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PERSPECTIVE

Digital Gods: The Making of a Medical Fact for Rural Diagnostic Software

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The chronic shortage of doctors in rural India seriously impacts the quality of health care available to villagers. In recent years, there has been considerable excitement in digital diagnostics as a possible answer to this situation by allowing non-doctors to diagnose and treat patients. In this article, the author focuses on one such diagnostic tool that has gained serious traction among transnational health foundations and state governments alike. The focus is on the customization and localization of this software through a pilot study in central Himalayas. A baseline survey and extensive interviews are conducted for categorization and population of health data content. This entailed analyzing the segmentation and transfer of health information on disease history and symptoms from the patient to the software as well as situating this study in the larger understanding of the healthcare system in this community. In doing so, the author argues that much of such health information is difficult to categorize and sufficiently vague to not provide for a confident diagnosis. Further, the data population of the treatment segment is deeply political and sociocultural. This article thereby problematizes the innate assumption underlying the design of such software, that it is possible to diagnose and treat patients based on pure information.

Doctors are often seen to play God, converting probability into certainty. This is even more so in regions where the dearth of resources and poor training compel medical practitioners to make health decisions based on fragmented information flows. It is no wonder then that

medical misdiagnosis is common among rural and poor populations, resulting in the worsening of an already desperate situation. Also, sophisticated health management systems, when present, seem to largely serve the purposes of policy-making and control. More specifically, in the case of India, there exists an impressive seamless flow of health information of citizens, from bottom to top, aggregated for government officials. This surveying can be attributed to the postcolonial legacy wherein information is viewed for the most part as a tool of national surveillance instead of reflective learning and change for medical efficacy at all levels in the healthcare system.

While macrosurveillance no doubt has its place in health care for detecting possible epidemics and health shifts of entire groups and peoples, an equally compelling case can be made for access to medical information at the micro level. Health care workers and practitioners can benefit greatly in gaining a bird's-eye view of their patients' health by having information on their medical histories and socioenvironmental trends. New technologies could provide opportunities for new strategies of healthcare.

The digitalization of health care information has become globally widespread. In India itself, ambitious efforts to digitalize health information are underway. Currently, there is excitement about extending these tools to enable better diagnostic accuracy and treatment.

In this article, I focus on the pioneering development of one such diagnostic software—*RightChoice*[1]—by an American medical company, which claims to have created one of the most comprehensible medical knowledge management databases and the most effective diagnostic tool for developing countries. This software has recently gained serious traction among some of the top international health-care foundations as a key tool for digital diagnostics in developing countries. Its stated unique advantages lie in its intuitively interactive and decision-supporting ability for accurate diagnosis and treatment by

nondoctors, as well as in its customized database for rural diseases. This tool is meant to encompass not just information management but also evaluation of symptoms and other data to reach an accurate diagnosis. In other words, this tool touted as the answer to the lack of doctors in rural areas in developing countries, allowing a non-physician to diagnose and treat patients.

In particular, I delve into the first live pilot testing of this tool in rural India, revealing some critical issues in healthcare information management. More specifically, the focus here is on how medical information is collected and populated as part of the phase 1 deployment of this software. Problems of standardization and localization come to the fore. In doing so, this article argues for a reevaluation of the claims of digitalization of mass healthcare information for diagnosis and treatment. This is timely, as massive investment into such tools is being considered by transnational health foundations and state governments worldwide. Although there is much potential for guided learning and training of healthcare workers with the help of this tool, such tools continue to be "unintuitive" and possibly dangerous if used by nonphysicians.

SOCIALIZING (WITH) THE GEEKS?

It's not easy to humble technology. For decades, software has been created in the laboratory with little interaction between the users and designers. If at all, users are often beckoned as guinea pigs, testing their adaptability and responsiveness so as to tweak software to suit their needs and abilities (Davis 1989; Goodhue 1995). Otherwise, user groups are identified, propelling the creation of particular software products. In recent times, there appears to be a paradigm shift as markets expand crossculturally and internationally, and users are revealed to be deeply complex and dynamically changing in their needs (von Hippel and Katz 2002). The age of digital customization seems to have arrived. Users and their contexts appear inseparable.

