

A Doctor in Your Pocket

Health Hotlines in Developing Countries

Afiya lives in the rural Sylhet region of Bangladesh. For two days, her youngest daughter, Rubina, has been complaining of fatigue and has felt warm to the touch. Taking the child to the nearest clinic would cost Afiya a day's lost wages, round-trip bus fare, and clinic fees of Taka 200 (U.S. \$3). Instead, Afiya and her husband use the family's mobile phone to dial "7-8-9," the *Healthline* hotline service set up by TRCL, Ltd., a telemedicine firm, and GrameenPhone, the country's largest mobile network operator. The family quickly reaches Dr. Quadri at Healthline's call center in Dhaka. After asking a few questions, Dr. Quadri tells her to give Rubina small regular doses of paracetamol, available at neighborhood shops. For the three-minute call, Afiya pays only Taka 15 (U.S. \$0.21) from her family's GrameenPhone prepaid talk-time balance.

Afiya is not the only person seeking basic medical advice and information by calling a health hotline. Telephone-based nurse triage, primary care, and health information have been offered in developed countries since the late 1990's, and

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today are available to about 150 million people in the United States, Britain, Australia, Canada, New Zealand, and elsewhere.¹ More recently, health hotlines like Healthline have emerged in developing countries, and have already been used by more than 10 million people in Mexico, India, Pakistan, and Bangladesh.² New hotlines are being set up in the Middle East, the Caribbean, Latin America, and Southeast Asia.

Health hotlines are medical call centers that provide health-related information, advice, referrals, and sometimes prescriptions to individual callers over a phone line. Callers are connected to health professionals (nurses, paramedics, or physicians), who usually follow standard protocols to assess medical situations and provide information and advice.

Now that there are more than four billion mobile connections³—most in developing countries—health hotlines accessible to mobile phone subscribers can bring basic health information and care even to people in sparsely-populated or low-income areas where there are few health care facilities and doctors. Fifty-five percent of calls to Healthline in Bangladesh are from rural areas, and 77 percent of callers are women. Of rural callers, 81 percent are women, of whom two-thirds are calling about their children's health.⁴

The GSM Association—the global trade association for mobile network operators—and its Development Fund believe that health hotlines can transform health care for poor people just as mobile phones are revolutionizing financial services (“mobile money”). Health hotlines are simple to understand (“call a doctor”), provide immediate assistance, and are available to anyone with a mobile phone. The reach and branding of a mobile network operator (MNO), and the scalability of call-center technology may mean that health hotlines serve vast numbers of people in the coming years.

As a first scan of the approach, this report tracks hotlines operating in developing countries, assesses their social and commercial success to date, and offers suggestions for governments, industry bodies, and development agencies to advance this approach.

In the next section we define the health hotline model and present a brief landscape of health hotlines in operation today. Section 3 spotlights four of the most prominent health hotlines in developing countries and compares their business approaches. In Section 4 we assess their commercial viability and potential for growth, and in Section 5 we evaluate their potential for social impact. Finally, Section 6 offers thoughts on how development agencies and governments can support the health hotline phenomenon.

Our findings are largely based on visits to and interviews with four health hotlines in developing countries, as well as on secondary research and phone interviews with academics and technology vendors. The four health hotlines we studied in depth are:

- Healthline (Bangladesh)
- Teledoctor (Pakistan)
- HMRI (India)



Figure 1. A doctor answering calls at MedicallHome in Mexico.

- MedicallHome (Mexico)

These hotlines, three of them private and for-profit services, and the fourth a public not-for-profit service, emerged from the health care, call center, technology, and mobile phone industries. Each provider has partnered with health care companies or professionals, government agencies, and fixed-line or mobile network operators to develop its service.

THE HEALTH HOTLINE MODEL: PHONE-BASED PRIMARY CARE

Defining Health Hotlines

We define a health hotline as a service whose main goal is to provide medical advice and information over the telephone, and which has the following four characteristics:

- It primarily gives information to callers who are individual patients, but may also serve medical personnel or health workers.⁵
- It delivers information to callers mainly through a voice call, over the caller's wireless or land line telephone connection.
- It is primarily inbound, meaning that the service receives many more calls than it makes; the limited number of outbound calls may be for follow-up or reminders.
- Callers may be anywhere, and need not be at a specific location, such as a

telemedicine center, a health clinic, or with a health worker.

Health hotlines provide some or all of the following information and services to callers:

Medical information, including the location and availability of nearby hospitals, clinics, laboratories, or other facilities;

Triage: identifying whether the caller should be directed to emergency, administration, or medical consultation services;

Consultation: discussing the caller's condition with him/her as a first line of care ;

Diagnosis: determining the caller's health issue based on information gathered;

Referral: "pushing" the caller to the next level or type of health service, such as an in-person consultation at a clinic;

Treatment: recommending the next step in terms of care, such as prescribing medications, prescribing care by another health care provider, or prescribing a plan of action for the caller or the caller's caregiver;

Counseling: providing support and encouragement to callers with specific mental or physical ailments;

In some instances, *discount purchasing*, or access to special pricing for private medical care or prescriptions.

Our definition draws clear boundaries between health hotlines and other health services that make use of a mobile phone. Because anyone is eligible to call the health hotline, we exclude medical call centers that are dedicated to specific employers or that offer after-hours triage for patients of a specific physician's practice. Because callers can be anywhere, we exclude telemedicine programs that require callers to visit rural kiosks where they are connected to doctors via video and/or voice. And by including only services that are predominantly inbound (that receive more calls than they initiate), we exclude public health data collection and health awareness initiatives that use mobile phones to gather information or to push public health messages with textmessaging and voice calls.

The Health Hotline Landscape

For over a decade, call centers have been used for telemarketing, customer support and other business functions, although the practice is on average six to eight years old in the developing world.⁶ But staffing call centers with doctors or other medical personnel to create health hotlines is a relatively more recent phenomenon in these markets.

As Table 1 shows, health hotlines may be sponsored by a government, a health-care provider, or an MNO, and some are independent.⁷ Sponsoring does not imply that the MNO or government is putting up all the funding, is operating the service, or is even the lead partner in it. Rather, by sponsoring we mean acting as the "public face" of the initiative.

Government-sponsored hotlines. In general, these are designed to supplement existing public health facilities and reduce the total cost of care to the public health system. HMRI in India was set up as a public-private partnership between the state

Type	Developed countries <i>Country, Name, Launch date (where available)</i>	Developing countries <i>Country, Name, Launch date (where available)</i>
Government-sponsored	<p>Australia</p> <ul style="list-style-type: none"> - HealthDirect (Northern Territory) - HealthDirect (South Australia, 2006) - HealthDirect (Western Australia, 1999) - Health First (Australia Capital Territory) - National Health Call Centre Network or <i>healthdirect</i>, 2007 - Nurse-on-Call (Victoria, 2006) <p>Canada</p> <ul style="list-style-type: none"> - Fonemed (for USA callers, 1999) - Telehealth (Ontario, 2001) <p>New Zealand (Healthline, 2006)</p> <p>South Africa (Eastern Cape Health Call Centre, 2007)</p> <p>United Kingdom (NHS Direct, 1999)</p>	<p>India (HMRI, 2007)</p>
Healthcare provider-sponsored	<p>United States</p> <ul style="list-style-type: none"> - Informed Health Line (Aetna) - FirstHelp Nurse Advice Line (MedicareBlue PPO) - dozens of others... 	<p><i>None identified</i></p>
MNO-sponsored	<p><i>None identified</i></p>	<p>Bangladesh (Healthline, 2006)</p> <p>Pakistan (Teledoctor, 2008)</p>
Independent	<p>United States</p> <ul style="list-style-type: none"> - MedicalHome USA - Teladoc, 2007 - Telamed (Puerto Rico) 	<p>Colombia (Telemedic)</p> <p>Mexico (MedicalHome, 1998)</p> <p>Mexico (Telemedic)</p> <p>Dominican Republic (Telemed)</p> <p>Philippines (Fonemed Asia-Pacific, <i>planned</i>)</p> <p>Trinidad and Tobago (MedStar Health Information, 2004)</p>

Table 1. Known Health Hotlines, December 2008.

government of Andhra Pradesh and the Satyam Foundation. Although it is not a government agency, its services are promoted publicly as initiatives of the state government, under the *Rajiv Arogyasri* scheme of the central government. The state government covers 95 percent of direct ongoing costs, and Satyam Foundation covers 5 percent.

Healthcare provider-sponsored hotline. In developed countries, after-hours nurse triage services or pediatric nurse hotlines are set up by hospitals, private physician practices, health maintenance organizations, and insurance companies to supplement in-person care, reduce unneeded visits, and lower costs.

Mobile Network Operator (MNO) sponsored hotlines. Although Healthline in Bangladesh and Teledoctor in Pakistan are managed independently by telemedicine companies, these firms promote their health hotlines jointly with MNOs to gain retail access to individual consumers, collect payments, and leverage the MNOs' consumer brand recognition.

Independent hotlines. These hotlines are not affiliated with a specific health care provider, MNO, or other group. All of the independent health hotlines listed in Table 1, including MedcallHome in Mexico, were set up in conjunction with Fonemed, a U.S.-based provider of software and triage protocols to medical call centers globally. MedcallHome acquired a competitor in Mexico in 2008, eliminating the one independent hotline not affiliated with Fonemed.

All hotlines we identified in developing countries, except HMRI in India, are MNO-sponsored or independent, while those in developed countries tend to be sponsored by governments or health care providers. As a result, health hotlines in developing countries tend to have three characteristics:

- They are for-profit, instead of not-for-profit.
- They market their services directly to individual consumers and charge them, instead of charging governments, health insurance companies or employers.
- They partner with MNOs or other telecom firms that have a wide retail presence, brand recognition, and substantial billing and revenue collection systems.

