

Title: Alma Ata in the Digital Era: Telemedicine for Community Health Workers

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Manuscript Word Count: 1,719 words

Introduction

The Alma Ata declaration thirty years ago this September laid out a vision for primary healthcare for all (1). Today, its promise remains incomplete. Recent, rapid advances in information and communication technologies (ICTs) have led to exciting opportunities to apply telemedicine to help realize this ideal by improving healthcare equity and access in developing countries. Nearly all current telemedicine strategies, however, are focused on delivering information and expertise in one direction, namely from specialists based in urban centers in wealthy areas to physicians based in poorer communities. While these applications are important and useful, the greatest gains of ICTs for improving population health will come from getting the tools into the hands of mid-level practitioners and community health workers (CHWs; alternatively denoted village health workers, indigenous health workers, or *accompagnateurs*). CHWs are the foot soldiers of Alma Ata, and they have a growing evidence base to support their work (2, 3). They should be the focus of a public health and social justice approach to telemedicine in resource-poor areas.

The failure to bring CHW programs to meet the needs of global public health has typically been the result of a vast separation between urban and district hospitals and remote villages (4). ICTs can bridge this gap and allow CHWs to partner with physicians within a given region. ICT-equipped CHWs can also be more effective at providing data for the surveillance for monitoring trends, programme performance, and the emergence of epidemics. Appropriate technologies can be deployed to improve recruitment, training, job satisfaction, and retention of CHWs. Telemedicine undertaken in this fashion is a dialogue and exchange of information within resource-poor settings, as opposed to a unidirectional arrow of information from North to South or wealthy to poor. This, in our mind, should form the foundation of telemedicine applications upon which to build external specialist links.

Like the CHW networks, information and communication networks remain a work-in-progress and largely inaccessible to the rural poor. In rural communities in Nepal, for example, only 2.1% of households have a landline phone, 2.1% have a mobile phone, and 0.7% have a computer (5). These numbers are approximately ten times lower than those for urban communities in Nepal, and are lower still in many villages, such as those in the district of Achham where we work. The challenge and opportunity is to make large, functional leaps in access to medical information through strategic investments in appropriate technology. The fundamental questions do not center around technology but pertain to who will use the tools and for which populations.

Alma Ata provides a relatively straightforward answer: the full potential of ICTs will be realized best by training and equipping CHWs to utilize them and share them with their local communities. While few programs have been piloted and many research questions remain unexplored, several basic principles are likely to be followed by any effective ICT/telemedicine programme for CHWs [box 1]. These principles follow the fundamental vision of Alma Ata: that medical knowledge should be decentralized, accessible, and affordable. They integrate nicely with many important social movements within ICT, which emphasize open access to information (6), universal internet access (7), and the use of open-source software (8).

Applications

Telemedicine is commonly associated with doctors in cities providing advice and even surgical care to patients in remote areas. Although such telemedicine applications can be incredibly useful and can effectively deliver specialist medical care where no other options exist, they are unlikely to have a significant impact on broader healthcare access. Our experiences in developing a telemedicine program in rural Nepal (9) have suggested that

the most powerful applications of technology—and the ones most consistent with Alma Ata's mantra—are those that decentralize ownership of the information and effectively expand the pool of “experts”. This is by no means a critique of the important and effective initiatives aimed at supporting rural physicians. Physicians are a key component of the health system, and they need to be connected with information. We would argue, however, that greater attention needs to be made towards developing applications centered around the CHW.

These include: 1) data and voice communication systems between CHWs and doctors or other health professionals at hospitals and primary health centres within a CHW's home district for support in diagnosis, treatment, and triage; 2) voice communication among CHWs for social support, knowledge exchange, solidarity, and shared experiences; 3) simple data collection and management tools for surveillance using straight-forward interfaces with minimal literacy requirements; 4) similar data applications for quality assurance and programme monitoring; 5) integration of these data applications with early response systems for disease detection; and 6) targeted data- and voice- applications for communication with urban-based specialists outside of the district. Such applications directly support the CHW's fundamental mission of achieving local access to essential primary care.

The good news is that much of the software, data, and specialist networks are in fact in place or rapidly developing. The technology is there; the next step is to adapt it to be effectively utilized by CHWs. Innovative social entrepreneurs like Dimagi are working to get health technologies and electronic record-keeping into the hands of non-physicians (10). Straightforward internet interfaces like Rural Health Online Nepal facilitate communication among mid-level practitioners, rural doctors, and specialists (11).

Translations into local languages and for semi-literate populations need to continue to be developed. Databases such as the Global Infectious Diseases and Epidemiology Online Network (GIDEON) provide critical repositories of up-to-date knowledge useful to health practitioners (12). Non-profits such as Satellife have developed networks and internet portals of health-related resources used throughout the developing world(13). A similar network, Réseau en Afrique Francophone pour la Télémédecine (RAFT) has been developed for francophone Africa in continuing education for physicians (14). Consultancy networks such as the Swinfen Charitable Trust provide intellectual support to doctors in rural areas (15). These are incredibly effective at delivering information to physicians, but adapting them for CHWs is in the very early stages. Google.org, the philanthropic arm of the information titan, is developing ICT-based solutions for responding to emergencies and disasters (Innovative Support to Emergencies, Diseases, and Disasters, InSTEDD) (16). For such applications to effectively reach the most poor and remote places that are the focus of Alma Ata—and indeed respond in a timely manner to disease outbreaks—they must be made accessible to non-physician providers.