In the process of knowledge creation, users and their contexts continue to be largely untapped (Rogers 2003). Knowledge can be characterized as a proportional blend of that which is factual and context-free as well as that which is embedded within the context of the user (Tornatzky and Fleischer 1990). Put another way, knowledge creation is the intersection and interplay of "tacit knowledge—that which is personal, context-specific, and difficult to articulate and communicate—and explicit knowledge—that which can be transmitted from one source to another in a systematic manner and that which is relatively objective" (Nambisan et al. 1999, 369). Thereby, in the production of information technology software, it can be argued that the logic employed in the design of software navigation is contingent on users and their contexts. "Intuitiveness" in the usage of information tools can be seen as the degree to which context is translated and manifested in the design of software.

This extends to the understanding of usage of digital information that requires an "interdisciplinary study of the design, uses and consequences of information technologies that takes into account their interaction with institutional and cultural contexts" (Kling 2007, 205). In other words, this "social computing" encourages dialogue between software designers and users across different phases of product development. The design of effective information systems requires an understanding of what constitutes as "better" and "easy" technologies in relation to the user's context. The confidence in predicting socioeconomic outcomes from particular technologies, however well-designed, is slowly dissipating; after all, "the analytical failure of technological determinism is one of the interesting and durable findings from social informatics research" (208). Thereby, the interplay of laboratory designed tools with live and targeted environments requires a nuanced and multiple-perspective approach. Statistics are compelled to partner with qualitative means if we are to genuinely investigate technosocial efficacy.

The stakes are raised substantively when it comes to the creation and usage of medical information to guide in digital diagnosis and treatment. Health care is essentially an important public good. Both public and private interests come to play when information technologies are intertwined with health care (Siesta and Watzke 2007). There is no doubt, however, that to diagnose and treat patients with the aid of medical software, it is critical to customize and indigenize the system to patient's specific medical symptoms, history and locality. This is no small feat because it entails balancing "special" needs and interpretations of the user with a "universal" design.

E-GOVERNANCE AND HEALTHCARE IN INDIA

Health care in India is in crisis. The Third National Family Health Survey[2] revealed that 46 percent of all Indian children are malnourished. The infant mortality rate, though improving, is still high and much worse than in other developing countries. This is complicated by the fact that less than half of all Indian women receive care after childbirth and only 40 percent give birth in hospitals or medical centers. The percentage of women and children in India who are anemic has increased to 56 percent and 79 percent, respectively, since the late 1990s. The number of people living with HIV/AIDS in India is estimated to be 5.206 million, the second-largest in the world.

Currently, there is broad commitment globally to computerize national health-care information (Madon et al. 2007). Part of the Millennium Development Goals,[3] this effort is seen as crucial for managing and delivering

improved public health-care services. In India, such commitments are reflected in the ambitious multibillion dollar National Rural Health Mission[4] (NRHM) healthcare plan launched by the government of India in April 2005 to provide Medicare facilities in villages. However, in spite of significant investments, improvements are slow and intermittent in rural health care in India. The shortage of doctors in India is one of the most critical barriers to the expansion and quality of health care (Ranjan Roy 2008); against the requirement for 21,490 doctors, there are only 5,910 specialist doctors available at community health centers across the country, and of the 66,059 nurses and midwives needed for the health centers, only 41,313 appointments have been made.

Sadly, most of India's rural villages, where two-thirds of the population resides, have few other options but to seek for diagnosis from healthcare providers who do not even hold a high-school diploma (Ranjan Roy 2008). After all, 75 percent of allopathic practitioners reside in cities, leaving space for a crop of unqualified practitioners to serve the rural public. For example, it was found that among rural general practitioners, only 29 percent knew the exact composition of oral dehydration solution (ORS) for diarrhea, an often fatal but easily preventable malady among the poor, with none knowing the right method to prepare the ORS package (Patil et al. 2002).

