Highlights

- In Bhutan, patients incur high costs to reach health care centers. This spurred the Royal Government to explore innovative approaches to providing quality health care.

- The Asian Development Bank partnered with Bhutan in 2013 to pursue electronic approaches that address rural connectivity deficits in a cost-efficient way. These include e-Health and Television White Space.

- The pilot demonstrated how countries can use technologies to improve provision and delivery of health care services. Faster medical diagnoses help patients receive timely and much-needed medical treatment.

Developing e-Health Capabilities in Bhutan

BACKGROUND

Bhutan is characterized by steep, high mountains crisscrossed by rivers that form deep valleys before draining into the plains of India. Its constitution mandates the Royal Government to provide its population with free access to basic public health services and security in the event of sickness.

However, some 80% of Bhutan's population[1] live in settlements where health care facilities are usually more than an hour's walk away, and many districts are connected only by mule tracks. It can take an ambulance more than 20 hours to reach the capital of Thimpu, where there are more extensive health facilities and services.

The country's rugged topography and underdeveloped road network—affected also by pavement conditions, sheer drops, hairpin turns, inclement weather, and landslides—have serious implications for the provision of health care. Another challenge is the country's limited health care workforce. Currently, there are only 12 health care professionals per 10,000 people in Bhutan, lower than the World Health Organization's benchmark of 23 per 10,000 people.

Thus, high costs[2] are incurred when patients and medical equipment must reach health care centers from remote locations. Communicable diseases, such as HIV and hepatitis B, and the burden of emerging and reemerging diseases, e.g., rabies, severely strain Bhutan's capacity to provide equitable access to health.

To address this issue, Bhutan introduced Health Help Centers in 2009. The centers' services include emergency response and health care helpline services through a toll-free number accessible from mobile phones, fixed landlines, and public call offices. However, more still needs to be done to improve the centers' use of information for decision making and to design more effective interventions. In fact, since 2000, the government has been pursuing innovative approaches, including e-Health.

APPROACH

e-Health. Bhutan has successfully tapped e-Health to meet the demand for quality and accessible health care. It involves the internet and other related telecommunication technologies to facilitate efficient communication and delivery of health services. It covers the electronic generation, transmission, and filling of a

Before and after (inset) the installation of the Television White Space antenna and base station at a health center in Tang, Bhutan.
Photo by the Basic Health Unit Team

medical prescription, and sometimes electronic transmission of prescriptions from doctors to pharmacists. It also encompasses telemedicine or distance treatment. e-Health also makes use of virtual health care teams—health care professionals who collaborate and share information on patients through digital equipment, and health care information systems that provide software solutions for appointment scheduling, patient data management, and work schedule management. It likewise covers health knowledge management.

Meeting a Steep Challenge through Technology and Partnership. However, Himalayan mountains, valleys, and sub-tropical forests defy terrestrial broadband connectivity. In such circumstances, the cost of deploying conventional connectivity solutions such as terrestrial and satellite-based connections and the limited prospects of generating revenue from related investments are major deterrents. Then again, with the advent of mobile technology, fiber optics and—especially where latency[3] is an issue—Television White Space (TVWS) can tackle last-mile connectivity issues progressively with wireless functionalities.

The Technology. White Space refers to the high-quality, underutilized portions of the radio frequency spectrum. It is available for unlicensed public use and includes frequencies

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[1] Bhutan's population of 742,000 (2012) lives in scattered settlements over 38,400 square (km²). This makes for a very low population density of 19 persons per km².

[2] The Bhutan National Health Accounts for 2009–2010 reveal that 44 percent of average household health care expenditure is spent on transport, 33 percent on medicine, 12 percent on other expenditures, and 11 percent on consultation fees.

[3] Latency is the time it takes a packet, viz., a piece of transmitted message, to travel from source to destination. Together, latency and bandwidth define the speed and capacity of a network.

ADB

allocated for analog television and those used as buffers to prevent interference between channels. Large portions of the spectrum are commonly unexploited and can be opened up, for example to stimulate the development of wireless technologies and services. In 2013, Bhutan partnered with the Asian Development Bank (ADB) and Hewlett Packard (HP) to connect patients from a basic health unit to service providers in a district hospital. The TVWS's frequency signals can penetrate foliage and works well in difficult terrain, making the technology highly relevant to Bhutan.

