Telemedicine in developing countries

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BMJ 2001;323;524-525
doi:10.1136/bmj.323.7312.524

of adverse outcomes are superimposed on poverty, other severe illness, and illiteracy.[11] Furthermore, despite advances in antibiotic treatment, the morbidity from meningitis has not improved and a role for routine steroid administration is unproved. Strategies required to reduce neonatal meningitis include improved antenatal care, aseptic techniques during labour and delivery, and promotion of breast feeding and domestic hygiene. For older children vaccination remains the only realistic hope for improvement. As disease is greatest in the young, conjugate vaccines are necessary, first with *H influenzae* b and eventually for pneumococcal and meningococcal infections. Cost is the greatest obstacle. It is sobering to consider that although conjugate *H influenzae* b immunisation leads to a 90% reduction of invasive disease, this has resulted in only a 6% decrease in cases of *H influenzae* b meningitis globally.[3] Bulk purchasing and decreased numbers of vaccine doses may help to address this disparity.[3 12] Meanwhile, even in countries able to afford conjugate vaccines there are many survivors of meningitis, most of whom are considered by their parents and peers to be normal. Nevertheless, they are at moderate risk of developmental problems associated with learning and behaviour difficulties. Doctors need not only to check vision and hearing after bacterial meningitis but also to ensure that caregivers and schoolteachers are aware of possible language deficits and problems understanding language based material. Simple educational interventions may help compensate for these deficits, improving academic performance, behaviour, and self esteem.

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Telemedicine in developing countries

May have more impact than in developed countries

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The advent of modern communication technology has unleashed a new wave of opportunities and threats to the delivery of health services.[1] Telemedicine, a broad umbrella term for delivery of medical care at a distance, has reached around the world, and now health professionals can communicate faster, more widely, and more directly with clients and colleagues, no matter where they are.[2] Telemedicine may in fact have a more profound impact on developing countries than on developed ones.

Satellite stations in Uzbekistan, wireless connections in Cambodia, and microwave transmission in Kosova have shown that the low bandwidth internet can reach into remote areas, some of them with troubled political situations and uncertain economic environments. It has been more difficult and costly to implement broad bandwidth applications in these locations. Nevertheless, with the internet come email, websites, chatlines, multimedia presentations, and occasional opportunities for synchronous communication via internet phones and videoconferencing. Each of these communication vehicles provides an opportunity for medical education and medical care, not to mention collegial support.[3] Of course, they also provide the threat of mischief occurring within the health community, with breaches of security, inappropriate use of equipment, and engagement of terrorist tactics to reach political ends. For example, malicious hackers have been known to electronically deface websites. Threatening messages have been sent to health providers by opposing forces in some conflicts. Lack of systems support may lead to higher levels of virus and worm infections of electronic patient data.

Many physicians who travel to developing countries now take their laptops with them, or check in to internet cafes to maintain their medical contacts.[4] Although connections are sometimes unreliable, and often the practitioner needs more than a passing knowledge of communication protocols, modems, and software, it is remarkable how many locations are accessible via the internet. This connectivity allows greater flexibility in consultation, whether it is on health policy for hospitals or unique therapy for rare autoimmune diseases. For example, I have recently communicated with a visiting health professional in Cambodia who suspected a case of Henoch-Schönlein purpura (vasculitis) and sent a complete case history plus digital photographs of the lesions. The patient, living in a hill community, improved dramatically on prednisone after languishing for weeks with an undiagnosed illness. Another example of the value of the internet was the implementation of educational

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web servers in Kosovo, established with satellite links only months after the conflict abated. The installation of an internet server allowed the local physicians to gain access to literature and websites which replaced their 10 year old collection of journals.

There are threats, however. Technology from developed countries can replace guns in the fight for economic and social control.[4] Reliance on foreign non-governmental organisations may provide a short lived stability to the situation. Selection of a particular technology will often dictate many other developments in health care. It may even dictate the type of medical training programme that is embarked on, depending on which country has underwritten the new technology.

Successfully implementing telemedicine services within developing countries demands consideration of how the local people will support the services when the "foreign developer" has moved on. Expertise in the specific software is only one component. There must be a commercial capability that allows replacement parts to be provided and "evergreening" of the equipment and software. There must also be a stable communications strategy that connects the developing country with the global internet, without huge debts to pay for the connectivity. In addition, there should be a security framework that protects health professionals and their patients from electronic snooping.[1]

As we learn more about distance medicine we will also learn more about the diversity of disease, healthcare systems, and outcome expectations around the world. There is a temptation to introduce Western technology into health systems that are naive with respect to Western approaches to health care. Without paying attention to the historical underpinnings of each country's current health system, telemedicine could have a negative impact on the wellbeing of those countries. And unless we understand the technological and cultural readiness of each country and its healthcare practitioners, much effort can be expended with little gain.

Nevertheless, telemedicine is beginning to have an important impact on many aspects of health care in developing countries. When implemented well, telemedicine may allow developing countries to leapfrog over their developed neighbours in successful health care delivery.[5] Places such as Pakistan may find that local practitioners can provide the best advice to their patients without having to send them from small communities to large urban centres. Outposts in the highlands of Papau New Guinea may replace their radio communications from the 1970s with internet communication at little extra cost. Trainees from the United Kingdom, Canada, and the United States may find excellent opportunities to gain experience in Bangladesh, Guatemala, or Nepal, while continuing to pursue their learning objectives in concert with mentors from their home institutions.[6] These trainees will develop collaborations with local students, which could last a lifetime, opening the way for more equitable distribution of knowledge and medical care throughout the world. Medicine rests on solid principles which can transcend political and social divisions. Telemedicine should allow us to implement advances in the spirit of our historical roots, even at a distance.

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Measuring the prevalence of permanent childhood hearing impairment

The introduction of screening makes this important and timely

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In June 2000 Britain's health minister announced the introduction of universal neonatal hearing screening into the United Kingdom with initial pilot programmes at 20 sites.[1 2] Such universal neonatal screening is now also mandated in 35 of the 50 states of the United States, with legislation in other states pending.[3] There is only one existing controlled trial of this approach,[4] the remaining studies having compared their results with historical data. Although initial results are promising, they are primarily from hospital centres, often with a strong research interest, with relatively short follow up. Whether these results can be sustained when screening is introduced across whole communities, and when programmes are subjected to long term follow up, remains to be determined.

Given this setting, it is particularly important that new, universal screening programmes are evaluated adequately. One way to achieve this in the short term is to compare the observed prevalence of targeted hearing impairments being detected by the new screening programme with the expected prevalence in the population. Unfortunately neither the United Kingdom nor the United States currently collect national data on all cases of permanent childhood hearing impairment, so expected prevalence rates are not readily available. Lack of prevalence data also hinders adequate service planning and the ability to monitor changes in patterns of hearing impairment over time.

In an effort to overcome this problem, Fortnum et al performed an ambitious UK wide study to

BMJ 2001;323:525–6