HEALTH HOTLINES IN DEVELOPED COUNTRIES

Health hotlines have a longer operating record in Australia, Canada, and Britain than in developing countries, although most offer telephone triage by nurses rather than consultations with physicians. Studies that track the dominant government and health care provider sponsored hotlines in developed countries seem to offer several main findings:

- *Health hotlines receive large numbers of calls.* Western Australia's *HealthDirect* health hotline, launched in May 1999 as the first in the country, had over 1.4 million calls a year by December 2006. This is an impressive figure considering that the state's population is only 2.1 million.⁸ Furthermore, about 10 percent to 15 percent of all calls received were from rural parts of the state in the first 12 months that the service was available there.⁹ In the UK, NHS Direct took five million calls in 2007.¹⁰

- *Most callers are women and mothers.* Between 2001 and 2006, 40 percent of callers to Ontario's *Telehealth* service were mothers asking about their children's symptoms.¹¹ In the UK, 60 percent of callers to NHS Direct are women.¹²
- *A significant percentage of calls result in self-care.* According to Ontario's Ministry of Health and Long-Term Care website, 43 percent of callers received advice on self-care, 35 percent were advised to visit a physician, and only 16 percent were considered urgent.¹³
- *Most callers report being satisfied with the service.* In New Zealand, 97 percent of callers surveyed in an independent evaluation said they were very satisfied or satisfied with their *Healthline* contact, and 98 percent said they would call again.¹⁴ In the UK, 95 percent of callers to *NHS Direct* rated the care and service as "excellent," according to the service's customer satisfaction surveys.¹⁵
- *Evidence of cost savings to general practitioners (GPs) and public health services is mixed.* In a rural New Zealand pilot, two-thirds of calls to *Healthline* were made after hours, and two-thirds of these were triaged to a low level of care that did not require calling the rural clinic's on-duty doctor.¹⁶ Similarly, a three-year study in Australia found that use of telephone triage seemed to have reduced GP claims for after-hours service.¹⁷ But the UK's *NHS Direct* faces consistent criticism that its cost per call (estimated at £16.54 at the end of March 2008) is too high relative to the cost to the National Health Service of a GP visit (£20 to £25).¹⁸
- *Employers and insurers in the U.S. seem to save with health hotlines.* Between them, *Fonemed* and *Intellicare*—the two major U.S.-based medical call center providers—have more than a thousand healthcare facilities and insurers as clients.
- *Callers generally accept and follow the advice given.* A study of a telephone triage service among several hundred uninsured people in Kansas found that 98 percent of callers agreed with the advice given, and 90 percent reported following up on the advice given.¹⁹ In France, 70 percent of callers to the Grenoble university hospital hotline complied with the medical advice given. Compliance was 61% among patients who were advised to treat themselves, 84 percent among patients who were advised to consult a general practitioner during business hours, and 64 percent among patients who were advised to go to the emergency department.²⁰

Health hotline providers also contend that proper information, provided at the right times, can dramatically reduce the overall cost associated with health care. Informed individuals can prevent adverse health outcomes, treat some conditions themselves, and make the right decisions during medical emergencies. Health professionals, with the right information, can make better decisions on triage and diagnosis and give patients a better understanding of their conditions. All of these actions can reduce the cost of health care and improve its quality.

Still, the health hotline delivery model is not a full substitute for traditional, in-person modes of health information delivery. Several factors also limit the ability

Country	Infant mortality rate per thousand live births (all 2006 data)	Maternal mortality ratio per 100,000 live births (all 2005 data)	Years of life lost due to communicable diseases (%) (all 2002 data)
Bangladesh	52	570	60
India	57	450	58
Mexico	22	63	27
Pakistan	78	320	70
Russia	10	28	8
United Kingdom	5	8	10
United States	7	11	9

Table 2. Sample Health Indicators, Selected Countries.

Source: World Health Organization Statistical Information System (WHOSIS), The three indicators are often used to monitor progress against the health-related Millennium Development Goals established by the United Nations. Goal 4 is to reduce child mortality, Goal 5 is to improve maternal health, and Goal 6 is to combat HIV and AIDS, malaria, and other diseases.

of health hotlines to provide information and advice to callers. First, some callers require in-person consultations, prescription drugs, or other treatments that may not be affordable even if they are available nearby. In these cases, having diagnosed the patient's ailment, the hotline can do little else.

Second, health hotlines have limited ability to follow up with callers to understand the results of their information and advice. Patients do not regularly call to report the results after they complete a course of treatment or act on the hotline's advice. This makes it difficult for hotlines to judge how successful their interventions have been and how to adapt their protocols or recommendations. If anything, the patient is more likely to call back if the advice or prescription has not worked.

Rationale for Health Hotlines in Developing Countries

The poor state of health care systems and outcomes in developing countries is widely documented (Table 2).

The poor state of the health care infrastructure in developing countries is at the root of these disparities; Table 3 provides some examples. Seven characteristics apply to the health care delivery systems in these countries.

Country	Births attended by skilled health personnel (%)	Hospital beds per 10,000 population	Total health workers per 10,000 population
Bangladesh	20 (2006)	3 (2001)	5 (2001)
India	47 (2006)	9 (2003)	14 (2003)
Mexico	83 (2005)	11 (2002)	28 (2001)
Pakistan	54 (2006)	12 (2005)	12 (2003)
Russia	100 (2006)	97 (2006)	128 (2003)
United Kingdom	99 (1998)	39 (2004)	75 (2001)
United States	100 (2004)	32 (2005)	125 (1999)

Table 3. Sample Health System Indicators, Selected Countries.

1. *They lack primary care physicians or other health professionals.* Developing nations continue to face a shortage of health care workers, particularly in remote and rural areas. Individuals and governments do not have the resources, either financial or academic, to properly train and develop health professionals.

2. *People lack the financial resources to consult better quality providers.* Physicians, especially specialists, are often located in urban areas and tend to be quite costly because of the high demand for their time and services. Increasingly, higher-level health practitioners are migrating to wealthier regions because they can earn more for their work, creating a brain drain. This raises the cost of accessing a physician or specialist for people in poor and rural communities.

3. *Going to a health facility has a high effective cost.* “A recent study conducted by the Indian Institute of Public Opinion found that 89% of rural Indian patients have to travel about 8km to access basic medical treatment and the rest have to travel even farther.”²¹

4. *Primary health care facilities are of low quality and personnel are often not highly skilled.* The lack of infrastructure in rural health care facilities makes it difficult to attract and retain qualified professionals. A quality assessment of 44 randomly selected rural private practitioners in Maharashtra, India, found that only 20 percent of the practitioners recorded the patient’s blood pressure, only 30 percent recorded their temperature, and none recorded a provisional diagnosis. Only

Problem	Infrastructure / Setup
Limited number of medical professionals and mid- and lower level providers	Rely on base of existing urban (or even off shore) health professionals
Limited financial resources to consult better providers	Low cost per-call or per-minute pricing model and low calling Charges
High transaction costs for visit and Use	Anytime, anywhere access via mobile phones
Poor quality of facilities and Personnel	Strict hiring criteria, staff training, and standardized triage and diagnostic protocols, often tied to brand of MNO or government \ agency (which creates an incentive for quality care)
Lack of correct information about facilities, medicines	Database of facilities and professionals and standardized drug information
Reliance on informal, untrained Providers	Accepting calls for advice from “quacks” and rural clinicians, and certifying and training them
Poor timing of delivery	Round-the-clock call center shifts to handle expected call volume
Limited privacy when visiting local clinic	Randomized call routing unless caller requests a particular doctor or nurse

Table 4. Health Hotline Solutions to Information Constraints.

20 percent explained the prescription to patients.²²

5. *People lack basic information about the location and availability of pharmacies, clinics, and laboratories, and about prescription medicines.* No formalized distribution or supply-chain systems lead to pharmacies stocking key medicines and medical supplies. In addition, few if any drug regulatory agencies or protocols are in place to guarantee that drugs are accurately compounded or that they actually are produced.

6. *People widely consult with informal, sometimes traditional, health care providers who may not be trained or ethical (e.g. quacks).* India boasts top specialty clinics and hospitals, yet is also plagued by practitioners who falsely claim expertise. “Quacks” provide health consultations and medications in lieu of public providers, but are notorious for misdiagnosing illnesses and prescribing the wrong and potentially harmful medication to patients.

Healthline (Bangladesh)	Teledoctor (Pakistan)	HMRI '104' (India)	MedicalHome (Mexico)
Orientation For-profit Telmedicine firm and MNO	For-profit Telmedicine firm and MNO	Not-for-profit Government and a private charity	For-profit Call center entrepreneurs
Sponsors Telmedicine firm and MNO	For-profit Telmedicine firm and MNO	Not-for-profit Government and a private charity	For-profit Call center entrepreneurs
Mission (summarized) Be a first reference point to complement conventional health solutions	Provide cheap, easy access to experienced doctors	Create platform to enable 1 billion virtual and 1 billion physical service contacts	Be the first choice in private health services
Major services - Phone consults - Information on facilities, drugs - Test result interpretation - Discounts on hospital visits	- Phone consults - Information on facilities, drugs - Test result interpretation - Discounts on hospital visits	- Phone consults - Counseling and complaints - Information on facilities, drugs - Mobile health clinics (vans)	- Phone consults - Information on facilities, drugs - Discounts at clinics, pharmacies
Eligible users GrameenPhone mobile phone subscribers (20 million)	Telenor mobile phone subscribers (18 million)	Residents of Andhra Pradesh state (77 million)	Telmex fixed-line telephone subscribers (10 million)
Unique callers to date 3.5 million, since Nov 2006	500,000 since Mar 2008	4.4 million, since Aug 2007	(1 million subscribers)
Fee charged for 3 minute call US\$ 0.21 (BDT 15)	US\$ 0.30 (PKR 24)	US\$ 0.00 (free)	N/A (unlimited calls for US\$ 5.00 monthly)
Top caller complaints - Chronic diseases (40%) - ENT, early pregnancy, malaria, pneumonia (each 8%) - diarrhea (7%)	- Diarrhea and vomiting (gastro-enteritis) - Gynecological ailments and obstetrics - Fever (usually associated with respiratory tract infections)	- Recurring abdominal pain (13%) - back pain (9%) - knee pain (8%)	N/A

Table 5. Health Hotline Providers.