THE RIVER NEVER RUNS DRY: FLOW OF HEALTHCARE INFORMATION

The cliché "knowledge is power" is experiencing a new lease of life in this information age. Since independence from the British in 1947, India has been surveying her population on multiple facets including land tenure, health, education, and employment. However, much of this information aggregation has imitated the colonial legacy of hierarchical flow from bottom to top for consolidation, policymaking, and control (Cohn 1996). On the healthcare front, government officials at the district level serve as "human computers," bringing together maternity, fertility, mortality, and other medical data from the monthly updates sent by the vast and spread-out field staff of nurses, midwives, and health-care volunteers.

The efficiency and streamlining of such data through its manual system is truly impressive and remarkable. For instance, there are 17 registers maintained at the Auxiliary Nurse station alone (ANM's office) that are regularly updated. The registers include health information on mothers and their children, administrative funds, monetary incentives for "volunteer" *Asha* health workers, child immunizations, antenatal, measles, primary health-care center (PHC) reports for their doctors, stock registers, family planning, school children, and village health indices.

This remarkable bureaucracy is no small feat. That said, it is important to bear in mind that little of this information

has been historically used for diagnosis and treatment. In the last decade, however, the Indian government has partnered with transnational health agencies to monitor and track national health-care information for preventive and curative measures as well as to digitalize such efforts for easier modification and cross-departmental sharing within a state and also between states.

RIGHTCHOICE: A NOVEL MEDICAL DIAGNOSTIC SOFTWARE

RightChoice is a software suite designed especially for the healthcare needs of developing countries. It is pioneered and owned by a private U.S. medical software company, backed by significant venture capital funding. Its ability to provide accurate, customized, and rapid diagnosis, portable and accessible medical information, and informed public healthcare planning and implementation are key selling points. The company claims to have built it around the most powerful and "intuitive" engine. Its inference engine is said to be extremely efficient, compact, portable, and capable of running against very large medical databases that simultaneously check multiple medical specialties. In effect, it represents a shift in medical informatics from simple data gathering to comprehensive systems management, data interpretation, and decision support.

The company states that even a minimally trained healthcare worker in a remote clinic can make an "accurate" diagnosis of common and challenging medical conditions and be guided to give effective treatment and advice. This is accomplished by its offline software-mediated intuitively guided interview process, supported by a medical database customized for the region of use. With each patient encounter for diagnosis and treatment, it creates a fully integrated electronic health record. The entire database is compiled centrally for healthcare planning, monitoring, and program evaluation. Its capabilities are as follows: diagnostics, treatment recommendations (only for those diseases that have been "approved" by the medical community as treatable by nonphysicians with stabilization techniques by nonphysicians), prevention and education, electronic health records, epidemiological and disease monitoring services (monitoring national health programs and schemes through alert systems), supervision of healthcare workers (electronic flagging for mistreatment), and reference and treatment guide.

The knowledge base is created from a modular format that assumes that each disease can be broken down into a description of findings, such as symptoms, physical exam, medical history, and laboratory tests. By incorporating data on how frequent a finding may be in a disease along with the prevalence of the disease in general, the diagnostic software can make a more powerful prediction as to the presence of an individual disease. The company claims that *RightChoice* is the only product in its category

that can run statistical inference in near-real time, producing not only a differential diagnosis but also suggestions of related clinical findings. The knowledge base itself is being created from a review of specialty textbooks as well as original medical articles and input from specialty physicians to ensure that every finding has the best data that can be found to substantiate it. When fully developed, it is expected to have the most extensive database of medical knowledge available, and it is both multilingual and multicultural.

