada. Satellite based store and forward telemedicine was used by the US Army in Ethiopia in 1993.[27]

Telemedicine initiatives in Africa are often announced in a fanfare of press and Web releases, but few survive beyond the pilot phase to become integrated into routine clinical practice and published data on their use are sparse. A search of the electronic database SCOPUS on the terms (telemedicine OR telehealth OR tele-health OR ehealth OR e-health OR mhealth OR m-health), returned 22,947 papers. Limiting the search to (Africa OR sub-saharan africa OR southern Africa OR north Africa OR west Africa OR central Africa OR east Africa) returned only 250 papers, approximately 1% of the total. Similar searches were undertaken of Pubmed using the appropriate MESH search terms which returned 19,569 and 218 papers respectively. After removal of duplicates, the abstracts of 330 papers were reviewed and 228 were found to be relevant to telemedicine and tele-education in heath in Africa. Further papers were retrieved from references and grey literature.

The potential of telemedicine in Africa was reported in 21 papers, with 24 papers discussing the barriers to its implementation and adoption and 21 papers reporting on feasibility studies.

Of actual services, education is the most cited, with 39 papers. Scott et al. have recently reported that there is eHealth activity in all African countries bar South Sudan.[28] On a country basis, 63 papers were from South Africa; Kenya (13), Uganda (8), Botswana (7), Ghana (6) and Ethiopia (6) were the only other countries with more than 5 papers reporting primary telemedicine activity in the respective countries. Many of the papers reported on the same projects.

When reviewing telemedicine, use and growth of a service are important metrics. Use and growth have been reported as the number of patient consultations, or an increase in teleconsultations over time, or growth in the number of sites referring patients to the service.[29] A new metric, telemedicine consultations per referring site, per week, gives a simple figure for comparison of services. In a review of telemedicine services internationally, excluding teleradiology and diabetic retinopathy screening programmes, 61% of services referred one case or fewer per site per week and 71% two cases or less per site, per week.[30]

Telemedicine in Africa

The experiences reported in the failed implementation of the first Ethiopian telemedicine project and the reasons for the failure of the National Telemedicine Project in South Africa are similar and enlightening.[31–33] These include lack of a change management plan, no business model, limited buy-in from practitioners, high staff turnover, limited eReadiness, problems with connectivity and transmission of large files, inappropriate software and devolution of project management to health authorities which had not budgeted for ongoing telemedicine services and their management. The approach of "if you put it in place they will use it" highlights the lack of understanding of the human, management and cultural factors that need to be resolved for successful change management and technology adoption.

Cardiology

Telecardiology covers a spectrum of activities, including remote monitoring of implantable cardiovascular devices,

continuous home monitoring of patients with heart failure, transmission of ECGs by telephone, tele-echocardiography, tele-auscultation, medication compliance monitoring, and patient education and support.[34,35] Meta-analysis of remote patient monitoring in congestive heart failure showed reductions in hospital admissions and the risk of death,[36] but two large, subsequent studies, Telemonitoring to Improve Heart Failure Outcomes and Duration of Hospitalization[37] and the Telemedical Interventional Monitoring study have failed to demonstrate significant changes in mortality and rehospitalisation rate.[38] The transmission of tele-ECGs is common and a service in the State of Minas Gerais in Brazil has reported over 1 million consultations.[39]

There is little published on telecardiology in Africa. The Dream Project (Drug Resource Enhancement against Aids and Malnutrition) has established six telecardiology centres in Tanzania, Malawi and Mozambique and provides telecardiology training and remote reporting of ECGs from Italy.[40] Remote reporting of ECGs from four district hospitals has been reported in Mali.[41]

The prevalence of heart diseases in children and young adults in Africa is high,[42] and African countries would benefit from tele-echocardiography services. This requires a minimum bandwidth of 384 kbps for real-time diagnostic quality images, still relatively high bandwidth by African standards, especially in rural areas. Paediatric tele-echocardiography is routinely used in Canada[43] and Sable and colleagues reported a 10 year experience of over 6000 tele-echocardiograms in their service in Washington DC by 2008.[44] Tele-echocardiography may be unidirectional with the images being transmitted live with consultation by simultaneous telephone call, bidirectional using videoconferencing or asynchronous review of previously stored studies. The Children's National Medical Center in Washington holds weekly videoconference case review meetings with colleagues in Morocco and Uganda, with patient data and echocardiograms reviewed in real time.[45]

There are devices such as electronic stethoscopes, ultrasound probes, pulse-oximeters and ECG equipment, which can be attached to mobile phones and used in an examination at a distance. There are also many mobile phone "apps" for cardiology. Mobile phones and short messaging services have been used in Africa to improve patient compliance with drug regimens for HIV/AIDS through text message reminders[46,47] and monitor medication compliance in tuberculosis using a smart pill box.[48] There are no reports of their use for improving medication adherence for treatment of cardiac and cardiovascular conditions.