7. *People perceive that they cannot have privacy if they attend a neighborhood clinic or physician.* This perception varies, depending on the culture of a given region, but it is often an issue for those dealing with issues of sexual health and diseases that have social stigmas attached to them, such as HIV/AIDS.

Even where providers make a special effort to extend public health services to underserved communities, the poor often continue to prefer to visit more expensive private facilities. The All India Institute of Medical Services (AIIMS) offers a mobile health clinic in the slums of New Delhi; an evaluation found that more than two-thirds of respondents (70.5%) to a community survey preferred private practitioners or private hospitals, and far fewer (12.9%) preferred the mobile clinic. Reasons for this preference included more faith in private practitioners, the clinic's inconvenient schedule, and long wait times at public facilities and the mobile clinic.²³

Poor information also leads to poor health care outcomes. Individuals spend time and money to go to the doctor because they don't know that the condition doesn't warrant it, or they travel long distances only to find that a health care provider is unavailable. Public clinics triage a large number of patients who didn't know that a visit was unnecessary, sometimes making people with more serious ailments wait. In addition, health workers and caregivers in rural areas do not have the depth of knowledge to address many complaints, but they have no backup or peer from whom they can get advice.

How health hotlines can help

By making each telephone a possible "touchpoint" where people can access quality health information, a health hotline creates a low-cost, widespread infrastructure model for the delivery of health information and solves several of the constraints described above. We have summarized these solutions in Table 4.

Mobile network operators, which have played a key role in developing health hotlines in Pakistan and Bangladesh, provide key functions in developing this infrastructure. In many markets, MNOs have the largest retail penetration of any private enterprise. They also rank highest in brand recognition, and can deploy tremendous financial resources to setup new services. More than four billion mobile phone connections are now active, making it possible for even the very poor (many of whom use mobile phones today) to access health hotlines.

Perhaps most important, MNOs have established mechanisms for billing and collecting revenue in tiny increments. For health hotlines that wish to reach the broadest possible customer base, simple ways of collecting revenue are essential. Virtually nothing is more commonly traded in developing countries, though in small amounts, than the prepaid airtime distributed by MNOs. In India, for example, a Rs. 10 (U.S. \$0.20) talk-time top-up is widely available at corner stores and market vendors. By piggybacking on the MNO's prepaid billing and account management systems to charge people for using their services, health hotlines gain immediate access to millions of potential customers.

The transformative power of mobile networks has been demonstrated in

Feature	Healthline (Bangladesh)	Teledocter (Pakistan)	HMRI (India)	MedicalHome (Mexico)
Launch date	November 2006	March 2008	August 2007	[1998]
Sponsorship	MNO	MNO	Government	Independent
Average calls received/day	10,000	1,000	50,000	10,000
Near-term objectives	<ul style="list-style-type: none"> - Increase range of services - Expand internationally 	<ul style="list-style-type: none"> - Integrate with physical telemedicine kiosks and pharmacies 	<ul style="list-style-type: none"> - Increase female callers - Integrate with rural clinics and mobile vans 	<ul style="list-style-type: none"> - Maintain subscriber base
Service Profile	<ul style="list-style-type: none"> - All doctors - Lab report interpretation, discounts - Medium 	<ul style="list-style-type: none"> - All doctors - None - None (planned for 2009) 	<ul style="list-style-type: none"> - Some doctors - Referrals, complaint line, (more planned) - High 	<ul style="list-style-type: none"> - Some doctors - Referrals, complaint line, discounts - High
Revenue model	Charge a premium rate per minute	Charge a premium rate per minute	Government pays costs	Charge monthly subscription for unlimited calls
Role of telecom partner(s)	<ul style="list-style-type: none"> - Marketing and promotion - Billing and revenue collection - Voice bearer 	<ul style="list-style-type: none"> - Marketing and promotion - Billing and revenue collection - Voice bearer 	<ul style="list-style-type: none"> - Voice bearer 	<ul style="list-style-type: none"> - Shareholder - Billing and revenue collection - Voice bearer

Table 6. Key Strategic Decisions, Four Health Hotlines.

Kenya, where Safaricom (a leading MNO) has been able to attract nearly five million subscribers to its mobile money transfer service, *M-PESA*, in only two years. In comparison, only about five million Kenyans have bank accounts.

FOUR HEALTH HOTLINE CASES

To better understand the commercial viability and social impact of the health hotline model in developing countries, we studied four hotlines in depth: Healthline (Bangladesh), HMRI (India), MedicallHome (Mexico), and Teledoctor (Pakistan) (see Table 5). In this section, we review the business approach of each hotline, and how they manage operational challenges.

Business approach

Understanding the business approach of each hotline can yield insights about its likely impact on social development, and its viability in the long run. In this context, categorizing hotlines by their type of sponsorship is useful because the sponsor's identity suggests the business approach of the service.

It appears that three key business decisions lie at the heart of each hotline's overall business approach:

- What services will be offered to customers?
- How will revenue be generated?
- What partnerships with telecommunications firm(s) will be set up?

How each provider makes these decisions flows from the provider's mission, the context of its health system, and its commercial requirements—at a minimum, the need to cover costs. These questions also reflect a close parallel between the health hotline business and other mobile phone-delivered services, such as mobile phone banking. All of these businesses involve five elements:

- *Per-unit pricing.* MNO-sponsored health hotlines charge customers per minute (as premium rate calls) or per call (for calls under three minutes, for example).
- *Significant costs of system setup and maintenance.* Providers must invest in telecommunications and networking hardware infrastructure, and software that tracks and routes calls and/or automates triage and initial diagnosis via standardized protocols.
- *Channel partnerships.* Health hotlines rely on MNOs or land line telephone companies to carry their voice and data traffic and handle billing and revenue collection.
- *Content partnerships.* Doctors and other medical professionals are employed to give callers health information, or “premium content.”
- *Marketing partnerships.* Hotlines co-brand their offering with mobile operators to achieve quick recognition and credibility; operators may market services as a differentiator to retain customers or promote the company's social responsibility.

Like mobile banking providers, health hotlines face the challenge of generating enough revenue to cover the ongoing costs of paying content and their channel partners and the amortized fixed costs of the technology and systems.

	Healthline (Bangladesh)	Teledoctor (Pakistan)	HMRI (India)	MedicallHome (Mexico)
Summary of Integration approach	Expand rural Telemedicine facilities	Establish presence at pharmacies and Expand telemedicine	Multiple interventions in rural areas to strengthen and Supplement health system	Integrate patient records with existing facilities and build new clinics
Healthcare delivery activities	Deploy telemedicine kiosks in rural areas linked to health hotline	Deploy phone and video units at pharmacies linked to health hotline	- Mobile vans - Train rural health workers - Video-con hospitals and doctors	Network of 10 clinics built
Data-sharing activities	Single patient record	N/A	Single IT platform with data shared among blood banks, hospitals, mobile vans, health hotline, etc.	Get clinics and physicians on single IT platform for single patient record, discounts
Cost recovery model	Charge callers	Charge callers for phone, video calls	None (government funded)	Referral fees to physicians, hospitals

Table 7. Approaches to Integration with Physical Health Facilities.

Table 6 summarizes the key business decisions of each of the four hotlines studied.

In summary, the four hotlines seem to have made the key business decisions listed above very differently, depending on whether they are sponsored by an MNO or the government, or are independent. What is strikingly similar is the common ambition to integrate their virtual (or phone-based) service with the physical health care delivery system. All indicated that the health information service is only one piece of a larger strategy to facilitate physical health care—via telemedicine kiosks, mobile health vans, enhanced emergency transport services, or improved rural clinics.

Otherwise, the revenue model and relationships with telephone companies are structured a certain way for the MNO-sponsored hotlines, and quite differently for the government-sponsored and independent hotlines (HMRI and MedicallHome, respectively). This fact seems to validate the basic typology of the hotlines proposed. But as health hotlines are still in an infant stage, and because they can change type, future studies may yield very different conclusions.

Decision 1: What services to offer?

As shown in Table 6 above, this question really has three dimensions: who, what,

and how much? That is, who should be hired to answer calls: doctors, nurses, paramedics, or non-medical personnel? What services beyond basic health information should be provided? And how much integration with brick-and-mortar health facilities should be sought?

The answers to these questions are remarkably similar across the four health hotlines we studied.

All hotlines employ different types of “call agents”—including doctors but also nurses, paramedics, and non-medical personnel—or expect to do so in the near future. Although the founders of Healthline and Teledoctor have argued that employing doctors early in their existence has been useful in generating market trust and establishing quality service, commercial realities are coming to the fore. Both of these hotlines expect to employ non-doctors as call agents shortly, as they are more available and less costly.

