

A Model for Remote Health Care in the Developing World: The Markle Foundation Telemedicine Clinic in Cambodia

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I. Introduction

This paper is a summary of the Markle Foundation's work in supporting the development of a telemedicine clinic in Ratanakiri Province, Cambodia, which was launched in April of 2003. It includes an overview of the project, a discussion of lessons learned and applied thus far, and suggestions for future work.

II. The Context: Rural Cambodia

Cambodia's health situation is among the direst in the Western Pacific Region. Malaria, dengue fever, diarrhea, tuberculosis, hepatitis, and HIV/AIDS are among the most prevalent diseases affecting its population. Average life expectancy at birth is estimated to be 54.4 years.¹ Compounding the trouble is the threat posed by land mines: Cambodia has the highest per capita rate of amputation in the world.²

Although a significant proportion of Cambodia's health problems result from poverty and malnutrition, many can be traced directly or indirectly to the violence of the Khmer Rouge regime, which killed between one and two million people through executions or enforced hardship during the 1970s. In an effort to create a simple agrarian-based society, the Khmer Rouge set about eliminating the country's professional classes, leaving it with only fifty doctors in 1979.³ Not surprisingly, despite significant progress in the last two decades, the overall performance of Cambodia's health system is still ranked near the bottom of those of the member states of the World Health Organization.⁴



About 80% of Cambodians live in rural areas, making the delivery of health care services all the more challenging. Ratanakiri Province (pictured at left), the location of the Markle Foundation Telemedicine Clinic, is 600 kilometers northeast of Cambodia's capital, Phnom Penh. It borders Vietnam to the north and Laos to the east. It is among the poorest and most remote

¹ National Institute of Statistics, Cambodia.

² One per thirty-six people, according to the Cambodian Ministry of Planning, 1999.

³ World Health Organization

⁴ World Health Organization, 2000

regions in Cambodia, and is populated in part by members of an ethnic minority who typically have even less access to health care services than do other Cambodians.

The Markle Foundation and its partners chose Ratanakiri as the site for the telemedicine clinic based on the assumption that if it were able to function successfully in this extreme setting, it would be relatively easy to replicate it in less difficult circumstances.

III. Project Partners

The Markle Foundation established the telemedicine clinic in partnership with several organizations that were previously making significant contributions to Cambodia's development: American Assistance for Cambodia, The Sihanouk Hospital Center of Hope, and Partners Telemedicine. The Markle clinic was designed to leverage and expand upon the existing efforts of these organizations.

American Assistance for Cambodia (AAfC) is a non-profit organization established in 1993 by Bernard Krisher, a former Newsweek Tokyo bureau chief who covered Cambodia in the 1960s and has since been engaged in volunteer activities targeted toward its reconstruction and rehabilitation. AAfC's projects include the construction of 250 solar-paneled rural primary schools, many of which are computer and Internet equipped, in addition to contributing to the establishment of the Sihanouk Hospital Center of Hope and other Cambodia-based NGOs.

The Sihanouk Hospital Center of Hope is a privately-funded charity hospital staffed and managed by HOPE worldwide, a United Nations-recognized NGO. The hospital has made a six-year investment in developing the skills of a Cambodian staff of 36 doctors and 75 nurses, who provide medical care for 300 patients daily. A small team of international volunteer doctors and surgeons works alongside national health leaders to treat 60,000 patients every year.

The United States-based Partners Telemedicine is an arm of the Partners HealthCare System, a non-profit integrated health care delivery system founded by Brigham and Women's Hospital and Massachusetts General Hospital, both teaching affiliates of Harvard Medical School. Partners Telemedicine was established in 1995 and has provided more than 10,000 specialty consultations, held 7,000 educational videoconferences and numerous multimedia productions streamed via the Internet.

The health specialists at both the Sihanouk Hospital and Partners Telemedicine volunteer their time in support of the Markle Foundation Telemedicine Clinic.

