Columbia Center for New Media Teaching and Learning, Seminar #683
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Chairs: Ryan Kelsey, Professor Frank Moretti *Rapporteur: Ruth Palmer*

Achieving International Health Objectives with New Media and Technology at Columbia's Earth Institute

Speakers: Dr. Prabhjot Singh Dhadialla, director of the Program for Health Systems Development and Research at Columbia University's Earth Institute, and Dr. Patricia Mechael, director of strategic application of mobile technology for public health and development at the Center for Global Health and Economic Development at Columbia University's Earth Institute

Summary

In the first of a series of New Media Teaching and Learning University Seminars that focuses on global health and technology, Dr. Prabhjot Singh Dhadialla and Dr. Patricia Mechael of the Columbia University Earth Institute discussed the historical progression of health systems and the role that new media and technology plays in helping to achieve international health objectives particularly as they relate to developing countries.

Dr. Dhadialla provided an overview of a health systems approach to global health. He is followed by a presentation from Dr. Mechael on mHealth, which pertains to the use of mobile phones in healthcare. Drs. Dhadialla and Mechael concluded by co-presenting ChildCount+, an initiative which uses a mobile phone-based events registry and alert system to facilitate and coordinate the activities of community health workers.

Presentation

Dr. Dhadialla began by giving an overview of what it means to approach global health at a systems level, using both his and Dr. Mechael's work on the Millenium Village (MV) Project to illustrate his points. He explained that the MVs are located in 10 countries in sub-Saharan Africa where there are very few health workers; for example, in Tanzania there is one doctor for every 28,000 people. This obviously poses a challenge when it comes to structuring a health system: how can we effectively leverage skills and abilities at the human and systems levels in these environments?

Dr. Dhadialla noted that doctors usually begin their training at the point of treatment, but in a low-resource environment like that of the MVs, doctors must start thinking in a larger, community context. Before addressing the moment of treatment, doctors and health workers need to look at how people decide to seek care and where they seek it. In sub-Saharan Africa, many people live hours away from community centers and, therefore, communications technologies can have a huge impact.

Dr. Dhadialla explained that households are the focal point of health systems in the MVs: community-based services center around household clusters. Villages in sub-Saharan

Africa vary a great deal in their distance from clinics and other resource centers, and it is often difficult for the healthcare system to penetrate all of these remote areas. The MV community health workers provide a key link between households and clinics. On a systems level, the question is how to remotely support these health workers taking into account what they know and what they need to know in order to provide health services, and this is where new communications technologies can play an important role.
Dr. Dhadialla went on to explain that the science of health systems is concerned with very basic decisions: How can I help? What are my priorities? What should I do next? How can I do it? How can I improve?

So, how can new technologies help with these decisions? Dr. Dhadialla explained that technologies can help, but it is still *interactions* between people, managers and systems, and between people and the tools themselves that are central to these decisions. He then gave an example of one way the MV Project is using technologies to support remote decision-making. Using a program on a mobile phone, health workers can ask and input the answers to a series of questions about a patient's HIV status. While the program makes a series of complex decisions, the worker sees a linear stream of questions and tasks on his or her phone, which change depending on the input from the prior screen.

Dr. Dhadialla noted that through these technologies, the MV Project team is also able to think about health system *diagnostics* in a very different way. Though they typically think in terms of diagnosing individual patients, these tools make it possible for health workers to diagnose how the system itself is performing on the household or macro levels. They show in real time what is happening in remote places, because people are using information and communication technologies as their support tools that simultaneously provide data about how the system is working.

Next, Dr. Dhadialla introduced Dr. Mechael, who further explained the uses of mobile phones in public health (mHealth). She began by noting that mHealth originated in the early 90s with the use of PDAs for data collection, but that coherent discussion about it took off in the last few years. The recent explosion of mHealth is mostly due to the proliferation of mobile phone technologies worldwide. Because they are so pervasive, even in the developing world, mobile phones have great potential for facilitating a broad range of health related activities.

The range of mHealth programs runs the gamut from awareness-raising through text messaging; compliance and monitoring for diseases such as TB and HIV; data collection about diseases; and telemedecine, which includes diagnosis, consultation, and emergency medical services. At the Center for Global Health and Economic Development Dr. Mechael and others recently completed a targeted literature review of mHealth, focused on low- and middle-income countries. They found that from 2007 to 2009 there has been an explosion of peer-reviewed articles on mobile health, but the projects themselves are often very small-scale. Discussing how mHealth can strengthen larger health systems in a strategic way is increasingly critical.