Call-agent salaries are the major ongoing cost that health hotlines incur. Providers must ensure that each shift at the call center has enough agents on hand, but not so many that their time is not used well. In some countries, such as Bangladesh, enough doctors are available at low enough salaries that Healthline has been able to cover costs, employing 50 doctors in shifts to handle 6,000 to 10,000 calls per day. On average, ten doctors answer calls during shifts of six or seven hours each, and are each paid about 18,000 taka (U.S. \$300) monthly. In Mexico, on the other hand, although MedicallHome pays about U.S. \$1,000 a month²⁴ to each doctor for half-time work, it keeps only 15 doctors on hand per shift as opposed to 100 non-medical call agents. Three-quarters of its calls are purely for information and not for consultation.

The health hotlines are also similar in the services offered beyond health information. All of the health hotlines studied, except Teledoctor in Pakistan (the newest), offer physician referral services, discounts at hospitals and pharmacies, and interpretation of lab tests. MedicallHome in Mexico issues customers a “medical card” that brings discounts from five percent to 50 percent at selected clinics, hospitals, opticians, labs, and other health facilities.

Healthline is now exploring the potential to generate revenue from its referral service, by developing a mobile phone based system for issuing electronic prescriptions and referring patients. The company envisions charging callers for the ability to refer them automatically to clinics and physicians, and for issuing prescriptions via SMS.

Finally, all of the sponsors we interviewed argued that it is imperative to integrate with physical health service points and facilities; phone-based information services alone are insufficient to meet all of their objectives of improving health care, especially for under-served communities. To distinguish how each hotline is approaching this task, we looked at their overall approach, their activities in healthcare delivery and data-sharing, and their cost recovery model. This analysis is summarized in Table 7.

HMRI in India is perhaps the most integrated; it operates more than 100 mobile vans with diagnostic equipment that travel through rural areas each

month. It also trains and certifies rural medical practitioners and ‘quacks’ to provide better in-person care, offers an emergency toll-free number and ambulance service, and maintains a customer complaint system for all public and private hospitals in the state. Since all of these services share a common database and technology platform, the health hotline can serve as patients’ single contact point to get information or schedule services.

Decision 2: What revenue model?

On a first glance at our four health hotline examples, the choice seems quite simple. As described earlier, because MNOs make it possible to collect small amounts of revenue, health hotlines can charge per minute. This makes the price per call relatively low, and expands the potential user base for the service—including the poor. The two MNO-sponsored hotlines use exactly this revenue model to cover their costs: most callers to Healthline and Teledoctor are using their prepaid GrameenPhone or Telenor mobile subscriptions, and are therefore charged a per-minute rate.

MedicallHome in Mexico proposed a similar arrangement to a leading mobile carrier, but found the price of this arrangement too high—the MNO sought 50 percent of all revenue in return for making this billing and collection system possible. As a result, MedicallHome serves only those customers with land line phones, and charges a monthly subscription fee rather than a per-call amount. This arrangement is more affordable and the costs are in line with what Teledoctor and Healthline are charged by their MNOs. Because MedicallHome bills through its customers’ TelMex accounts, it inherently serves people who are middle-class or affluent. It also packages discounts at a network of pharmacies, hospitals, and clinics along with its health hotline services. As a result, its customers can afford to pay a monthly subscription instead of paying per call or per minute.

But these are not the only two revenue models available to health hotline providers. Charging insurance companies and governments for the benefit of avoided emergency room and doctor visits may be more attractive to health hotline providers, as it aggregates volume quickly, costs less in marketing and promotion, and ensures a more reliable revenue stream.

Decision 3: How to partner with network operators?

All four of the hotlines have relationships with mobile or land line network operators—from co-owning the business to simply contracting an MNO to carry voice traffic. In general, telephone network operators (whether fixed or mobile) can offer five assets to health hotline providers:

- *Bearer channel(s)*, in this case the voice channel, for the interaction between the caller and the health hotline. All health hotlines rely on telecoms for the bearer channel—most often voice, but sometimes also text messaging for registration confirmation, sending test results, or other services.
- *Shortcode*, an abbreviated phone number (such as 7-8-9 or 9-1-1) that cus-

tomers can call instead of dialing a number that is nine or ten digits or longer. Shortcodes must be negotiated individually with each telecom so that subscribers to any telecom can dial the same number to reach the service.

- *Billing and revenue collection.* Hotline operators find it extremely valuable to use a telecom's billing and revenue collection system, as that lets them avoid creating such a system themselves. Customers need only pay their telephone bill or have sufficient prepaid talk time to be able to call the health hotline.
- *Marketing and promotion.* MNO-sponsored health hotlines rely on telecom companies for marketing and promotion. Teledoctor and Healthline are both branded by their MNO partners, which helps in public awareness and credibility on a national scale.
- *Capital.* In only one case have we seen a telecom operator take an equity ownership stake in the health hotline business. In Mexico, TelMex owns a large minority share of the MedicallHome business.

In return, operators get non-financial and financial benefits from partnering with health hotline providers. From a purely financial standpoint, operators can expect incremental revenue from each subscriber, since callers to Healthline or Teledoctor must be subscribers to the network. Although it is probably too soon to judge the magnitude of returns for either Telenor in Pakistan or GrameenPhone in Bangladesh, GrameenPhone has reported being satisfied with the commercial results from its Healthline partnership. In Mexico, MedicallHome reports that its fixed-line operator partner, TelMex, is pleased with its share of the hotline's subscription revenue (in return for which it only handles billing and collection).

The greatest short-term returns to operators seem to have come from a non-financial standpoint: helping to bring reliable health advice to unserved areas can boost brand value. GrameenPhone in Bangladesh won the "Best Use of Mobile for Social & Economic Development" category of the GSM Association's 3GSM Global Mobile Award in 2007. Telenor in Pakistan and GrameenPhone also advertise health hotlines as value-added services to set themselves apart from competing MNOs and to build brand loyalty with subscribers. Both of these MNOs value the health hotline services for enhancing brand value and winning public recognition that they are good "corporate citizens."

In the medium and long term, an improved corporate social responsibility image may also reduce customer turnover and lower the cost of acquiring new customers. But it is too early to attempt to quantify these financial benefits, even if this were a simple task.

Managing Operational Challenges

Health hotline providers must tackle three key operational challenges:

- Medical liability and negative public relations.
- Non-standard information or advice.
- High turnover among call agents.

Limiting medical liability and negative public relations

Because they provide callers with health and medical information that callers then use as the basis for self-treatment or doctor visits, health hotlines may find themselves accused of providing the wrong information or suggesting the wrong course of action.

None of the health hotline operators interviewed stressed this as a major risk, in part because they do not perceive the health systems in India, Mexico, Bangladesh, and Pakistan to have a high level of litigation for medical malpractice. And at least one study in the United States suggests that inappropriate telephone triage in primary care results mainly in temporary and minimal harm to patients.²⁵

Still, the four hotline operators we interviewed recognize the need to standardize information and advice (as discussed in the next section) as one way to avoid such an outcome. MedicallHome is seeking multiple certifications as a call center, including certification from ISO (the International Standards Organization); it also maintains a dedicated complaints line to resolve complaints and disputes rapidly.

On the other hand, partners of these health hotlines, particularly the MNOs in Bangladesh and Pakistan, saw the potential for considerable public relations risk from complaints and potential litigation for incorrect advice or information. In Pakistan, *eHealth Services*, the Teledoctor hotline manager, specifically sought and received an endorsement from the Ministry of Health in Sindh province, at the request of Telenor. Telenor also maintains the following disclaimer on its Teledoctor webpage:

Telenor neither gives secondary medical advice directly nor engages in the practice of medicine. In all cases Telenor is not accountable for the malpractices, genuineness or authenticity of the advice/information given through this service or for the credentials of the medical experts giving the information/advice and Telenor shall not be liable for any loss or damage caused to any subscriber or any other party as a result thereof.²⁶

Interestingly, Healthline in Bangladesh faces the opposite problem. On occasion, one of the call center doctors will diagnose an ailment that requires a certain prescription medicine to treat. However, due to the absence of law on providing prescription and non-prescription drug formularies over phone, Healthline's management does not permit its doctors to give a prescription over the phone. Callers often plead with doctors to prescribe something for their illness or pain, but the doctors can only respond by asking the caller to visit a clinic or physician for an in-person consultation.

Ensuring standardization of information

Health hotline providers take several steps to standardize the information they provide to callers. First, some use software with built-in protocols that guide call agents through a series of questions. As the caller gives responses to the questions,

the protocol narrows down the possible causes of the ailment and the recommended treatments. Fonemed, a U.S.-based company, has deployed this software internationally at a number of existing and soon-to-be-launched health hotlines (including MedcallHome in Mexico). In the Philippines, for example, Telemed Asia-Pacific plans to launch a new health hotline staffed by nurses who will use the Fonemed software to diagnose patients and recommend treatment. The software walks the nurse through standard protocols developed in the United States for adults and children.²⁷ Taking this approach can ensure a standardized service at a lower cost than employing doctors to answer all calls.

HMRI in India took a similar approach by building an automated diagnosis Decision Support System in-house to allow paramedics to diagnose minor ailments. Doctors at the hotline are only consulted on complex cases. The system includes 175 algorithms developed internally to diagnose ailments and 570 disease summaries—standard scripts that call agents read aloud to callers to explain their condition and recommended treatment. A key performance indicator for the hotline is the percentage of callers who can be diagnosed through its 175 custom algorithms.