IV. Project Description

Telemedicine involves the exchange of medical information via information technology, especially the Internet, to enable people to overcome the barriers of time and distance to

obtain better health care services. Telemedicine may involve the exchange of text, sound, images, or even the remote operation of instruments. It has been used in a variety of medical fields to aid in diagnosis as well as in direct treatment and follow-up care. Although the use of telemedicine is expanding both in the developed and developing worlds, it is still in a relatively early phase of adoption.

The Markle Foundation Telemedicine Clinic was designed to build on experience gained from the operation of the first—and only other—telemedicine clinic in Cambodia, located in the region of Rovieng. The Rovieng clinic, in the village of Robib, was established in 2001 by the other collaborators on the Markle clinic: American Assistance for Cambodia, the Sihanouk Hospital Center of Hope, and Partners Telemedicine.

The Markle clinic, like the one in Rovieng, uses an Internet link, transmitted via a dedicated satellite dish donated by Shin Satellite of Thailand, to send and receive e-mail text and images.⁵ A nurse from the Sihanouk Hospital Center of Hope visits the Markle clinic once a month for a four-day stay, during which he examines and photographs patients and measures their vital statistics. The resulting report is e-mailed to doctors at both the Sihanouk Hospital Center of Hope and Partners Telemedicine, who collaborate with doctors in Ratanakiri on making a diagnosis and developing a course of treatment. Patients are encouraged to return for follow up telemedicine check-ups as necessary.



In addition to supporting the physical plant and the acquisition of computer equipment, Markle Foundation funding contributes to the cost of AAfC staff time, the purchase of drugs, and transportation fees to the Sihanouk Hospital Center of Hope in Phnom Penh for those patients who require additional care.



One such patient at the Rovieng clinic is Leng Hak, pictured at left with one of his ten grandchildren.⁶ Mr. Hak, who is 68, has been a telemedicine patient for more than a year. Although he did not know the medical terminology for his condition, he reports having been unable to walk during his initial telemedicine consultations. He now takes medication regularly and has his condition monitored remotely. On several occasions, on the advice of doctors at the Sihanouk Hospital Center of Hope and Partners Telemedicine, he has traveled to Phnom Penh to undergo lab tests and receive additional care. He now demonstrates his progress in walking—and navigating the steps up to his family's traditional wooden home, lifted 12 feet off the ground by stilts—with satisfaction and pride.

⁵ Photo courtesy of AAfC.

⁶ Mr. Hak has agreed to share his name, image, and story publicly.

V. Applied Lessons: Innovations Based on Experience from the Rovieng Clinic

The Markle Foundation Telemedicine Clinic was designed to benefit from and build on knowledge gained from the telemedicine clinic in Rovieng in several ways:

- **Measurement of Impact**

Assessment of telemedicine's impact is an important component of understanding its potential value and enhancing the performance of the clinics in both Ratanakiri and Rovieng. The foundation funded the administration of survey on telemedicine patients' quality of life, satisfaction with services, and willingness to pay for future consultations. The survey was designed and analyzed by Partners Telemedicine and administered by AAfC.⁷ As far as Markle and its partners know, this survey represents the first application of a quality of life instrument to assess the impact of a telemedicine clinic in a developing country. The findings are discussed in the next section.

- **Extension of Access via Wi-Fi “Motomen”**

The Markle clinic and the AAfC schools in its region are part of an innovative initiative that cost-effectively extends the reach of the Internet via a wi-fi network. Within Ratanakiri Province, poor roads and distance isolate villages. Many of these villages have no phones, TV, electricity, water, transportation system, or much contact with the rest of the province or country. Fourteen of them do have AAfC-built schools, each with a solar-panel fueled computer. While it would be prohibitively costly to dedicate satellite dishes to individual villages in this area, or to create a wire-based network among them, they are now being linked to each other and to the Internet wirelessly via a mobile send-and-receive system. Twice a day one of a small fleet of motorcycles is driven past each of 14 computer-equipped schools and the satellite hub, the Markle Telemedicine Clinic.