Dr. Mechael then gave an overview of the findings from the literature review. In the realm of information support tools for health workers, Dr. Mechael explained that there has been a shift toward asking how you support workers through algorithm-driven platforms that also work as data collection mechanisms. These allow you to both provide support and capture real-time data in a way that was previously impossible. In terms of prevention, there has been little study of how mobile phones as a medium can be used for prevention and behavior change. Emergency medical response is the most common use of mobile phones in low- and middle-income countries.

Dr. Mechael explained that most of these programs target 100,000 people or fewer and are funded by foreign assistance rather than by the governments themselves, leading to a gap between the overarching health systems' priorities and how the applications are being designed and deployed. This in turn can create many problems. Thousands of projects never make it past the pilot stage despite great results because external resources fund them.

Further complicating the issue, in many cases these programs are being deployed by technology developers, rather than being driven by the health sector. Dr. Mechael elaborated on this point by explaining that one way mHealth differs from traditional ehealth is that mHealth involves a whole mobile services component. Major telecoms operators are setting up healthcare divisions to look at this market, and unless governments, NGOs, and donors become more clear on how they want the technology to be directed, we'll continue to see projects that are not driven by health system priorities. At the same time, these telecom companies have expertise that is needed and should be engaged more effectively by taking into account their industry objectives and determining methods to leverage their core competence for health objectives.

From a human resources standpoint, one of the challenges in many developing countries is finding and educating people who have abilities in both health and technology, and who can potentially merge the two. Finding programmers and software engineers who can customize tools for local environments and needs is also a major issue. As such, there is now a movement in some universities in developing countries to set up multi-disciplinary programs to train specialists to support this work.

Dr. Mechael noted that security also poses a challenge: how do we protect patient information and confidentiality? Mhealth raises a lot of concerns about this, and there must be guidelines about storing and managing information to protect citizens. Equal access is also a big challenge: mHealth has its greatest potential in treating people in rural areas where the help is most needed and, therefore, urban environments should not be the sole focus.

Dr. Mechael also introduced a specific project she is working on called ChildCount+, which began as a childhood nutrition screening program in a Kenyan MV site, but has expanded to monitor all children under 5 years old for immunization and illnesses such as malaria and diarrhea. Within a few months of beginning the program, 10,000 children were registered and monitored for key critical health issues. The system has now been

expanded to include pregnant women and newborns. ChildCount+ has a community health worker component, focused on management and training of these key actors and an informatics component, focused on how mobile phones can strengthen the health system and measure progress over time against specific targets.

Next, Dr. Dhadialla provided some background on community health workers. Most villages in the MV Project had some form of community health worker before they were designated MVs, but there was no standardized coordination and training of these workers. Dr. Dhadialla explained that the MV Project team quickly realized it was important to train health workers in community units, with a community defined as a cluster of 40-60 thousand people. They soon found that even when health workers had received training and education, when they went into houses to confront problems, prioritization and decision-making became very difficult, especially when they had enormous workloads. There was a clear need for programs that would support health workers as they confronted these difficult decisions.

The ChildCount+ program is one such program. It focuses on five essential issues: diarrhea, malaria, pregnancy, nutrition, and immunizations. These five areas are connected to algorithms in mobile phones that take workers through very simplified decision trees and almost always end in referrals to a clinic. From a systems perspective, this process not only helps community workers make decisions, it also gives valuable insight into information flows. This is very important because in these health systems, along with people management, information management is also necessary.

Dr. Dhadialla went on to explain how the program works: workers who are visiting a patient in a household enter a short SMS code (that may include things like age, sex, and key health indicators) into a mobile phone. After entering this structured SMS code, the health worker receives immediate feedback on what he or she needs to do. If it is an emergency, a message is sent alerting the health worker of the emergency. Alerts are also sent to the health coordinators at the facility and at many other points in the system, so health workers can follow up and be held accountable. Periodically, Dr. Dhadialla's team receives a list of all high priority patients, so on a weekly basis they and their management teams can reallocate resources and efforts. Local community health managers who have been trained in the skills necessary to support ChildCount+ are responsible for running the program.

