Editorial

Using Information Technology and Social Mobilization to Combat Disease

As Ebola, Middle East Respiratory Syndrome, Enterovirus D68, and other outbreaks threaten the health of nations, information and communication technologies (ICT) combined with social mobilization interventions are becoming weapons in the war against disease. In nations where healthcare providers are scarce, but cellular telephony abounds, the opportunity exists to "get the message out" to the general public via ICT, mHealth, and social networking. The phrase "going viral", a term commonly used to describe content on the internet that has spread rapidly and widely, can and must now be applied to the battle against communicable (and non-communicable) disease. In addition to the use of ICT in emergency situations, information technologies in health are vital for monitoring, disease surveillance, and supply chain management, which are also crucial in global health. Frontline caregivers and the patients they serve may have the most to gain from adaptation and adoption of ICT techniques in practice.

In the absence of formalized health services, ICT (particularly using mobile health approaches with cell phones & social media or "mHealth") can be used to mobilize residents to help prevent spread, care for the sick, and to gain a deeper understanding of the disease itself. In the example of low resource areas such as Liberia, Sierra Leone, and Guinea, the most powerful tool for slowing spread of diseases may be such ICT-based interventions coupled with social mobilization in communities. When one considers that Liberia's population of over 4 Million people is served by less than 200 physicians, it becomes obvious that Western acute care-based approaches to controlling the spread of disease are untenable [in that country]. The use of ICT interventions has shown to be a vital tool in the battle against infectious disease, especially in areas where a rapid intervention can mean the difference between containment and spread, life and death.

Combining community action and ICT, most notably using cell phones, is a primary tool used most notably to slow the spread of Ebola in Liberia and Sierra Leone. In these two countries, access to the internet for the general population is below 1.7%. In Sierra Leone, the civil strife has resulted in devastation to the educational system, with an illiteracy level of about 50%. However, in both countries more than 65% of the population own and use cell phones, relying heavily on radio for information. In these West African nations, after organized efforts people quickly began to use these "avenues" to disseminate vital prevention information, mobilize community groups, and create a rudimentary method for phone reporting of suspected cases. Here, the important lesson is that solutions using ICT do not have to be thought about or designed as extremely high tech or expensive interventions. Instead, the opposite may be true. Matching the ICT delivery
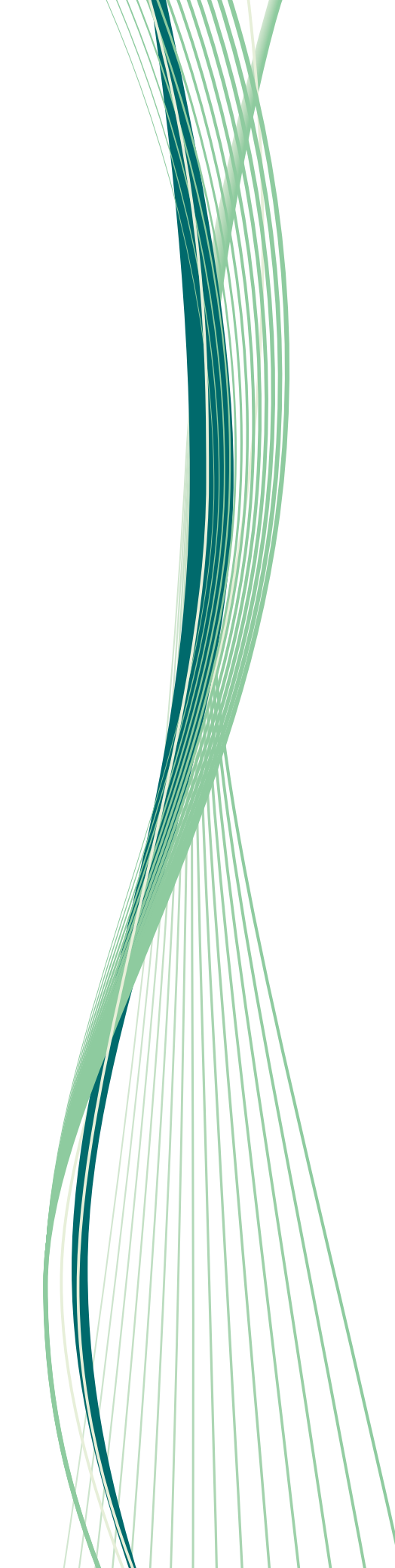
mechanism to the context and capacity of use is critical. Written material on infection control are useless in the hands of the illiterate.