Each motorcycle is outfitted with a wireless antenna and a data storage box (see photo, above). As it drives past a school, the motorcycle can transmit e-mails and information from web sites. This mechanism allows people to send e-mail and effectively surf the web in a time-delayed fashion. The schools, in addition to the clinic, are becoming community hubs from which villagers can send and receive questions and information about their personal health, regardless of whether they are able to travel to the Markle clinic, as well as communication on other topics. This so called “Motoman” initiative was designed by the Cambridge, Massachusetts-based firm First Mile Solutions in association with AAfC.

⁷ “Quality of Life, Satisfaction and Willingness to Pay Assessment of the Telemedicine Clinic in Rovieng, Cambodia” by Heather A. Brandling-Bennett, BA, and Joseph C. Kvedar, MD, unpublished.

- **Connection to a Hospital**



The Markle clinic was established within a regional referral hospital, rather than as a freestanding building or in association with a smaller health center, such as the one in which the Rovieng clinic is located. This arrangement enables the Markle clinic to benefit from the hospital's facilities and professional staff, and also saved money on construction. As a result of the clinic's link to the regional

hospital, telemedicine staff is able to acquire and e-mail laboratory data, x-rays, and ultrasound images in addition to descriptive text messages and digital photos. (Photo from AAfC.)

- **Orientation for Volunteers**

Project leaders at Partners Telemedicine observed that American-based physicians who participated in telemedicine consultations at the Rovieng clinic sometimes lacked a clear understanding of the environmental conditions and constraints of patients and health care providers in Cambodia, and therefore suggested courses of treatment or other actions that were not feasible. In response to the need for greater understanding, an orientation document has been prepared for American telemedicine volunteers.

New Lessons Learned

At the writing of this report, the Markle Telemedicine Clinic has been operating for less than a year. Nevertheless, the foundation and its partners have already been able to extract some useful lessons from it in addition to those already applied from the Rovieng clinic.

For example, one of the greatest applications of telemedicine is in building the skills and expertise of health care providers. As mentioned previously, Cambodia lacks an adequate number of trained health practitioners such as doctors and nurses; and, those who are in practice often lack rigorous and extensive training. According to Dr. Gary Jacques, Director of the Sihanouk Hospital Center of Hope in Phnom Penh, telemedicine enables his staff (and volunteers at Partners Telemedicine) not only to reach distant patients, but to train and mentor the health care providers based in the regional referral hospital where the clinic is located. The telemedicine links enable otherwise isolated Ratanakiri doctors to learn not only how to treat individual cases, but about the underlying methodologies and mindsets on which their highly educated and experienced colleagues' practice is based. At the same time, volunteers in Phnom Penh and in the United States deepen their understanding of medicine as practiced in a remote, resource-poor region, while learning about tropical diseases.



Also of value are the results of the patient survey on quality of life, satisfaction, and willingness to pay for telemedicine services. This initial translation into Khmer of a quality of life and symptom scale instrument is likely to be useful in future studies. The survey was administered in April of 2003, and, while it did not yield the expected results with regard to quality of life, it did produce valuable information pertaining to patient satisfaction.⁸ Forty-six percent of sixty-three patients of the Rovieng clinic responded that they had been “very satisfied” and 54% reported that they had been “satisfied” with their experience at the clinic.