PHASE 1: REGIONALIZATION PLAN: BASELINE SURVEY

Positive clinical tests of diagnostic products are not enough to scale and create buy-in, particularly in rural areas in developing countries. The potent combination of new terrain and new technology in health care comes at a cost. However, there are no shortcuts. Live pilot projects are ideal as they allow for crosslearning and product customization within safe boundaries of "trial and error." This article focuses on the first phase of this project, namely, the creation of the baseline survey and population of such content to help understand the major diseases and census information that exist in the specific region of choice. This information is meant to serve as a guide to the localization of this diagnostic software that takes into account the social background, living conditions, previous diseases, immunization history, and many other factors.

The system is envisioned to work as follows: When a person who has already gone through the baseline data entry comes in for medical care, a medical record will be available for the healthcare worker (created from the baseline data). Then the healthcare worker will ask questions that exist in the software, including chief complaints and all the other information not included in the baseline data, to guide his or her diagnosis. However, as this article argues, even this seemingly basic first stage of information gathering for product development raises red flags, demanding a reevaluation of the claims made by the company.

ALMORA: SETTING FOR THE PILOT STUDY

Although it is common to associate rural areas with poverty, Almora, a picturesque district in the Kumaon region of the newly created Uttarakhand state in India, evokes anything but that. This area, lying between the river Kosi and Suyal, has stood as the cultural and political nodal point of Kumaon for almost 400 years. Yet, according to the latest 2007 state government statistics, 90 percent of Almora's 632,866 population resides in villages. Males number 294,984 and constitute roughly 47 percent of the population and females number 337,882,

or roughly 53 percent. The women outnumber men because of the high male migration rate of 60 percent to the neighboring states of Uttar Pradesh and Punjab, primarily because of Almora's high rate of unemployment (Sati and Sati 2000). The majority of the population is Hindu (98 percent) and Muslims, Sikhs, Christian, and Buddhists comprise the rest of the population. Also, 90 percent of the population is engaged in subsistence agriculture. Villagers in Almora struggle with certain basics for survival, including access to quality health care, clean water, electricity, good education, and regular transportation, particularly strenuous because families are scattered across this mountainous region. For instance, 55 percent of villagers have to walk more than five kilometers to reach the nearest bank in Almora, and women spend an average of four-to-six hours collecting fodder and fuel for their day-to-day living (Mehta 1997). Also, 60 percent of the rural population lives in areas that are more than five kilometers from towns where most of the markets, hospitals, colleges, and other service providers are located.

Given that Uttarakhand is a newly created state, it has made efforts to gain the title of "aspiring leader" in e-readiness[5] as it actively engages in creating connectivity across its terrain by providing a steady supply of computers to high schools, universities, and government agencies and ICT kiosks to villages for accessing a host of government services. In Almora, all government high schools and universities currently have computers, and broadband and wireless services started becoming available a few years ago. Additionally, initiatives are underway for digitalizing data across government agencies, including the health sector.

INFORMATION COMES AT A COST

The choice of Almora was not random. One of the chief venture capitalists of this software company happened to be of Indian origin and related to a savvy Indian businessman in Almora who was interested in this project. That said, this kind of "doing good" was also a possible lucrative business opportunity for all actors involved: the Almora consultancy, the venture capitalist group, and the medical software company. The researcher here was hired by the Indian consultancy to facilitate the pilot project from start to finish. However, this article delves deeply into only the initial facet of this pilot study, which focuses on the surveying and populating of medical data into the system.

The baseline survey was conducted as a random sampling of villagers across four different villages (total population 267). We hired two girls with college degrees and some experience in nursing to help with the fieldwork data collection over a period of two months. Both girls were fluent in Hindi and Pahadi, both languages commonly

used in this area. They also had adequate familiarity with English for such a task and sufficient data entry skills. The researcher often accompanied the girls in fieldwork for quality checks of data collection, as well as for a detailed ethnographic understanding of this region and its people. Fieldwork commenced at 8:00 a.m. in the morning and went on until 4:00 p.m., with lunch breaks in the field. This was a particularly difficult region in which to conduct surveys as houses were spread across the mountains, taking about half an hour to get from one household to another. On average, about twenty minutes was spent in each household. The data were entered into the computer twice a week, and at the end of the two months, it was shared with the medical company.