One of the advantages to ChildCount+ is that it allows data to be aggregated in a global manner for real-time epidemiology; the data collection is embedded in the very process of managing programs. Dr. Dhadialla emphasized that this is very important to his team because monitoring and evaluation is a priority in the Millenium Villages. Using these mobile technologies in ChildCount+ they are able to combine monitoring and evaluation with improving processes, patients lives, and systems themselves. ChildCount+ will be deployed in all MV sites over the next few months.

Dr. Dhadialla concluded by adding that for the first time, by using these technologies, complete information about health status is available not just from a clinic, but also from

a community. This is key; looking only at what is occurring in a clinic will give a very poor sense of *community* epidemiology, because there are many reasons why sick people do not go to clinics. Clinic registries are often used to determine funding priorities and policy decisions, but they are actually poor indicators of where resources should go. Gathering health status information from the community itself is a seminal advance in the field.

Dr. Mechael added that this program helps structure interactions and standardize key steps in the system. She noted that recent studies have indicated shortcomings in facility-based care, so there has been a shift toward looking more closely at early detection and community-based healthcare. A program like ChildCount+ can help to enable these approaches because the core of the program is routine monitoring coupled with early detection and treatment.

Discussion

Ryan Kelsey, CCNMTL associate director of education and research, opened the floor to questions, encouraging the group to consider how a university like Columbia and centers like CCNMTL in particular might contribute in a useful way to projects like the ones discussed.

Suzanne Bakken, alumni professor of nursing and professor of biomedical informatics, began by asking for more information about the technical architecture of ChildCount+. Dr. Mechael responded that they are using an open-source platform called Rapid SMS (with extended functionality built on), which enables a two-way, SMS-based communication. A community health worker registers himself into the system, then registers other individuals, and can link information to them using a person's I.D. number. She added that they also use MGV Net, which includes other tools used in the MV Project, one of which is an electronic medical records system based in clinics called Open MRS. Once they built a transport layer from Rapid SMS to Open MRS they were able to look at patient information both at the community level and in the clinics, which makes it a much more powerful set of tools.

CCNMTL Executive Director Frank Moretti then asked how the aggregated data was used and whether the community health worker would get a sense of himself as part of a complex network. He noted that this seems like it has interesting potential as a community-building tool. Dr. Mechael responded that the system works as a management tool, so one can conduct performance monitoring of community health workers and generate automated reports on them. One can also print reports of specific categories of priority patients, like pregnant women, and give them back to the community health worker. Thus, it serves as a good two-way information tool, rather than data collection for data collection's sake.

Dr. Dhadialli also noted that community health workers rarely have a sense of how much people are talking about them, even though they are actually the focus of many discussions and health strategies. Health workers are often doing two jobs, and they are poorly paid if at all, so there is a large effort now to show them that they are valued. The

feedback ChildCount+ can provide can contribute to this by showing health workers that they are connected to communities and to managers.

Ryan Kelsey asked if a center like CCNMTL might be able to offer technical expertise that could provide some pushback against technically well-equipped telecoms that are more focused on their industry priorities. Dr. Mechael responded that the Earth Institute works very closely with the WHO, ministries of health, and other organizations, as well as with the telecom companies, to try to balance corporate interests with what makes the most sense on the ground. One of the big challenges for governments is just having the expertise to know how to channel their resources effectively. There is a place for academic institutions like Columbia to provide technical expertise and support for efforts to build local capacity and support programs.

Tseday Alehegn, a doctoral student at Columbia Teachers College in health and behavior studies, asked if Drs. Mechael and Dhadialli had looked at using text-to-speech technologies in addition to SMS, to which Dr. Mechael replied that there are a number of open source text-to-speech platforms out there that are becoming stronger options. They always assess the range of available tools and functionalities and the skill levels of the health workers when trying to determine what will be the most appropriate tools. They then test those tools and see what happens. ChildCount+ was originally started with a Java-based application, but the SMS-based platform garnered the most traction. Dr. Mechael added that they still plan to phase in the Java-based application, but it will be used for more complex decision-making support.

Ms. Alehegn next asked if this was due to the skill level of the workers and Dr. Mechael responded that it was the skill level needed to use the technology, but also the infrastructure needed to design and manage it. The Rapid SMS application only requires health workers to send structured SMSs, rather than requiring uploads or other forms of transferring infomation. Dr. Dhadialli pointed out that increasingly texting is a core competency of a global 18-year-old, so text-based platforms make sense but that means that literacy also becomes very important.

