Are the Obstacles too great for telemedicine in sub-Saharan Africa?

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Abstract

The purpose of this paper is to identify and report the issues facing telemedicine uptake and use in Sub-Saharan Africa. Sub-Saharan Africa has a great burden of disease and an extreme shortage of health workers. Telemedicine has the potential to address some of these problems but telemedicine uptake in Africa has been low. A number of factors have been identified that impede the use of telemedicine in sub-Saharan Africa. These include poverty, shortage of human resources, very limited existing infrastructure, lack of connectivity, high connectivity costs, lack of capacity development and policy issues. Examples of successful use of telemedicine in Africa are given. Innovative solutions are required to overcome the infrastructural and human resource barriers, reduce costs and develop policy and legislation, both national and international, that is enabling of the practice of low cost international telemedicine, for sub-Saharan Africa to move towards widespread telemedicine uptake.

Key words: *Telemedicine; Health Services Accessibility; Technological Development; Communication Barriers; Sub-Saharan Africa.*

Resumen

¿Son los obstáculos para la Telemedicina en África SubSahariana demasiado grandes?

El objetivo de este trabajo es identificar y relatar los problemas enfrentados a la hora de implantar y utilizar la telemedicina en el África Subsahariana. El África Subsahariana tiene una gran carga de enfermedad y una gran escasez de profesionales sanitarios. La telemedicina tiene el potencial de tratar de algunos de estos problemas pero la asimilación de la telemedicina ha sido lenta en África. Se han identificado varios factores que impiden el uso de la telemedicina en África Subsahariana, incluyendo la pobreza, escasez de recursos humanos, infraestructura actual muy restringida, falta de conectividad, altos costes de conectividad, falta de desarrollo de capacidades y políticas adecuadas. Se muestran ejemplos de utilización exitosa de la telemedicina en África. Es necesario usar soluciones innovadoras para superar las barreras impuestas por la falta de infraestructura y recursos humanos, reduciendo costes y desarrollando políticas y leyes adecuadas, tanto a nivel nacional como internacional, que permitan que la práctica de la telemedicina internacional de bajo coste para África Subsahariana crezca ampliando la penetración de la telemedicina.

Palabras clave: *Telemedicina; Accesibilidad a los Servicios de Salud; Desarrollo Tecnológico; Barreras de Comunicación; África Subsahariana.*

Resumo

São os obstáculos para a Telemedicina na África Subssaarina muito grandes?

O objetivo deste trabalho é identificar e reportar os problemas enfrentados na implementação e assimilação da telemedicina na África Subssariana. A África Subssariana sofre com uma grande carga de doença e uma grande escassez de profissionais da saúde. A telemedicina tem o potencial de lidar com alguns destes problemas, porém a incorporação da telemedicina na África tem sido lenta. Foram identificados muitos fatores que impedem o uso da telemedicina na África Subssariana, incluindo a pobreza, escassez de recursos humanos, infra-estrutura atual muito limitada, falta de conectividade, altos custos de conectividade, falta de desenvolvimento de capacidades e falta de políticas adequadas. São mostrados exemplos bem sucedidos do uso da telemedicina na África. São necessárias soluções inovadoras para superar as barreiras de infraestrutura e recursos humanos, reduzindo custos e desenvolvendo políticas e leis tanto em nível nacional quanto internacional, que permitam a prática da telemedicina internacional de baixo custo para que o uso da telemedicina na África Subssariana possa crescer e se ampliar.

Palavras-chave: *Telemedicina; Acesso aos Serviços de Saúde; Desenvolvimento Tecnológico; Barreiras de Comunicação; África Subsariana.*

Sub-Saharan Africa is made up of 42 countries and six island nations, extending as far east as Mauritius in the Indian Ocean. All sub-Saharan African countries are categorized as developing nations and many countries are among the least developed nations, with their people forming part of the "bottom billion" people of the world who are least likely to emerge from poverty.[1] While the developed world is grappling with the problem of increasing healthcare costs and keeping ageing populations out of hospitals, sub-Saharan Africa faces a disproportionately high burden of disease, growing populations, poverty, and shortages of healthcare workers. Africa has almost a quarter of the world's burden of disease serviced by 3% of the world's health workers who have access to less than 1% of world health expenditure.[2] e-Health is seen as a possible way of addressing some of these problems and the World Health Assembly of 2005 called on member nations to develop long term ehealth strategic plans, provide necessary telecommunications infrastructure for e-Health and establish national centres of excellence.[3] The World Health Organization (WHO) Global Observatory for eHealth report of 2006 went further, suggesting that, "*It may be time to put forth the concept of 'e-Health for all by 2015' as an addendum to the Millennium Development Goals.*" It also noted the need for an international knowledge exchange network to share practical experiences on the application and impact of ehealth initiatives, the use of e-learning programmes and the inclusion of e-Health courses within university curricula.[4,5]

While the World Health Report identifies the problems of disease burden, the health workforce and budget in Africa, it does not mention technological and other obstacles to the implementation and uptake of e-Health solutions in Africa or the effect of population growth. These need to be examined in more detail to better understand the potential use of eHealth and the obstacles to its sustainable use.