In Bangladesh, Healthline decided that because it uses licensed doctors to answer calls, it does not need standard protocols to arrive at a diagnosis of the patient's condition and to deliver standard treatment (as these protocols are focused on guiding nurses, according to Healthline). For the doctor, following the protocol would restrict flexibility in the line of questioning, and prevent the doctor from quickly reaching to complaints or ailments common in Bangladesh (but not included in standard protocols built into off-the-shelf software). Instead, Healthline relies on training its doctors and documenting a history of patient records to yield standardization and common responses from the team.

Teledoctor in Pakistan also found that standard protocol-based software was costly and time-consuming for doctors. Instead, it relies on a quality control team that randomly monitors calls to ensure a proper standard of information and advice. The team reviews individual patient health records that the doctors maintain through Teledoctor's software to ensure that doctors have been maintaining a high quality of service.

Retaining doctors and nurses

Though these operators provide competitive compensation and supplement the income their staff members earn at hospitals and in private practice, all the operators concede that managing the turnover in call agents is a challenge. HMRI in India expects its annual turnover to settle within the 15 percent to 30 percent range. The main reasons for agent turnover include a lack of in-person interaction with patients and the sense of boredom that comes from repeatedly providing similar, standardized information to callers over a period of four to eight hours each day.

As in any business, turnover has several impacts: the operators need to hire and

train replacement staff, accumulated knowledge may be lost when a call-taker leaves, and morale and productivity can drop when turnover reaches a critical level.

The health hotlines we studied described a range of strategies to cope with, or mitigate, this turnover. MedcallHome in Mexico tries to balance its own demands on doctors with their other interests and responsibilities. It pays its doctor call agents a wage comparable with what they would earn in a traditional position: about U.S. \$1,000 per month for working half-time. It contends that because they make it a part-time rather than full-time position, the doctor can still have face-to-face patient interaction, increase his or her experience base by handling many patients, and keep skills sharp—all while satisfying the desire to perform traditional consultations.

At the other end of the spectrum, Healthline in Bangladesh believes that turnover of doctors is healthy. TRCL operates the hotline with full-time doctors and encourages them to leave after two to three years to pursue higher studies or fellowships that will strengthen their clinical skills. After this amount of time, most lose their focus and motivation to handle phone-based consultations. Healthline's management believes that working in a medical call center is a wonderful transition job for young doctors, to fine-tune their clinical expertise and knowledge in a challenging and dynamic environment, and to become familiar with technology that can help doctors increase clinical efficiency. To ensure a regular flow of doctors to staff the hotline, the firm is based in the Dhanmodi residential area of Dhaka, where medical colleges and physician practices are concentrated.

COMMERCIAL RESULTS OF HEALTH HOTLINES

Health hotlines are interesting from a commercial standpoint, since they offer callers low-cost access to basic health information and consultations and provide competitive differentiation for mobile operators and possibly reduce subscriber churn; they may also make public health care provision more efficient. Insofar as they are profitable, health hotlines may be poised to scale far beyond the size of most mobile health services deployed to date.²⁸

In this section, we address two questions. First, is the health hotline business viable, today and for the long term? Second, what are the commercial limits to this business, in terms of its potential for scale and its ability to be replicated across markets?

Viability of the Health Hotline Business

Since all four of the hotlines studied operate in competitive environments and take a strong commercial approach to their businesses, we are not able to discuss key financial results. However, the three for-profit companies report healthy profits or at least say they cover costs. Based on the cost structure of the health hotline model, the viability of these operations is a sign that the providers have been able to offset the variable costs of call agents (doctors, nurses, and non-medical personnel) and the amortization of the callcenter setup, with revenue from callers. As a

further sign of their confidence in the model's financial viability, Healthline and MedcallHome have begun expanding internationally in partnership with local players and commercial financiers. Teledoctor is planning similar expansion in the coming year or two.

But it is not clear that health hotlines can be expected to continue on an unabated path to large scale and further profits. Our analysis of these four relatively young hotlines suggests several areas of vulnerability. These concerns are most relevant to hotlines that are sponsored by an MNO or a government. In essence, the risk is that the operating partner's demand to scale up and expand its scope may not be matched by that of its partners—whether they are MNOs, governments, or other actors. At the least, a mismatch could lead to friction and delay, and insufficient financing for new opportunities.

Partners in the MNO-sponsored model may find themselves moving at different speeds over time. The two health hotline providers, TRCL (Bangladesh) and eHealth Services (Pakistan), have formed ambitious plans to add new mobile-enabled services to their portfolio, including electronic prescriptions, automated referrals, and video consultations via telemedicine. But MNOs, which have aggressive targets to increase penetration in relatively open markets, may prioritize investments to expand their core business rather than allocating resources to develop new health hotline services.

A similar challenge may await the government-sponsored model. As HMRI's scope and scale increases, neither the state government nor the Satyam Foundation (privately funded by the founder of Satyam Computer Services) may have the financing to keep it free of cost to customers. In addition, there is always the risk that a government-funded program will lose funding or support should the government change. This may be a minor risk given the professionalism and wide reach of the HMRI service and the level of funding made by private donors and industry. Still, this is a long-run risk to the viability of the government-sponsored approach.

Commercial Limitations of the Model

Some observers, seeing the success of health hotlines in reaching relatively large numbers of people, including those in hard-to-reach and rural areas, have wondered how big this model can grow, and how easy it is to replicate in developing countries. In general, it seems that scaling up the health hotline to handle more and more calls will be an easier task than expanding the scope of the service to integrate with physical health care facilities.

Increasing scale: Expanding call volumes

For operators scaling up call volumes, technology does not seem to be a constraint. The technology and human resources that make up a call center can theoretically support far greater numbers of concurrent calls. While not specifically for a health hotline, an international consortium in Karachi, Pakistan is building what will house the world's largest call center, with 10,000 seats (the largest, in Sydney, has

8,000 seats).²⁹ By comparison, the largest health hotline today, HMRI, maintains just over 400 seats to handle 50,000 calls per day. Extrapolating from the staffing of the four health hotlines we studied, a 10,000-seat call center would be able to handle more than one million calls per day.

Existing health hotlines maintain excess technical capacity, although some systems are likely to need upgrading or even “re-architecting” as volumes multiply. TRCL in Bangladesh reports that its existing call answering and routing systems can handle up to 240 concurrent lines, although only about 15 are used today at peak hours. New entrants to each of these markets would also be able to handle latent demand and increased call volumes.

Instead, the main constraint to scaling up call volumes is likely to be the limited availability of physicians and other medical personnel to staff the health hotline. Also, some health hotline operators report a lack of funding for expansion.

In Bangladesh, for example, the management of Healthline sees real challenges in identifying, hiring, training, and retaining 500 doctors to answer hundreds of thousands of calls daily. Although the company does foresee changing its staffing complement to include paramedics and nurses, health hotlines in many countries may not be able to take that approach. Whether the need is doctors or less-experienced medical personnel, the health system and existing educational institutions in the countries examined will probably not be able to keep providing the number of staff required if call volumes rise quickly and dramatically.

A further constraint is the simple fact that the hotline operator may not have an interest in scaling up call volumes beyond a certain point. In Mexico, MedicallHome is interested in maintaining a subscriber base of about one million households in the face of significant (15 percent) annual turnover within this base. Similarly, TRCL in Bangladesh and eHealth Services in Pakistan plan to expand the scope of their health hotline services, which may require paying less attention to acquiring new callers and expanding call volume.

Solutions to these constraints may include an expansion in the number of medical education providers, systems that route calls directly to doctors and other medical personnel rather than requiring them to sit in call centers, and locating health hotlines offshore, in markets with a greater availability of personnel.

Increasing scope: Integrating with the health care infrastructure

The constraints to expanding the functionality of health hotlines may be harder to overcome than those to simply increasing call volumes. Several health hotline providers now envision connecting their service to rural medical practitioners, health clinics and labs, and even urban hospitals. But if many more people call the hotlines and require referrals to clinics, lab testing, or medicines from pharmacies, these physical service points may find themselves stretched beyond their capacity. Also, the standards and collaboration required to connect all of these organizations—from both a regulatory and a technological standpoint—are not in place. For example, today most developing country health systems lack any unique sys-

tem for identifying patients who reliably use multiple health providers, insurance companies, and other health facilities.

Replicating health hotlines

The high demand for health care services and health information across developing countries, and the successful track record of the health hotlines studied, would suggest a rationale for setting up similar services in new markets.

If a government wishes to set up a health hotline, special conditions need not apply. If committed to the idea, policymakers should be able to adapt regulation and enlist private firms and foundations to set up a health hotline service. But based on the experience reviewed in this report, we see two sets of exogenous factors that will determine whether a for-profit health hotline can launch. These are, first, the conditions of the market, and second, the openness of health policy and regulation.

At the market level, there are three requirements. First, there should be a critical mass of individuals willing to pay for phone-based health information. Based on the experience of Healthline and Teledoctor, it seems that even reaching a level of 10,000 calls per day can generate sufficient revenue to cover costs.

Second, the health hotline must be able to partner with at least one MNO or other firm with a large-scale retail business, in order to be able to collect payments from callers or subscribers. Collecting payment by credit or debit card through the Internet or over the phone may be possible in some places, but in many markets this would restrict the potential user base to only middle-class or affluent customers. In some least-developed countries, the only potential partners with sufficient retail reach are MNOs. Ensuring their buy-in and resource commitment may be essential to the feasibility of a new health hotline.

Finally, there should be an adequate supply of relatively low-cost, qualified health personnel to staff the hotline. In countries without such a supply, it may be feasible to “offshore” the hotline to a neighboring country or one with the same language.