Another attendee asked the speakers to name the two major human and technology challenges they face in implementing ChildCare+. Dr. Mechael responded that one of the biggest challenges was having good programmers in each country that can manage and customize the tools, but she also noted that at a higher level the policy-making has been the most challenging. Dr. Mechael explained that the challenges are less and less technological: the solutions are there. It's a question of how to operationalize them.

Dr. Dhadialla said one big challenge related to people is compensating community health workers: it is difficult to get countries to do this, which creates an environment in which supporting workers and demonstrating that they are valued becomes challenging. Another challenge is organizational dynamics: you may have 120 health workers and only one coordinator. They have had to work on changing management structures and creating more management layers, which is particularly difficult when you can't pay people.

Elizabeth Day, CCNMTL creative director, asked if it was realistic to think some health solutions might come from the bottom up in these communities, especially given the apparent undervaluing of community health workers. If there was more transparency in the systems, might patients be able to find health information they need for themselves that would enable them to act in their own best interests?

Dr. Dhadialla responded that undervaluing community health workers was really a problem at the global health level; within many of these communities local health workers have long been valued members of the community. However, he agreed that there is a lot of work to be done to make information more available. Dr. Mechael added that mobile technology lends itself very well to citizen-centered healthcare. In Ghana, for example, the MoTeCH project is looking at implementing a support system for pregnant women who register and then get voice messages based on where they are in their pregnancy. Similar tools have been implemented in other countries for direct-to-consumer support that allows people to take a more proactive role in self-managing their own care. This can really only get going when mobile phone penetration reaches a level of individual ownership, and in the MVs the mobile phone penetration levels are currently about 30-40%, although this is increasing. At the moment, many households have one phone, so even for the MoTeCH project the aim is to send support messages for the family—what the family can do to support the pregnant woman—because she is not necessarily the phone owner. Ryan Kelsey noted that CCNMTL is a part of the MoTeCH project and they may have a future seminar session about it when the project is farther along.

Ken Petricig asked if any of these projects use video or images. Dr. Mechael replied that health workers informally use the camera function of mobile phones to take pictures and send them to friends for a second opinion, mostly for dermatology and opthamology conditions, but to do a proper diagnosis the images must have a certain resolution. They are looking at implementing some of these technologies in the future, including the mobile microscope, a camera phone with a built-in microscope that can transmit images.

Sue Bakken observed that faculty who may have something to offer projects like these find it difficult even to figure out what projects are going on at Columbia, which is necessary if we are to have an effective university response to some of these problems. Dr. Mechael agreed, noting there had been an effort to create a Center for eHealth at the University to pool some of the fragmented information and resources. Ryan Kelsey and Frank Moretti explained that CCNMTL is hoping these seminars will be a space of convergence for groups at Columbia working on these issues; since CCNMTL works across the University, they hope it can play a key role in efforts to aggregate information about these initiatives.

Frank Moretti observed that before the international community intervened in many of these communities, local people had ways of dealing with health, and asked if there are indigenous ways of addressing some of these health issues that have to be translated or accommodated when the global health community does intervene. Dr. Mechael responded that local ways of dealing with health issues often do align with Western

medical practices, and those that don't may be either harmful or neutral; the harmful ones are the real challenge. The global health community must understand the behaviors and develop communication tools and messages to address them. For example, when they were developing the MoTeCH project they had to deal with the fact that women in Ghana usually conceal pregnancy until the fifth month, which makes it hard to monitor pregnancy prior to that point. Health workers must test many messages to understand how to address these types of issues.

Lastly, Frank Moretti then pointed out that even in the U.S. some areas are losing their local medical facilities; perhaps these mobile systems could be useful in some form here. Dr. Mechael responded that telemedicine—like remote patient monitoring to allow patients to stay in their homes longer without having to go to medical facilities—is growing in the US. There has been a lot of resistance to telemedicine, but in many ways it can standardize quality of care to a degree human medical workers cannot.

In closing, Ryan Kelsey thanked Drs. Dhadialla and Mechael for the presentations and welcomed the audience to the next University Seminar on New Media Teaching and Learning.

For more information about the University Seminar on New Media Teaching and Learning, please visit http://ccnmtl.columbia.edu/seminars.