None reported being “neither satisfied nor dissatisfied,” “dissatisfied,” or “very dissatisfied.” This positive response is augmented by anecdotal evidence. In the words of one of the AAFc survey administrators: “They [patients] said they can be alive because of our telemedicine clinic. Some of them said they are having next life because of our telemedicine clinic. And they thank us very much.”⁹ (The photo above is of a villager from Ratanakiri province.)¹⁰

In addition, the survey yielded positive results with regard to patients’ willingness to pay for telemedicine consultations in the future—the majority of patients indicated that they would. The median amount suggested by patients was \$0.63. While this may sound low relative to outside standards, it is important to consider that the average annual per capita income in Rovieng is about \$40. According to an informal survey, consultations at public hospitals in Phnom Penh range from \$0.50-\$1.25, consultations at provincial hospitals are about \$0.25, and consultations at district health clinics are about \$0.13.¹¹

VI. Future Challenges

While the Markle Telemedicine Clinic has already made significant contributions to the health of villagers in rural Cambodia and to the knowledge base of health care professionals in Cambodia and beyond, several challenges remain for the future. Two of particular salience are 1.) Expanding understanding and analysis of the clinic’s impact, and 2.) Developing mechanisms to support the clinic’s ongoing financial sustainability.

⁸ In a forthcoming journal article, Partners Telemedicine discusses the impact of the clinic based on the survey findings as well as on additional data that demonstrate a positive correlation between patient use of the clinic and improved health.

⁹ Partners Telemedicine.

¹⁰ Cropped from a photo taken by Karen Jacques.

¹¹ From Brandling-Bennett and Kvedar, unpublished.

Because telemedicine is still relatively new to rural Cambodia, and indeed to much of the rest of the world, there is a great deal to be learned about how best to apply it. Efforts such as the patient survey described above should be strengthened so that telemedicine can be understood and applied in a more systematic and scientific way. Future evaluations should also assess such innovations as the “Motoman” wi-fi Internet delivery service. In addition, the importance of human factors, such as the training of doctors and nurses, cannot be underestimated and deserves study. Ultimately what is needed is a rigorous cost/benefit analysis; by learning about what works and what doesn’t, health practitioners associated with this project and others will be able to use limited resources more effectively. (The photo is of a mother and child in Rovieng.)



Another area that requires some work is the challenge of generating revenue to support telemedicine activities. In the long term, it may be appropriate to integrate telemedicine into the Cambodian government’s national health care system. Even in that case, however, any outside infusion of funds will be helpful. Efforts by AAfC in the area of revenue generation are already well-underway. In particular, Cambodians in the Rovieng and Ratanakiri areas are working with AAfC staff to re-learn some of the traditional crafts and activities that were nearly lost during the Khmer Rouge years. In Rovieng, village women weave silk scarves on wooden looms. In Ratanakiri, they produce brightly-colored blankets and hangings of a thicker natural fiber blend. In addition, villagers harvest and roast coffee beans and produce note cards from hand made paper. These crafts both perpetuate some of the traditional skills from the area and provide a source of revenue for the workers who produce them and for the clinic and AAfC’s related activities. (Photo of weaving in Ratanakiri by Karen Jacques.)

AAfC is in the process of revamping its web site to encourage an increased number of e-commerce sales of such products.¹² Markle staff has been working with AAfC to enhance the success of its marketing activities. AAfC’s products are also distributed via local Cambodian and international stores. Although these activities do not yet represent a significant source of income, it is hoped that they will be able to bring in considerable funding in the future. In combination with fees contributed by patients themselves, such commercial activities could significantly support the costs of telemedicine activities in the coming years.

¹² See <http://www.villageleap.org>

VII. Conclusion

This paper is intended to contribute to the general knowledge regarding ICT for development projects in health. The Markle Foundation hopes that its investments in the telemedicine clinic in Ratanakiri will continue to improve and perhaps save lives, and also contribute to the work of others engaged in similar projects throughout the world.

While the Markle Foundation has concentrated its health care focus toward the United States, it encourages other foundations, NGOs and individuals to continue the pioneering work associated with the telemedicine clinics in Cambodia—through financial and other contributions to the ongoing efforts of AAfC, the Sihanouk Hospital Center of Hope, and Partners Telemedicine.



A rural Cambodian family