POVERTY

All of sub-Saharan Africa's countries are poor. The percentage of national budget that governments spend on health is relatively low and the resultant budgets are very small. The median government budget for health is US$ 14.00 per capita per annum which when corrected for purchasing power parity equates to US$ 32.00 per capita per annum.[6] What is available for e-Health? A working figure is that Governments spend about 2 – 2.5% of their budgets on Information and Communication Technologies (ICT). Based on the median spend in sub-Saharan Africa this is US$ 0.28 – US$ 0.35 per capita per annum, which after taking purchasing parity into account is US$ 0.64 – US$ 0.80 per capita per annum. What can be done with a budget at this level? Clearly expectations of what eHealth can offer have to be tempered by the reality of the available budget, careful reflection on the opportunity cost of using this money for e-Health and the recurring costs of ownership.

POPULATION GROWTH

Developed countries face stagnant or negative population growth. Africa continues to grow rapidly. The United Nations Population Division forecasts the population of Africa to increase by over a billion people by 2050.[7] Who is going to treat this growing and by inference, young population? Is there capacity to offer adequate care to mothers and their children while at the same time addressing infectious diseases and managing trauma?

HUMAN RESOURCE ISSUES

The shortage of health professionals is already dire: 28 countries have ten or fewer doctors per 100.000 people and 35 countries have fewer than 20 doctors per 100.000 people. For comparison, in Germany, the USA, the United Kingdom, there are 300, 260, 230 doctors per 100.000 people respectively while in Argentina, Venezuela, Brazil, Peru and Chile there are 340, 190, 120, 120 and 110 doctors per 100.000 people respectively.[6]

It is often forgotten that when there is a shortage of doctors there is also a shortage of doctors to teach doctors. It is not uncommon for medical schools to have no specialists in some disciplines, likewise some countries have no specialists in certain fields. Who then teaches these specialties at undergraduate and specialist trainee level? The effect of this shortage is that in some countries maternal mortality and infant mortality rates have increased as stretched health services are unable to cope. Some solution has to be found to build the capacity to develop capacity in sub-Saharan Africa.

TELEMEDICINE AS A SOLUTION?

Telemedicine offers an obvious solution to some of the clinical problems associated with a shortage of doctors.

There are very few sustained telemedicine services that have been integrated into routine service in sub-Saharan Africa. Several free international humanitarian store and forward telemedicine services exist and are available to doctors in sub-Saharan Africa but they are not being used. An example is the Swinfen Charitable Trust which offers free store and forward telemedicine services to 153 hospitals and clinics in 50 countries around the world. Hospitals and clinics in 13 African countries have used the service. Data from 2007 show that only seven of 206 cases referred that year were from six African countries and of the six doctors who referred cases, only one was a local national.[8] Why is use of a free service low? Possible reasons for this are: cost, lack of infrastructure or access to infrastructure, ignorance, workload, lack of training, issues of remuneration and legislative and policy barriers.[9]

WORKLOAD

Workload is seldom mentioned as a barrier to the implementation of telemedicine but it is when there is shortage of doctors. Telemedicine adds steps to the normal workflow of both the doctors and nurses at the send and receive sites.

CONNECTIVITY

Connectivity is a pre-requisite for telemedicine. Africa missed the benefits of the dot.com boom when widespread deployment of cable occurred in the developed world. It not only missed the dot.com boom, it missed the plain old telephone generation.[10] Most Internet service providers use fixed phone lines for Internet delivery. It is not surprising therefore that Internet penetration in sub-Saharan Africa is low, in the region of 4.5% compared to South Americas 20%, Europe 52% and North America 74%.[11]

In the developed world, fixed broadband is replacing dial-up access. Broadband connectivity is essential for synchronous telemedicine services. It has been identified as a prerequisite for e-Health services in Europe[12] and the United States is finalising a national broadband policy. Fixed broadband penetration in Africa is less than 0.1%. Mobile telephone broadband access is in the region of 0.9% but its use is limited by the high cost of mobile phone access.[10] Lack of broadband remains an obstacle to synchronous telemedicine in Africa. In part this is due to the low fixed telephone line penetration which limits the use of Asymmetric Digital Subscriber Lines (ADSL).