There are also no reports of remote cardiac monitoring in Africa or home monitoring. There is great potential for simple self or home monitoring for cardiac failure or hypertension in Africa, but as fewer than 2% of homes have fixed telephone lines and few have Internet access, simple low cost mobile phone based solutions are required. To benefit the average person in Africa, such services would need to be cheap enough to use, implying the need for subsidy by Government, mobile phone service providers or Universal Services Funds which derive their funding from the profits of mobile phone service providers. While simple in theory, such services are currently out of the reach of many, and if in place have not been reported.

Home or self monitoring has not yet been seen as a priority in Africa as donors and funding agencies tackle HIV/AIDS, tuberculosis and malaria. However, the growing number of projects involving community health workers using mobile phone solutions may lead to an African variant of patient centric healthcare through telemedicine in which an intermediary monitors the asymptomatic patient, rather than the patient taking that responsibility and bearing the cost.

Radiology

Teleradiology is an integral part of modern radiology. Digital images are moved electronically for reporting within radiology information systems, with digital images stored in electronic picture archiving systems. It is the norm in the developed world and in private radiology practices in the more affluent African countries. Teleradiology is potentially one of the simplest telemedicine solutions to implement in Africa. This has not occurred for several reasons. Few rural hospitals have digital radiographic equipment, requiring X-Ray films to be scanned or photographed for transmission.[49,50] Image file sizes are large and transmission time can be long. There are some countries with no radiologists and in many countries radiologists are only available in the capital or major cities. There is not the human capacity to manage the potential workload.

Teleradiology was established between two hospitals in Mozambique in 1998, but this was short-lived. There have been several teleradiology initiatives involving scanned or photographed X-Ray images sent to academic centres via dedicated connections or the Internet and linking CT scanners to academic centres in South Africa.[49–51] This has been of particular benefit in neurosurgery.[51–53] The French Military has also sent computed tomographic scans from Africa to France to assist in determining the need for evacuation or deployment of a mobile neurosurgical team.[54] Mali has had a teleradiology service since 2005, with scanned images sent by satellite from district hospitals to the capital. Over the first five years, 2500 cases were sent from three participating sites which equate to three cases per site, per week.[55] A Web based store and forward programme between a district hospital in Malawi and the USA reported 159 cases in the first year, again approximately three cases per site per week.[56]

Pathology

Pathology lends itself to store and forward telemedicine with the provisos that staining techniques are standardised or reference colours are given to allow calibration of monitors for the reader, photographs are taken of the correct areas of the slides, at appropriate magnification, and adequate clinical history is provided.[57,58] Image acquisition in telepathology can be as simple as taking a photograph through the eyepiece of a microscope with a mobile phone and sending the image by multimedia messaging service[59] to expensive automated or robotically controlled full slide scanning which requires large bandwidth and storage capacity.[57]

iPath, a Web based store and forward telepathology system has been widely used in Africa[33,60–63] and for a variety of services other than pathology.[33,64] In Egypt a store and forward telepathology service linking a hospital in Cairo to hospitals in Italy, England and the USA has advanced to dynamic whole slide imaging, virtual microscopy[65,66] which has also been trialled between Uganda and Germany.[57] A surgical telepathology service was established via satellite link between a hospital in Zambia and Italy in 2007, and is reported to have raised the standard of care. Fixation and staining were unsatisfactory in 15%–20% of slides, start up costs were high and the satellite link slow, unreliable and expensive.[67] Telecytology has been tested in Kenya.[68]

Dermatology

Teledermatology in Africa began in the late 1990s, with a store and forward service between Tanzania and Switzerland accessing the Internet via a telephone modem and satellite connection. Doctors discussed the images, patient history, and presentation via a separate telephone connection. This mixed mode approach although dated in terms of technology will become common as smart phones are used to capture and transmit images and afford the opportunity to discuss the case and images over the phone.[69,70]