The Partnership. In 2013, ADB and Bhutan, in association with HP, joined hands to establish e-Health capabilities in the Bumthang District in the central-eastern region of the country. Bumthang's population is just under 20,000, one of the lowest population densities among the country's 20 districts. The partnership delivered three outputs. Firstly, it provisioned a dedicated internet lease line of 2 megabytes per second (mbps) in the Wangdicholing District Hospital in Bumthang. Secondly, it deployed last-mile connectivity[4] of 2 mbps at the pilot location using TVWS technology. Lastly, it established an e-Health Center within the Basic Health Unit in the small remote town of Tang, 20 kilometers southeast of the Wangdicholing District Hospital.

The Connection. To deliver these three key outputs, an internet lease line capacity was procured from Bhutan Telecom Ltd. Point-of-presence infrastructure—including routers and switch—were then established to carry broadband signals through TVWS using Bhutan Telecom Ltd.'s telephone exchange in Tang.[5] The White Space component was configured and tested successfully. Thereafter, the e-Health Center was established by retrofitting a room at the Basic Health Unit with automated medical equipment. Next, patients' vital records were stored in a cloud-based system hosted in the United States.

Linking Patients with Health Care Providers. In parallel, business processes were developed to allow doctors at the Wangdicholing District Hospital to access patient records, consult patients by Skype call or videoconference, and prescribe treatment and medicine. Medical diagnoses were also stored in the cloud server. Patients are given a printed copy of diagnoses at the Basic Health Unit.

RESULTS

The pilot has offered benchmarks with which to compare other connectivity mechanisms, such as Worldwide Interoperability for Microwave Access and wireless connection or WIFI. It also provided practical insights into demand generation, infrastructure upgrade, capacity development, and policy requirements. These

Television White Space antenna and base station system configuration at a health center in Tang, Bhutan.

Diagram by the Basic Health Unit Team

may be useful in identifying operational issues and approaches to scaling up countrywide, which can assist Bhutan's Health Help Centers in extending their services.

The pilot also specifically showed how TVWS can quickly address rural connectivity deficits in a cost-effective way. Currently, important TVWS deployments are taking place in Africa and Asia and the Pacific. The largest TVWS deployments to date are in the archipelago of the Philippines, spurred by the need to provide critical communications for relief after the destruction of the Bohol earthquake and Typhoon Haiyan.

More importantly, the pilot demonstrated how countries can use technologies to improve provision and delivery of health care services. In the Bumthang District of Bhutan, rural people living in remote locations were provided a low-cost and convenient access to important health services. The pilot clearly demonstrated that with faster and more efficient provision of medical diagnoses, patients can receive timely and much-needed medical treatment.

Related Link

- Project Data Sheet: www.adb.org/projects/47222-001/details

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[4] "Last mile" refers to the final leg of a telecommunications network delivering connectivity to a client (the part that actually reaches him/her).

[5] The aerial distance between the equipment and the Basic Health Unit is 5 kilometers.
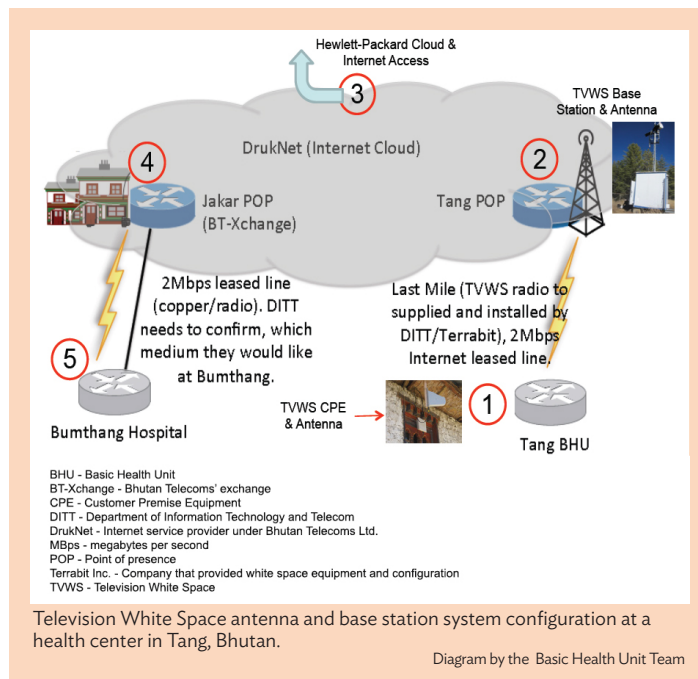
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