Per capita bandwidth is very low. In 2008, Africa had 12 Gbps of international bandwidth which is less than a third of that of India. New undersea fibre optic cables coming on line on the East coast of Africa and new cables planned for the West coast offer promise and are expected to increase bandwidth and reduce costs. Currently there is a large disparity in bandwidth per capita in sub-Saharan Africa with landlocked countries still dependent on expensive satellite access.[10]

COMMUNICATION COSTS

The International Telecommunications Union (ITU) has developed an ICT Price Basket and ranks 161 countries on the basis of a set of standardized fixed phone line telephony, mobile cellular and broadband services and describes these in terms of relative cost, expressed as a percentage of the average monthly Gross National Income (GNI) per capita. Nineteen of the most expensive services are in sub-Saharan African countries. Some examples of costs of sub-Saharan African and developed nations are shown in Table 1.

Table 1 - The cost of a basket of telephone, mobile cellular and fixed broadband services expressed as a percentage of monthly GNI per capita. (Derived from ITU)[13]

Country	Rank	Telephone	Mobile Cellular	Fixed Broadband
Niger	161	47.0%	55.7%	966.7%
Nigeria	141	5.9	10.7	108.6
Angola	120	5.8	3.8	54.7
Brazil	87	5.9	7.5	9.6
Argentina	66	0.9	2.5	7.6
Canada	11	0.5	0.5	0.7
Luxembourg	5	0.4	0.2	0.6
China	1	0.3	0.1	0.3

Broadband costs vary greatly. In the Central African Republic, Ethiopia and Malawi the monthly cost of the ITU bundle for fixed broadband services, is 39, 21 and 20 times the average per capita GNI per month respectively. Broadband access exceeds the monthly GNI in 22 African countries.[13] This is due in part to poor fixed phone line penetration and the resultant need to use fixed leased lines like Wireless Digital Subscriber Line (WDSL) and Symmetric Digital Sub-

scriber Line (SDSL) for broadband access rather than ADSL through a fixed phone line. Although costs continue to fall, they remain too high. This is a barrier to further uptake ICTs in sub-Saharan Africa and may further increase the digital divide. Broadband connectivity costs are therefore a major obstacle to eHealth, especially synchronous telemedicine.

MOBILE TELEPHONY

It is frequently said that Africa has jumped the fixed phone line generation and has moved directly to mobile phones. Large growth in mobile phone penetration is reported annually. It must be remembered that this is off a low initial base. Mobile phone penetration is now estimated to be in the region of 32%. Mobile phone penetration has increased access to rural communities with over 40% of the rural population covered by a cell phone signal in 2006. Of these areas only 3 % have fixed telephone connections.[10]

LACK OF CAPACITY DEVELOPMENT

Ignorance and lack of understanding of telemedicine have been cited as reasons for poor uptake of telemedicine in developing countries. There is, for some reason, the expectation that doctors and nurses will embrace telemedicine and use it without requiring training and that, in time, telemedicine will become an integral part of the practice of medicine, as has the telephone and fax machine and there will then be no need for specific training. Why this is so is not clear. Until this point is reached, there is need for training, especially in the developing world where Internet penetration and computer literacy is low. The International Society for Telemedicine and eHealth has developed a basic introductory telemedicine training programme to introduce health professionals to telemedicine and various vendors offer training in the use of their product. Turnover of medical staff in rural Africa is high and ongoing training is required.[14]

Ideally, telemedicine training should be part of medical student education and nurse training, with students exposed to its routine use. Until there are enough active telemedicine services in place this will not occur and telemedicine training for doctors and nurses will have to continue. There are few formal academic telemedicine qualifications in the world and only one in Africa.[15] Formal academic programmes are needed to provide future leaders and researchers in the field.

Continuing medical education using Information and Communications Technologies offers promise. It is well documented that doctors in rural settings feel isolated from their colleagues and the provision of continuing medical education over distance is a way of overcoming this.

POLICY AND LEGAL AND ETHICAL CONSIDERATIONS

Policy or rather lack thereof, and policy that is parochial is seen as a potential obstacle to the growth of e-Health in the developing world.[9] It is estimated that approximately half of the countries in the world have or are working on an eHealth policy, strategy or roadmap.[9] E-Health policy is also linked to other policies like IT, Telecommunications, eGovernment, Science and Technology and Education, and included in these are often policies on privacy, confidentiality and data security. In budget constrained countries some form of government policy on e-Health is required if pilot projects or programme specific projects are to become sustainable and integrated into the health system. It is unfortunate that none of the African Union, New Partnership for Africa's Development (NEPAD) or African Health Ministers' published polices and strategies mention eHealth, telehealth or telemedicine.[16-18] E-Health is mentioned as a spin-off of the NEPAD eSchools policy.