Free store and forward services have been in place since 1999. The iPath platform has been used[64] and more recently The Africa Teledermatology Project has set up a Web based service with educational material available on its site.[71,72] Two reports of its use in seven and later 17 countries showed an average use of approximately 1 case sent per country per month.[71–73] Low use of humanitarian telemedicine services such as the Swinfen Charitable Trust by doctors in Africa has been documented and possible explanations for this, provided.[74,75]

Only seven African countries have dermatopathologists. Store and forward services were established between four hospitals in Kenya and Tanzania, and the USA using iPath.[76] Use was low with only three cases per site per year. The African Teledermatology project offered dermatopathology services and described the problems associated with sending glass slides to other countries, which led to the provision of a robotic telepathology service in Botswana.[58,77,78]

A store and forward service between Burkina-Faso and France noted the knowledge transfer benefit to the referring doctor with agreement in diagnosis between referring doctor and consultant improving significantly over time.[79] Colven quantified the improvement in diagnostic concordance over time in a store and forward service in South Africa[80] which also provided associated educational material and found that concordance between referring practitioner and consultant dermatologist improved significantly after referring as few as 9 cases by telemedicine.[81]

Teledermatology using mobile phones[73] has been investigated[78,82] and a pilot study reported from Uganda.[83] In South Africa, a real-time videoconference based service has been running since 2003 and has saved approximately 75% of patients a transfer to an academic hospital.[32,84]

Obstetrics

Tele-ultrasonography has been reported from Togo[85] and South Africa.[32,51] Store and forward digital cervicography has been used for screening for cervical cancer in Zambia[86] and mobile phones have been used to photograph and send images to a physician for distant interpretation or for supervision of inexperienced healthcare staff.[87] In a pilot project in Ghana, traditional birth attendants with low levels of literacy have been trained to gather data about postpartum haemorrhage in their communities using simple mobile phones and text messaging.[88]

Psychiatry

Real-time telepsychiatry is well established in the developed world. The need for expensive videoconferencing equipment, adequate bandwidth and the ability to converse in the patient's language has limited its uptake in Africa. A pilot project has been reported of telepsychiatry from Somaliland to Somali Diaspora groups in Europe using Skype.[89] While there are concerns over data security and privacy when using Voice Over Internet Protocols like Skype®, simple solutions like this are needed. In South Africa a number of studies have led to a videoconference based service, with the development of clinical, operational and technical guidelines and an administrative model for telepsychiatry. [14,90–93] The need for forensic telepsychiatry to reduce the time that prisoners spend in jail awaiting assessment of adjudicative competence in Africa has also been highlighted and pilot projects are underway.[94]

Ophthalmology

Moorfields Eye Hospital ran a tele-ophthalmology service between England and up to three sites in South Africa by videoconference. Images obtained from a slit lamp were used for case discussion. The service was shown to facilitate knowledge transfer.[95,96] A Web based service was also established and was used in Ghana, South Africa and The Gambia.[97] A store and forward service has been reported from South Africa with photographs of the surface of the eye, the anterior chamber and lens taken by holding a digital camera to the eyepiece of a slit lamp and sending the photographs to an ophthalmologist by email. When appropriate, photographs of eye-test charts and computed tomographic scans were also attached. This reduced patient transfer by 80%.[32] Within the private sector in South Africa ophthalmologists seek advice from colleagues using images taken with retinal cameras and sent by email. A tele-diabetic retinopathy screening service has been reported in the Cameroon[98] and the potential use of mobile phones to photograph and transmit images of trachoma has been reported.[68,99]

Other examples of telemedicine

In Djiboutie, where there are no paediatric orthopaedic surgeons a store and forward, email based service has

assisted in diagnosis and altered case management.[100] Ongoing postoperative rehabilitation following hand surgery has been provided from England to a patient in Africa using Skype for videoconferencing, with improvement of range of movement.[101] In a feasibility study, audiological assessment of patients was successfully undertaken between the US and South Africa,[102] and the possibility of store and forward video-otoscopy reported.[103]

Mobile technology such as personal digital assistants or mobile phones has been used in many countries. Text message reminders sent to patients have improved appointment adherence in Malawi,[104] and follow-up in Nigeria[105] and the Cameroons.[106] Text messaging for treatment adherence with or without the use of smart pill boxes has been reported in Mozambique,[47] Malawi,[104] Uganda,[107] and South Africa.[48]