In most developing countries, no specific regulation is in place that either promotes or prohibits these services. Instead, health hotline operators have had to secure regulatory permission to run the service by situating it within existing healthcare, call center, and telecommunications regulations. To do this, providers setting up new health hotlines have made regulators comfortable with their commitment to quality, their business approach, and their systems.

In general, they do not perceive this process as having been very difficult. According to one hotline manager, the health system needs are so great that the country’s regulators are permitting all sorts of providers—even those with minimal or no formal training—to advertise themselves as health care professionals. Therefore, even though health care regulators are not entirely sure how to treat the health hotline, they are satisfied with a provider that is licensed by some regulatory authority, can show that its staff has medical certifications and experience, and

can demonstrate that its processes and protocols are standardized and of good quality.

The main requirement from a regulatory standpoint, therefore, is that health regulators be open to considering a new approach led by private firms, and willing to grant some regulatory space and flexibility to permit this innovative model to emerge.

In Mexico, MedicallHome operates with a legal opinion that draws a distinction between its service and activities regulated by the General Health Act. According to the opinion, the act makes no limitation regarding the service of medical advice via telephone, as it is not considered a medical consultation as established elsewhere in the Mexican regulation. (To be a medical consultation, a physician must conduct a physical examination of the patient.) MedicallHome's hotline is only treated as a value-added service under the Federal Telecommunications Law, and is licensed to operate as a call center in Mexico.

In Bangladesh, the health hotline is treated differently. TRCL, the hotline operator, is registered as a health related information, technology, and service company, received a license under the telecommunications regulator's new call center licensing regime, and is also considered a value added service provider to telecommunications firms and taxed at 5.5 percent on all call charges. Although there is no formal regulation governing phone-based medical consultations, the government has implicitly legalized this activity by announcing that all public health centers at the sub-district level will be equipped with mobile phones to answer calls from patients at no cost.³⁰

These examples suggest that an enabling regulatory framework is one that permits the setup of a new call center, allows health information and advice to be delivered over the telephone, and does not overly tax mobile phone "value-added services," such as health information. Doing so would raise the price of calling a health hotline above a level that poor customers can afford.

THE SOCIAL IMPACT OF HEALTH HOTLINES IN DEVELOPING COUNTRIES

At least six factors determine the social impact of a health hotline:

- The degree to which the population served lacks other sources of affordable and accurate health information;
- The nature of health inquiries that a population directs to the health hotline;
- The quality of the information provided;
- The affordability of the service;
- The ease with which even the least empowered and technology-savvy individuals can access it;
- The degree to which the hotline supports and shares information with local healthcare providers;

Understanding social impact, therefore, requires an analysis of both the hotline itself (the "supply side") and the population it targets and serves (the "demand

Feature	Healthline (Bangladesh)	Teledocor (Pakistan)	HMRI (India)	MedicallHome (Mexico)
Diarrhea	7% (child)	“very common, for children”	1.1%	8%
HIV/AIDS	2% (HIV/STDs)	“STDs common but no disclosure of HIV status”	0.7%	0%
Malaria	8% (82% calls from rural areas)	“very common”	0.5%	0%
Maternal, Newborn & Child Health	13% (early pregnancy, pre-birth) (71% calls from rural areas)	NA	0.2% (maternal) 0.4% (newborn & child)	0.7%
Pneumonia	8%	“very common”	0.0%	0%
Tuberculosis	5% (64% calls from rural areas)	NA	0.1% (but fever 4.3%)	2%

Table 8. Estimated Calls Related to Serious Diseases or Conditions.

side”).

In this study we did not specifically analyze the cost, availability, and quality of the health information already accessed by the people whom the health hotlines target in developing countries. We do not know of any such rigorous impact assessments being conducted. And since the health hotlines identified in developing countries have only been operating for two to three years, the results of such evaluations might still be years away.

Instead, we can draw some early insights about the likely social impact of health hotlines in developing countries based on two sources of information. First, a handful of small “point-in-time” surveys and some anecdotal evidence suggest that health hotlines are having a positive impact on people’s lives. We can also examine the data these four hotlines collected through their call-tracking software. In examining this impact, we will consider two types of benefits to society: direct benefits to callers, and indirect benefits to the health system as a whole.

Early evidence of impact

Based on initial surveys and anecdotal evidence, we draw four early insights about the social impact of the hotlines we studied:

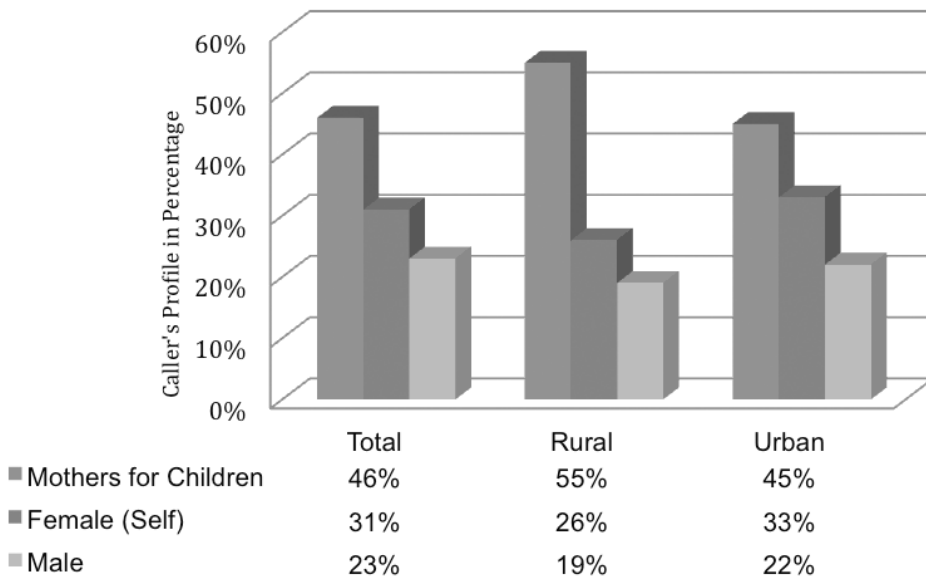


Figure 3. Callers to Healthline (Bangladesh).

Source: TRCL, Bangladesh.

- Health hotlines may reach people who have historically had poor access to quality, affordable primary care.
- In some cases, many people who call health hotlines are battling diseases or conditions that affect large populations in the developing world.
- Using health hotlines instead of traveling to physical health care providers appears to save people time and money.
- Callers are generally satisfied with the quality of information and advice they receive from these hotlines.

Health hotlines may reach people that who historically had poor access to quality, affordable primary care.

A survey³¹ of 253 callers to Healthline in Bangladesh, selected at random from among GrameenPhone’s subscribers and asked questions adopted from the Patients Satisfaction Questionnaire (PSQ-18),³² found that most callers had income below the poverty line (56 percent), and that most were located in rural areas (63 percent). Of those in rural areas, 72 percent reported not having access to a modern health care provider within a five mile radius of their home.³³ Figure 2 shows a further breakdown of callers to the Healthline service by gender, role, and geographic location, based on TRCL’s internal survey of 2,160 callers over a period of one month during the last quarter of 2008.

Not every health hotline studied reported serving a similar demographic pro-

file. HMRI in Andhra Pradesh, India, reports that 90 percent of its callers are men, and nearly 40 percent are between the ages of 15 and 24. Still, 20 percent come from India's most disadvantaged communities (scheduled castes and tribes), and an estimated 70 percent from rural areas.

In Mexico, on the other hand, although gender information was not available, the typical caller is from an urban location and is middle class. The pricing of the service—a subscription of MXP 50 (U.S. \$3.64) per caller per month—is likely to rule out those who are poor. (According to Mexico's Secretary of Social Development, urban dwellers earning up to MXP 42 per day are classified as living in poverty.)³⁴ For a poor person, it would not make sense to pay more than a day's earnings to subscribe to a service he or she might not call. The customer base is further restricted by the necessity of owning a fixed-line phone connection; Telmex, the country's fixed-line operator, handles the billing for MedicallHome by including it as a service on monthly phone bills. And there are only ten million fixed-line connections in the country. Finally, MedicallHome has tracked 80 percent of its calls as originating in 21 cities.

Significant percentages of callers suffer from serious diseases and conditions.

Table 8 shows the percentage of callers from each of the hotlines who are suffering from a serious disease or condition, or were diagnosed with that ailment by the hotline. Receiving phone-based advice on treating these conditions may be valuable. A recent study in Pakistan found that home-based treatment of children with pneumonia was as effective as hospitalization, the course of action recommended by the WHO protocol.³⁵

According to Healthline's founder, in 2009 the company aims to serve more than six million diabetes patients in the country, two million children up to age five who often suffer from diarrheal diseases, and about one million patients suffering from tuberculosis (TB).

Teledoctor recently took special initiatives to serve people suffering from respiratory tract infection (RTI), pneumonia, influenza, and dengue, particularly when many people were sleeping outdoors after the earthquake that occurred in Baluchistan on October 29, 2008. Telenor, the hotline's MNO partner, made all calls to the Teledoctor service free for one month, and the hotline's call volume doubled. In addition to hiring extra doctors to staff the hotline, the company recorded preventative information about malaria and dengue fever for callers to listen to while they were on hold waiting to speak to a doctor.

In India, HMRI has prioritized its battles against diabetes, hypertension, and asthma in rural areas, as large numbers of people remain undiagnosed.

Using health hotlines instead of traveling to physical health care providers can save people time and money.

On this question, the survey of Healthline users in Bangladesh again yields useful data.³⁶ By using the service, most callers reported saving travel time (98 percent)

and money (91 percent), and experiencing shorter wait times (97 percent) and reduced doctor's fees (83 percent).