Programme Evaluation

Few models have been developed that detail the staffing and management requirements necessary to ensure effective communication between CHWs and district-level hospital- or clinic-based staff. Indeed, the next steps in this endeavor include piloting and assessing scalable models of telemedicine programs for community health workers. Randomized controlled trials are important in testing specific hypotheses about efficacy, and are certainly needed in identifying optimal strategies for utilizing technology for CHWs (2). They are, however, only one piece of a larger strategy for developing effective policy (17). Case studies and cohort designs can contribute programmatic knowledge. Also, many of the innovations will come from social entrepreneurs and business leaders. Partnerships

between these creative forces and academicians will be critical to developing equitable and evidence-based solutions.

Important outcomes include: 1) retention of CHWs in their postings; 2) recruitment of high-quality candidates for CHW postings; 3) skills assessment of CHWs; 4) CHW adherence to clinical protocols; 5) CHW job satisfaction and retention 6) geographical expanse of CHW roll-out; and 7) equity with which this expansion occurs with respect to existing socioeconomic inequalities. The rationale for the first five outcomes is that maintaining motivation, confidence, and skills is critical to developing an effective CHW network (18). This is emphasized by recent task-shifting guidelines promulgated by the WHO in their focus on training, recruitment, and retention of CHWs (19). As the task-shifting policy document appropriately states, while providing sufficient financial incentives are a necessary part of maintaining a professional and effective CHW work force, additional incentives are needed. It will be important to test hypotheses as to the extent to which providing basic communications technologies and computing skills to CHWs might be able to improve job satisfaction and retention. ICTs, for example, may partially alleviate the problem of marginalization and lack of opportunities for upward mobility for many CHWs. ICTs offer new skills for CHWs and can help integrate them into the established health system. This in turn may help attract higher quality CHWs who feel excited about their job and are able to perform more than a few rudimentary tasks.

The fifth and sixth outcomes noted above present serious challenges of measurement. While there are certain quantitative outcomes—the number of citizens covered per geographic area, the percentage of women as trained and ICT-equipped CHWs, the involvement of programs of lower socioeconomic groups—truly addressing the phenomena of equity and access is immensely complex. Still, this is fundamental to the

endeavor laid forth by Alma Ata of democratizing healthcare and knowledge through CHWs and ICTs. Healthcare and information access for all runs up against a wall of still-massive illiteracy rates and entrenched cultural biases against minorities, females, and the poorest citizens. In some of the villages where we work in Nepal, for example, illiteracy rates among women exceed 75% and are several times higher than among those for men (9). In these settings, although ICTs have the potential to break down these socioeconomic barriers, they can also reinforce them if attention is not paid to who gains access. This is why developing sophisticated tools to evaluate programme impact on all sectors of society is so important.

Assessing how these outcomes are affected as programmes are brought to scale is critical (4). Any program needs to answer whether it can overcome political, logistical, and financial barriers to expansion on a national or international level. This is indeed the fundamental question underlying the potentials and pitfalls of ICTs: can they really assist in bringing to scale the huge promise of CHWs?

Conclusions

ICT will not save impoverished communities from the deficit of trained rural healthworkers, the lack of political will to build effective people-centered rural health systems, or entrenched discrimination with respect to gender, caste, or economic status. Still, effective expansion of these technologies among CHWs can help to expand access to effective health care among the rural poor. Such tools are not the panacea, but they must be part of any modern, comprehensive solution aimed at achieving the vision of Alma Ata.

Contributions and Conflicts of Interest

The co-authors work with Nyaya Health, a non-profit organization based in rural Nepal working on health infrastructure development. Part of this work involves training and equipping a network of community health workers. DSRM conceived the piece and wrote the first draft. All co-authors actively participated in the writing and research for the piece. The authors have no conflicts of interest to report.

Acknowledgements

DSR and SB are supported by the NIH Medical Scientist Training Program (GM07205). The funding source played no role in the conception or writing of this piece.

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Box 1. Principles of ICT Implementation among CHWs

Decentralized. Systems should be decentralized to ensure ownership and access in geographically dispersed communities.

Centered Locally. ICT applications should be developed to facilitate dialogue among CHWs and district-based physicians to provide each other with technical and social support. External specialist systems are critical, but locally-focused ICT is the base.

Open-source. Software and operating systems that are open-source should be utilized .

Connected affordably. Connectivity solutions that minimize usage fees and provide ICT access to the widest population should be pursued.

Focussed on equity. Care should be made to ensure employing and equipping of CHWs from the most marginalized and impoverished communities.

Sustainably financed. Mechanisms should be deployed to ensure sustainability through community cost- and risk-sharing.

Applications for minimally literate populations. Applications should prioritize access to CHWs with minimal literacy.

Protocol-based. ICT should be used to deliver medical and public health knowledge in a fashion that is based upon standardized clinical protocols.

Data-driven. Rigorous epidemiological monitoring should be developed to assess effectiveness of the various components of ICT interventions.

Integrated with surveillance systems. Surveillance systems for detection of emerging diseases and other outbreaks is only as good as its data input. ICT-facilitated CHW networks should form the backbone of such systems.