Clinical services using mobile phones include cervical cancer screening,[87] teledermatology in Egypt,[73] Botswana,[82] and Uganda,[83] assessing trachoma in Niger,[99] obstetrics in Ghana,[88] and telemedicine in Cameroon[108] and Malawi.[104]

In HIV/AIDS it has been used to promote HIV testing in Uganda[109] and South Africa,[110] provide HIV information and care in Uganda,[109,111,112] and HIV data gathering in SouthAfrica.[113]

Behaviour change communication through mobile phones has been used in several different projects in the Democratic Republic of the Congo, Ghana, Kenya, Nigeria, South Africa, Uganda and Tanzania.[114,115] It has also been used for family planning in Malawi,[111] and medication adherence programmes[46,48] and education in Botswana[116] and Kenya.[117]

There are two reports from South Africa of resistance by health workers to using mobile technology. Nurses would not use a mobile point of care eHealth solution to record stock used for patients in a large private hospital.[118] Community healthcare workers given mobile phones to report on patients on treatment for drug resistant tuberculosis completed fewer than a third of reports.[119]

Tele-education

Tele-education is by far the most successful use of ICT in health in Africa. This is consistent with reports from Canada, Australia and the US where tele-education reduces the sense of isolation experienced by rural doctors.[120–122] Tele-education in Africa has by the very nature of the poor infrastructure in rural areas been directed mostly to urban areas and academic centres. It is often forgotten that when there is a shortage of doctors, there is also a shortage of doctors to teach doctors. Tele-education is an attractive solution.

The first reports of teaching were from Canada to Kenya and Uganda in 1986 using satellite based audio teleconferencing.[25,26] There are several educational initiatives with over 10 years' experience. RAFT, Réseau en Afrique Francophone pour la Télémédecine, started in 2000 between the Geneva and Mali. Seventeen, mainly Francophone countries, participate in weekly webcasts using software designed to allow participation at very low bandwidth. Over 80% of the teaching sessions are from African centres to other African centres. The teaching sessions are recorded and are available on demand.[55,123–125]

The Institute of Tropical Medicine in Antwerp has used a hybrid email Web support system with a discussion forum, with the provision of interactive quizzes and policy documents for continuing education in HIV.[126] Mobile phones have been used for HIV education using 3D learning scenarios on smart phones supported by a discussion forum with HIV specialists.[127]

The University of KwaZulu-Natal has been providing continuing medical education by videoconferencing since 2001 with over 40 h of interactive sessions broadcast per week by 2010. The model was based initially on sharing broadcasts of existing postgraduate seminars. This has expanded into the provision of academic programmes in telemedicine and medical informatics to students in nine African countries, all of whom take the interactive courses from their home country with additional learning materials supplied through a learning management system.[32,128–130] The programme has also extended education to district hospitals and medical schools in other African countries through the provision of DVDs with recorded teaching sessions.[93,131,132]

Medical Missions for Children offer daily seminars on a range of medical broadcast three times a day via satellite and the Internet with access to its Global Video Library of Medicine.[133] Voice over Internet using commercial educational software has been used for interactive case based HIV training between the US and five Africa countries in Project Hope.[134]

Audio only teleconferencing, supplemented with projected slides has been used for cytology training in seven countries in the Africa Calla project.[135] Within a large multinational company teleconferencing has been used to mentor company health workers in five African countries on HIV management.[136]

Missing from the results of the database searches were papers on the Pan African eNetwork and the African Medical and Research Foundation. The Pan African eNetwork is an African Union and Indian Government initiative which provides satellite and undersea cable connectivity between India and 47 African countries. One telemedicine and one tele-education site in each of the participating African countries is linked to 12 Indian and 5 African super-specialty hospitals providing telemedicine consultation services and continuing medical education.[137] The African Medical and Research Foundation uses a virtual training school to reskill nurses in East and Central Africa.[138]

Conclusion

Telemedicine has the potential to help address the shortage of health professionals in Africa and improve the lot of rural patients. There are as yet few sustained clinical services and fewer that have benefited the rural poor. International services have tended to support urban, usually academic centres. This at least raises awareness and understanding of telemedicine in these centres and may lead to local services.

Tele-education has been well received and is well established in several large programmes. Its benefits to clinical practice are difficult to quantify. The mobile phone will facilitate telemedicine in some disciplines and is already doing so. Pragmatic solutions are required to regulatory and ethical issues. Africa needs telemedicine.

Statement of Conflict of Interest

There are no conflicts of interest.

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