The use of ICT in health has many facets, from the highly complex and advanced methodologies being used to produce a "personalized medicine" to low-tech radio broadcasts. In discussing personalized medicine, advanced analyses and complex statistical methodologies are being applied to large collections of genomic, operational, population, and social media data where the size and data quality challenges are considerable. However, interesting new approaches are compensating for some of the challenges inherent in big data. GOOGLE Flu Trends is a frequently used example, in which over-the-counter medication purchases from point of sale databases are being added to emergency room visit records, reports of absenteeism from local schools, and counts of the number of web searches on a particular health topic are combined and examined for patterns. While these sorts of analyses are not conclusive, the trends that emerge are often quite close to reality. For instance, increased purchases of loperamide (Immodium) in the local drugstores, a spike in the number of searches on the web for diarrheal diseases, and marked increases in absenteeism from school may point to an outbreak of gastroenteritis. A seemingly simple example, but as shown by GOOGLE Flu Trends, using these types of approaches as a disease surveillance mechanism can outperform larger surveillance efforts such as those of the Center for Disease Control (CDC).

Another example of how social media may be used to identify outbreaks and control disease is the HealthMap tool (http://www.healthmap.org) that uses informal online sources like government websites, social networks, and local news reports to map potential disease outbreaks and monitor public health trends. This software was able to detect the Ebola outbreak nine days in advance of the World Health Organization (WHO) announcement.

Epidemiological modeling, most recently used in Western Africa for Ebola, depends on access to and manipulation of a variety of data, much of them related to human behavior, burial techniques, and community response rather than lab results and data from healthcare facilities. These examples point to the value of data that arise from everyday life, which in turn encourage us to both think more deeply about the variables of the community health and target our interventions to address them. For example, in Liberia, where the rituals of burial include "imposition of hands", a major intervention was targeted to find other practices for dignified and culturally appropriate burials, as the Ebola patient's body is most infectious for several hours after death. Epidemiological modeling studies indicated that burial practices were a major driver in the spread of Ebola. Using radio and text messages to disseminate information to families not to bury their own family members resulted in the formation of community outreach task forces to educate residents and to deal with post-mortem care. Again, ICT served as a major tool in the Ebola battle.

Geographic information systems (GIS), which are used to capture, store, manipulate, and display geographic information, also play an important role

in disease surveillance. GIS has the ability to manipulate spatial data (such as maps) and relate them to data of interest that exist in other database. This functionality makes it possible to track outbreaks and supplies, and pinpoint areas where resources can be found (or are needed). These examples of the use of GIS in the Ebola response illustrate its utility. *Médecins Sans Frontières* stimulated a GIS team in Guinea and began generating and improving the regional maps, which were very poor and inaccurate before this effort. In part, this was accomplished by using crowdsourcing techniques, in which locals were engaged with drawing and labelling maps of their neighborhoods as a volunteer effort. When the maps emerged, they were reproduced with formal mapping software, resulting in 109 new maps with great detail and high accuracy. These maps were then used for localization and visualization efforts. The localization efforts enabled public health officials to pinpoint the exact location of villages and differentiate between villages and towns with similar spellings and/or pronunciations. This enabled teams of health care workers and public health officials to more quickly respond to reports of suspected Ebola, and to more effectively and efficiently deploy resources. The ability to visualize reports of outbreaks and locations of teams and supplies on a digital map helped officials to see the disease spread patterns, visualize the number of new cases, deaths, and survivals, and better manage supplies and resources by location (http://bit.ly/1J3iJOI).

Definition, value, ownership, and utility of the ICT are quickly moving into the hands of those who need them most. Individuals are becoming more empowered by access to vital information that may save the lives of their families and communities. Communities themselves are now able to take a greater leadership of their destinies since information is flowing into areas that did not have such access in the past. Frontline caregivers can use ICT for a direct line to referral networks, continuing education, and their patients. Public health providers and officers can use the liberated information to better plan and provide for rapid and targeted responses. Of course, ICT is not a panacea. It is simply a tool, which can help in remarkable ways when put into the hands of those who care.

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