Simultaneously, interviews with doctors and nurses in this region were conducted to gage their views on this digital intervention. Also, visits were made to all possible places of dissemination and implementation of the diagnostic software: primary health-care centers (PHCs), community health centers (CHCs), auxilary nurse (ANM) offices, district hospitals, private practitioners, and Ayurvedic centers.

SPEAKING IN SURVEY FORM?

There were six sections to the baseline survey given by the diagnostic company: demographics, disease history, childbearing, surgical procedures, immunizations, and habits (see table 1). "Demographics" include the individual's personal details, such as name, age, gender, address, and marital status. "Disease history" categories were drawn from the World Health Organization's list of rural diseases in developing countries, thereby including malaria, dengue, leprosy, and the like. The "childbearing" segment was designed around fact that in developing countries, women's health is deeply tied to maternity patterns and practices. "Surgical procedures" were basic, given limited resources, and the "immunization" section included initial and follow-up booster shots for children. Lastly, "habits" were basically limited to the ingesting of harmful substances such as tobacco, drugs, and snuff.

In our encounters with the villagers, most people would initially claim to not have any ailments. However, in making the "surveying" more in the nature of conversation, ailments such as stomach aches, knee pain, headaches, and worms among the children would make it to the surface rather quickly. With the exception of one village, the villagers were receptive and opened up about their health statuses. The reluctance on the part of this one village was due to its recent history with a nearby hospital that promised village residents medication after surveying them but never came back. While one would expect the demographic section to be rather straightforward, it is worth noting that most villagers did not know their

exact age or that of their children. Instead, they spoke in approximations, giving us ranges for their age. This can cause problems, particularly when tracking maternal health and immunization boosters. In fact, the immunization section was completely blank except for reports on measles and tetanus, which did not address this section. Besides polio drops, most villagers were unaware of what immunizations were given to their children. Polio drops were easy to remember as it was the only immunization that was orally ingested. That can be remedied easily in the digital medical database if ANM's and Anganwadi's (preschool teachers) records of immunizations are collated and entered into the system. After all, immunization is a government project administered by ANMs.

That said, one of the most important findings from this survey was on symptomatic reporting for diagnosis and treatment. When we came to the reporting on disease history, 27 percent of the villagers reported dysentery, followed by hypertension (13 percent) and then roundworm (10 percent). The statistics in the rest of the categories were negligible. Table 2 shows all statistics in detail. Under the surgical section, besides the five vasectomies reported, the rest of the sections came out blank. While the regular categories of this health report for the most part came out "clean," the most astonishing part of this reporting was the complete filling up of the "other" category in the "disease history" section. Every single "other" column was filled up with health issues that did not fit the stated categories. Every villager became a patient.

Some random examples from the 267 reports of villagers under the "other" column in the "disease history" section are:

- Hole in the uterus, doesn't feel hungry, swelling in intestine, faint;
- Weakness, faint, doesn't feel hungry;
- Waist pain, stomach pain;
- Joint pain, body rash with puss, faint, frequent fever;
- Body pain, constipation;
- Waist pain, foot pain, doesn't feel hungry;
- Waist pain, right arm pain, migraine, frequent fever, burning palm and foot, white dots on chest;
- Uterus came out in second delivery (suggested operation), cough, stomach pain, leg pain;
- Leg pain, stomach pain, waist pain, joint pain;
- Frequent vomiting;
- Right leg pain, waist pain, whole body swelling;
- Fainting (for one year), doesn't feel hungry, back pain, waist pain;
- Stomach pain, frequent fever, chest pain, cough, breathing problem, faint, eyes pain; Migraine leg pain, constipation, waist pain;