Legal and ethical guidelines need to be formulated that enable the use of e-Health and not impede it, while at the same time protecting both patients and the professionals. Africa is and will be dependent on international support for telemedicine and cross border telemedicine practice. While acting locally, countries need to think globally, to harness the capacity of among others, the African Diaspora. The European Community is developing guidelines and legislation for cross border telemedicine among its members and care is needed that this takes into account the need for telemedicine practice outside of the community. What is needed is an International e-Health Convention on international cross border telemedicine and work on this has commenced.[9]

TELEMEDICINE IN SUB-SAHARAN AFRICA

The obstacles to telemedicine in sub-Saharan Africa are many but there are several successful examples of telemedicine in sub-Saharan Africa.

The *Résau en Afrique Francophone pour la Télémédicine* (RAFT) based at the *Hôpitaux Universitaires de Genève* is active in 15 African countries and has been running since 2001. Largely focussing on webcast tele-education it has been used for telemedicine. Weekly teaching sessions are broadcast at relatively low bandwidth (30 kbs^{-1}) to up to 42 sites.[19]

iPath, run by the association TeleMed Basel is an international open source web based platform for store and forward clinical telemedicine, discussion groups and education. Information is not available on the number of cases submitted by doctors in Africa. Doctors in nine countries in sub-Saharan Africa have formed 36 discussion groups on the iPath platform. Activity within these groups is not available.[20] As mentioned, the Swinfen Charitable Trust which has been operating since 1999, offers free humanitarian store and forward telemedicine services, but uptake in sub-Saharan Africa has been very low.[21]

Several African countries have or are currently working on national eHealth strategies or policies but to date, no major telemedicine initiatives have been implemented. The Federal Government of Nigeria has recently announced the launch of a large telemedicine project and Nigeria is the only country in sub-Saharan Africa with a national telemedicine society.

In South Africa, a large pilot, national telemedicine project started in 1999 was not successful. A new national telemedicine strategy is currently being developed. Several telemedicine pilot projects have been successfully implemented at regional level in the public sector hospitals. These have been under the control of the Provincial Departments of Health with few examples of services between provinces. A telemedicine device designed for primary health facilities has been developed in South Africa by the Medical Research Council of South Africa and the Government's Department of Science and Technology. It awaits wide scale deployment. A new teleaudiology device made in South Africa is undergoing clinical trials as is a new digital stethoscope. There are examples of successful implementation of teleradiology and telepathology in the private sector in South Africa, but these are poorly documented and are not integrated into the large public sector services that support 80% of the population. The University of KwaZulu-Natal has been active in setting up videoconference based medical education and continuing medical education programmes in South Africa and several Central African Countries and offers postgraduate qualifications in Telemedicine and medical informatics.

The African Teledermatology Project has offered free store and forward teledermatology services through the web based teleder.org platform since 2007. Again use has been very low. In the first two years, doctors in 13 sub-Saharan African countries submitted 345 cases, which is one case per country per month.[22] The Mali IKON project is a store and forward teleradiology project that overcomes the problem of all the radiologists in the country living in the capital, by linking six regional hospitals to the capital.[23] The Pan African e-Health Network is a project of the Indian Government, supported by the African Union, that aims to eventually provide VSAT based telemedicine and tele-education facilities to one hospital in every African country with links to five regional super specialty hospitals, seven universities in Africa and 12 super specialty hospitals in India. One hour of synchronous telemedicine and five store and forward consultations are offered free for the first five years. Continuing medical education is also being offered but uptake is apparently low. To date infrastructure has been installed in one hospital in 22 countries.[24]

Other services include Medical Missions for Children, active in 13 countries.[25] Remote Access for Health Professionals providing Internet based support for Ismaili health professionals in Tanzania,[26] the Orbis cyber sight programme,[27] the Children's National Medical Centre in Washington's paediatric echocardiography service to a hospital in Uganda,[25] Johns Hopkin's medical training programme in Ethiopia and the Evangelical Lutheran Church's activities in Tanzania. African Medical and Research Foundation (AMREF) has embarked on an eLearning programme aimed at raising the qualifications of 40.000 nurses in Kenya. Rwanda is looking at a similar project.

CONCLUSION

There is little doubt that telemedicine has the potential to assist in managing the burden of disease, and overcoming the shortage of doctors, through international service. Whether this potential can achieved will depend on innovative solutions to overcome the infrastructural and human resource barriers, reduce costs and develop policy and legislation, both national and international that is enabling of the practice of low cost international telemedicine.

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