HMRI in India makes a similar case for the cost savings it creates, by analyzing the high cost of health care for rural villagers. According to its research, the rural "out-of-pocket" expenditure on health care, relative to household income, is five times higher than for urban dwellers. And since 70 percent of healthcare spending is out-of-pocket, rural citizens carry virtually their entire health care burden on their own shoulders. Transportation costs are a big part of this disparity: in one community, HMRI found that 19 of 22 rural villages lay more than 3 kilometers away from a primary health care center. Meanwhile, 95 percent of the primary users of a health clinic lived within a distance of three kilometers. Therefore, rural villagers apparently go without health care, or spend exorbitant amounts to access it.

In addition to saving rural and urban callers money by reducing their need to visit clinics or physicians, several health hotlines take advantage of their relatively large numbers of users to give callers discounts at these facilities, hospitals, laboratories and pharmacies. MedcallHome in Mexico gives subscribers discounts of up to 50 percent at nearly six thousand clinics, hospitals and pharmacies. Healthline in Bangladesh text-messages discount "coupons" to frequent callers that they can present at hospitals for discounts of 10 percent off hospital bills.

Callers are generally satisfied with the quality of information and advice they receive from these hotlines.

HMRI in India reports a customer satisfaction score of 4.3 out of 5.0 from its regular customer satisfaction surveys. Similarly in Bangladesh, Healthline received a score of 4.36 out of 5.0 in a customer satisfaction survey conducted by AC Nielson during the first quarter of 2008, Fifty-nine percent of callers surveyed rated the service "excellent" and 22 percent labeled it "fair." And 68 percent said the information they received was "very helpful."

Indirect Benefits of Health Hotlines

In addition to direct benefits, health hotlines may perform some functions typically covered by other parts of the public health system at lower cost, thereby indirectly improving the efficiency and quality of these facilities.

For example, HMRI in India estimates that of the 600,000 outpatient visits that go unmet in Andhra Pradesh, about 60 percent may be conducted without an in-person consultation, and 55 percent of ailments may be treated at home without a doctor. Through phone-based triage and consultation, health hotlines can take on a function that would ordinarily be performed by primary health facilities. Rural health clinics and medical practitioners benefit indirectly when fewer patients show up, and those who do can be offered more attention.

Limitations of Social Impact

Still, several factors may limit the social impact of health hotlines.

Affordability

Evidence from India and Bangladesh suggests that pricing may be too high for the very poorest. Healthline in Bangladesh charges callers only 15 taka (U.S. \$0.22) for the first three minutes and 5 taka (U.S. \$0.07) per minute thereafter, including the cost of the prepaid talk time. Still, Healthline's management and some of the callers it randomly surveyed acknowledge that this cost is too high for many potential users.

Availability

Poor mobile coverage and call quality is also a barrier to use in both India and Bangladesh. The managers of HMRI in India say that despite claims of near-universal mobile network coverage in the state, only about 50 percent of the state's geography is reached. Several phone numbers from which the largest numbers of calls originate are public telephones in areas where mobile coverage is poor. Furthermore, as many as 50 percent of the average daily 50,000 calls to HMRI are cut short because the signal is poor or interrupted.

Accessibility

Managers of HMRI in Andhra Pradesh are also concerned about the accessibility of their hotline to women, given that women make up such a relatively small percentage (10%) of the callers. Meanwhile, 60 percent of callers are males under age 25 who inquire about sexuality, acne, and other issues of concern to their demographic group.

Two possible explanations are that because the service is free, more young men are likely to use it casually or make prank calls, and that far fewer women than men use mobile phones in Andhra Pradesh. More research is needed to better understand caller demographics. But call pricing may explain more than gender differences: Healthline in Bangladesh charges callers but reports high usage by women.

In the short term, HMRI is making it a priority to rebalance its caller demographics through health care camps that operate temporarily in a given location, mobile vans, and dedicated marketing, among other strategies.

Integration

Finally, because the patient database and electronic health records that health hotlines maintain on callers are not accessible by local clinics, laboratories, or hospitals (and vice versa), it is not possible for hotlines to communicate with these health care facilities to improve patient care. Patient information captured at any one location would ideally be shared with other facilities and the hotline to ensure a complete picture, avoid gathering information multiple times, and improve accuracy. Local practitioners would know if callers to a health hotline needed follow up or in-person visits.

CONCLUSION: OPPORTUNITIES FOR SUPPORT

In Section 5, we presented initial evidence of the benefits that health hotlines can

have for poor people in developing countries. On the basis of those arguments, we suggest that opportunities exist for donor agencies, governments, and industry bodies, including the GSMA Development Fund, to support the emergence and growth of health hotlines. We conclude with some thoughts for these actors: first policymakers and regulators, and then donors.

Considerations for Policymakers and Regulators

The first step for policymakers is to develop a view on the role (if any) that health hotlines should play in the health system. The state government of Andhra Pradesh in India took the position that a free, high-quality hotline would go far towards increasing the penetration of health information and basic care into areas that were mostly unserved. Similarly, after seeing the success of Healthline in Bangladesh, the country's Health Ministry announced that it would equip all public hospitals in the country's 481 sub-districts with mobile phones to answer calls from patients at no cost.³⁷ On the other hand, Mexico's health ministry seems to have chosen to allow private health hotlines to emerge. One explanation offered by observers is that it sought to avoid the political opposition that would arise if jobs in government hospitals and clinics were replaced by seats at a private call center.

After establishing a vision of the role that the hotline can play in the health care system, a reasonable next step for policymakers would be to calibrate the level of intervention in the market required to achieve that desired state. In other words, should policymakers allocate funding to develop a free public health hotline? Should they instead encourage private health hotlines to develop, and rely on them to serve poor people who do not have good access to health care? Or, do some private hotlines already in operation need incentives to target poor and rural communities in addition to the higher-income market segments that they already serve? And, as always, what are the political priorities and competing resource demands, and how much attention is available to dedicate to this topic? This second step requires policymakers to ground their vision in market and political realities.

Should policymakers decide that health hotlines are an integral part of their public health systems, they may wish to ensure that barriers to their setup and growth are tackled. For instance, health policymakers could require that public and/or private doctors or paramedics spend part of each work week helping staff health hotlines. This could reduce the need for private operators to compete for these doctors and could ensure that the model can be scaled up. Governments could also subsidize calls to health hotlines from people who live in areas that are underserved by the public health system. This could be done simply, with private health operators being reimbursed for calls customers make from fixed-line numbers in particular geographic areas or in the vicinity of specific mobile base stations.

At the very least, governments may decide that setting regulatory parameters can help ensure that any private health hotline activity results in positive outcomes for poor people. People with limited financial resources often lack the education and experience with formal services that they need to make good decisions about

their health care (or their money, or anything else). As described above, operators of private health hotlines will certainly take strong steps to mitigate risks and avoid litigation, but they also have incentives to act in ways that do not necessarily serve the public interest. For instance, a private hotline may decide to refer customers to clinics or hospitals that pay better referral fees. Or, it might not make clear and simple disclosures to callers about the limitations of its advice and the need to visit a physician in person.

One approach, therefore, might be to establish minimum standards of quality, availability, and public disclosure. In the area of emergency response (calls to 911 lines), some governments mandate that calls be answered in a certain amount of time and that certain information be collected. In this area, it might be worth considering similar rules. They could govern, for example, the amount of capacity the call center should have, the minimum medical qualifications of call responders, and the minimum frequency and type of training given to call responders. Disclosure guidelines could also be standardized so that customers understand what they are and are not receiving. Another useful step, although it would likely require coordination with telecommunications regulators, would be to require mobile operators and fixed-line telephone companies to agree to a given 3- or 4-digit code (such as 9-1-1 or 3-8-3-8). This approach could avoid the scenario in which several MNOs or fixed-line telephone companies offer health hotline services through different codes, causing confusion among consumers.

Considerations for Donors

Bearing in mind both the large potential for health hotlines, and the challenges related to their growth and expansion, donors and development agencies may wonder what they should do to help the market mature. We have five recommendations.

1. *Awareness.* Health hotlines are new and still relatively unknown within the broader community of mobile operators and health practitioners. By supporting conferences, research studies, Web portals, social marketing campaigns, and other ways of evaluating and publicizing these services, donors can help build awareness and excitement among those who could deploy new hotlines.

2. *Research.* This paper has identified the emergence of health hotlines as being potentially valuable for expanding access to health care in developing countries. Further research must now be done to inform industry, policymakers, and donors. This should include careful analysis of the public health benefits, the effect on health outcome disparities, and the commercial benefits of health hotlines. The results should be shared widely via awareness activities like those mentioned above.

3. *Regulation.* Health care regulation is likely to become a key factor in the successful growth of health hotlines, as regulators become aware of these services and call volumes rise. Depending on how it is structured, regulation could either facilitate new deployments or inhibit them. It will be important to help regulators understand health hotlines and educate policymakers on the research mentioned

above in order to make informed decisions. Ultimately, regulations will need to strike a careful balance: they must be open enough to encourage innovation in the marketplace, but restrictive enough to ensure client/patient privacy, protection, and a high standard of care.

4. *Technical Assistance.* As the market evolves and various stakeholders—including mobile operators, governments, and start-ups—begin to offer services, they will benefit from outside technical assistance and expertise. Donors should consider creating or supporting organizations that can develop that expertise and help support the nascent industry, for example by leading the creation of technical and performance standards around electronic medical records, electronic prescriptions, and other medical applications, and by promoting interoperability and connectivity.

5. *Social Investment.* Though it is not yet clear what type of social investment might be required to help accelerate deployments, donors can likely play a key financing role through a combination of seed grants, low-interest loans, venture capital, and subsidies. In supporting the four types of activities listed above, donors should aim to gain a solid understanding of what type of social investment would be required.

Endnotes

1. Authors' estimate using data from health hotline operators in these and other developed countries.
2. Authors' estimate using data from health hotline operators in Bangladesh, Mexico, Pakistan and India.
3. 3G Americas, Mobile connections reach 4 billion worldwide. Press release, December 22, 2008. Available at <http://www.3gamericas.org>.
4. TRCL internal survey of 2,160 callers over a one-month period during the fourth quarter of 2008.
5. This is sometimes referred to as "doctor-to-patient" or 'D2P' rather than "doctor-to-doctor" or 'D2D'.
6. Global Call Center Network, The Global Call Center Report: International Perspectives on Management and Employment, 2007. Available at www.globalcallcenter.org.
7. A hotline may very well transition from one type of sponsorship to another: once its exclusive arrangement with an MNO expires, an MNO-sponsored hotline such as Teledoctor in Pakistan may partner with additional mobile operators and become an independent hotline. Including indirect costs, such as in-kind contributions of Satyam Computer Services staff to program the hotline's software, this ratio is closer to 60 percent paid by the government, and 40 percent paid by Satyam Foundation and affiliates.
8. McKesson Asia Pacific, Telephone triage, advice, and referral services. Electronic brochure available on McKesson webpage, www.mckesson.com.au, December 2006. Population of Western Australia found at www.wikipedia.org/wiki/Western_Australia.
9. V. Turner et al., Telephone triage in Western Australia. *Medical Journal of Australia* 176 (3): 100-103 (2002).
10. From NHS Direct webpage:
<http://www.nhsdirect.nhs.uk/article.aspx?name=FactsAndFiguresAboutNHSDirect>, accessed December 18, 2008.
11. E. Rolland et al., Using Ontario's "Telehealth" health telephone helpline as an early-warning system: A study protocol. *BMC Health Services Research* 6:10 (2006).
12. NHS Direct webpage.
13. Rolland et al.

14. McKesson, Telephone triage.
15. NHS Direct webpage.
16. Ian St. George et al., "Telephone triage reduces out of hours work for country doctors."
17. David Dunt, Robert Wilson et al., "Impact of telephone triage on emergency after hours GP Medicare usage: A time-series analysis." *Australia and New Zealand Health Policy* 4:21 (2007).
18. NHS Direct calls cost GBP 16 each. E-Health Insider Primary Care, March 4 2008.
19. Ruth Wetta-Hall et al., "Help on the Line: Telephone-Triage Use, Outcomes, and Satisfaction Within an Uninsured Population." *Evaluation & the Health Professions* 28 (4), 414-427 (2005).
20. J. Labarère, "Patient compliance with medical advice given by telephone." *The American Journal of Emergency Medicine* 21, (4), 288-292 (2003).
21. S. Bagchi, "Telemedicine in rural India." *PLoS Med* 3(3): e82 (2006).
22. E. Ganguly, PR Deskhmukh, and BS Garg, "Quality Assessment of Private Practitioners in Rural Wardha, Maharashtra." *Indian Journal of Community Medicine* 33(1) (2008).
23. BK Patro et al., "Community Perception and Client Satisfaction about the Primary Health Care Services in an Urban Resettlement Colony of New Delhi." *Indian Journal of Community Medicine* 33(4) October 2008.
24. They also offer performance-based bonuses of US\$ 200 per month.
25. David Hildebrandt, John Westfall, et al., "Harm resulting from inappropriate telephone triage in primary care." *Journal of the American Board of Family Medicine* 19(5) (September-October 2006)
26. Available at <http://www.telenor.com.pk/services/teleDoctor.php>. Accessed December 18, 2008.
27. "Schmitt and Thompson telephone triage protocols for adults and children." More information at <http://www.stcc-triage.com>.
28. "Vital Wave Consulting, mHealth in the developing world—A landscape analysis." Available at www.vitalwaveconsulting.com.
29. Karachi's IT Tower to be biggest in world: Nazim. *Daily Times*, Karachi, June 9 2008. Accessed at http://www.dailytimes.com.pk/default.asp?page=2008\06\09\story_9-6-2008_pg7_17.
30. Bangladesh to introduce countrywide "telehealth care services." Xinhua news service, January 8 2009. Accessed at <http://www.cctv.com/english/special/techmax/20090108/101361.shtml>
31. Rahman, 2008.
32. Ware, J. E., Snyder, M. K., and Wright, W. R. *Development and Validation of Scales to Measure Patient Satisfaction with Health Care Services: Volume I of a Final Report*. "Part A: Review of Literature, Overview of Methods, and Results Regarding Construction of Scales," (Publication No. PB 288-329) Springfield, VA: National Technical Information Service (NTIS), 1976 (262 pp).
33. A "modern" healthcare provider refers to a practitioner trained in allopathic care as opposed to "traditional" healers or homeopathic practitioners.
34. Secretaria de Desarrollo Social, "Medicion de la pobreza, variantes metodologicas y estimacion preliminar" (2002). Serie: *Documentos de Investigacion 1*. ISBN: 968-838-476-3. Comite Tecnico para la Medicion de la Pobreza.
35. T Hazir et al. (2008) "Ambulatory short-course high-dose oral amoxicillin for treatment of severe pneumonia in children: A randomised equivalency trial." *Lancet* (371) 9606: 49-56.
36. Rahman, 2008.
37. Bangladesh to introduce countrywide "telehealth care services." Xinhua news service, January 8 2009. Accessed at <http://www.cctv.com/english/special/techmax/20090108/101361.shtml>.

References

- Bagchi, S. (2006). "Telemedicine in rural India." *PLoS Med* 3(3): e82.
- Bali, S. and Amar Jeet Singh (2007). "Mobile phone consultation for community health care in rural north India." *Journal of Telemedicine and Telecare* (13): 421-424.
- Dunt, David, Robert Wilson, et al. (2007). "Impact of telephone triage on emergency after hours GP Medicare usage: A time-series analysis." *Australia and New Zealand Health Policy* 4:21.

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- Ganguly E., PR Deshmukh, and BS Garg (2008). "Quality Assessment of Private Practitioners in Rural Wardha, Maharashtra." *Indian Journal of Community Medicine* 33(1).
- Global Call Center Network (2007). *The Global Call Center Report: International Perspectives on Management and Employment*. Available at www.globalcallcenter.org.
- Hazir, T., et al. (2008) "Ambulatory short-course high-dose oral amoxicillin for treatment of severe pneumonia in children: A randomised equivalency trial." *Lancet* (371) 9606: 49-56.
- Hildebrandt, David, John Westfall, et al. (2006). "Harm resulting from inappropriate telephone triage in primary care." *Journal of the American Board of Family Medicine* 19(5), 437-442.
- "Karachi's IT Tower to be biggest in world: Nazim." *Daily Times*, Karachi, June 9, 2008.
- Labarère, J., et al. (2003). "Patient compliance with medical advice given by telephone." *Am J Emerg Med* 21: 288-92.
- McKesson Asia Pacific, "Telephone triage, advice, and referral services." Electronic brochure, December 2006. Available at McKesson webpage, www.mckesson.com.au.
- Munro, J., et al. (2005). "The impact of NHS Direct on the demand for out-of-hours primary and emergency care." *British Journal of General Practice* 55: 790-792.
- NHS Direct Annual Report 2007/08*. Available at <http://www.nhsdirect.org.uk>.
- "NHS Direct calls cost GBP 16 each." *E-Health Insider Primary Care*, Issue No. 158, March 4, 2008. Accessed at <http://ehiprimarycare.com>.
- Patro, BK et al. (October 2008). "Community Perception and Client Satisfaction about the Primary Health Care Services in an Urban Resettlement Colony of New Delhi." *Indian Journal of Community Medicine* 33(4), 250-255.
- Rahman, Mohammad A. (2008). "Introduction of Cellular Phone-Based Call-Center in Bangladesh: Impact on Access to Health Care Information." Dissertation, California State University, Fresno, CA. This is a PowerPoint presentation received from author.
- Review of NHS Direct to reduce number of patients it refers to GPs and hospitals. *The Telegraph* (UK), November 22, 2008. Accessed at <http://www.telegraph.co.uk/health/3496984/Review-of-NHS-Direct-to-reduce-number-of-patients-it-refers-to-GPs-and-hospitals.html>.
- Rolland, E., et al. (2006). "Using Ontario's 'Telehealth' health telephone helpline as an early-warning system: A study protocol." *BMC Health Services Research* 6:10.
- St. George, I., et al. (2003). Telephone triage reduces out of hours work for country doctors. *New Zealand Family Physician* 30(2), 95-99.
- Turner, V., et al. (2002). "Telephone triage in Western Australia." *Medical Journal of Australia* 176 (3): 100-103.
- "Victoria's NURSE-ON-CALL Adds to Existing Health Call Centre Network." June 4 2006. Available at <http://www.Callcentres.net>, accessed on December 18, 2008.
- Vital Wave Consulting (2008). "mHealth in the developing world: A landscape analysis." Available at www.vitalwaveconsulting.com.
- Wetta-Hall, Ruth, et al. (2005). "Help on the Line: Telephone-Triage Use, Outcomes, and Satisfaction within an Uninsured Population." *Evaluation & the Health Professions*, 28 (4), 414-427.
- 3G Americas (December, 2008). Mobile connections reach 4 billion worldwide. Press release, available at <http://www.3gamericas.org>.