TABLE 1
Survey design

Chart 1: SURVEY DESIGN -QUESTIONS FOR MEDICAL DIAGNOSTIC SOFTWARE

Category								
Demographic	Patient ID	Name	Father /Husbands Name	Birthdate	Age	Gender	Marital Status	Address	Village
Disease History	Asthma	Chicken Pox Y/N	Measles	Tuberculosis	Malaria	Leprosy	Hepatitis A	Dysentery	Diabetes	Stroke	Hypertension	Heart Attack	Dengue	Roundworm	Other
ChildBearing	No. of Pregncies	#live birth	#surviving children	Miscarriage /Abortion	Type of Delivery H/NB		Forceps birth	Birth control pill	Birth control	Tubal Ligation	Birth control IUCD/ C/O
Surgical Proceedures	Appendec-tomy	Cardiac bypass	Angiography	Tonsilectomy	Vasectomy	Other
Immunizations	P2/P3/ Pb1 /Pb2		BCGb1 /BC Gb2	BCG1 /BCG 2/BCG3	MMRBooste r1 = A/2	DTP- Boost er1 /2	ChickenP 1/2/ Other
	Polio1				DTP1 /2/3		
Habits	Tobacco S/C	Paan	Snuff	Alcohol	Supari Drugs	Other

TABLE 2
Survey results

Villages	No. Patients	Disease history	Childbearing	Surgical Proceedures	Immunizations	JarPhook
Village 1	132	CPox = 27/ Dyst = 55/ HepA = 4/ HyperT = 9/ Worms = 13/ Asthema = 5	Blank	Blank	Tetnus & Measles	67/132
Village 2	30	4dysentry/12 = hypertension/ 22 = roundworm/	blank	1 vasectomy		13/30
Village 3	65	Dyst = 12/ Diabetes = 4/ HyperT = 12/ Asthema = 4/ Worms = 3	blank	2 vasectomy	Measles	22/65
Village 4		HyperT = 1/ HepA = 2/Dyst = 2/			Measles-waist	
	40	Worms = 3	1-condom use	1 vasectomy	Pain	16/40
Total (n)	267					

- Stomach pain, waist pain, migraine, frequently fever; and
- Joints pain, waist pain, knee pain, migraine.

In fact, having analyzed the "other" category, the ten most-common health complaints are as follows:

1. Waist pain;
2. Stomach pain;
3. Chronic body pain;
4. Joint pain;
5. Eyes swelling and watering and burning;
6. Migraines;
7. Not feeling hungry;
8. Frequent fever;
9. Uterus problem; and
10. Stone problem.

In fact, pain seems to be chronic and frequent; a lifestyle companion of the poor in this region. This is partly because in the hills, much of the work is very laborious; for women, pain comes from their daily strenuous chores of carrying water and wood for miles and working in the fields for hours at a time. Also, given the responsibility of housework and the fact that many of their male companions have immigrated to the city for work, women take little rest after giving birth. Stories abound; for example, a woman from one of the villages just had a cesarean at the hospital. The day after discharge she walked back to her village, which was about four miles from the hospital. A short time after reaching home, she became very septic and had to be brought back to the hospital again. Males who have stayed behind are often subject to chronic pain: "My husband has very bad body pain but what can he do? He's a day laborer so he comes home, takes medication, and goes to work the next day." Hunger is also another cause of chronic pain, leading to "habits" such as smoking; says one woman as she minds her children while feeding the cow, "smoking settles down the stomach (*Paet sah jatha hai*)." And so it seems that this "other" category is inundated with data that are unwieldy and sufficiently vague. "Waist pain" finds itself in company of other similarly confounding descriptions of chronic health problems plaguing the villagers.

THE REIGN OF THE PAINKILLER

Diagnosis without treatment is a wasted endeavor; they are two sides of the same coin. Poverty compels villagers to seek medical attention primarily in times of emergency. Their most faithful friend is the painkiller. Pharmacists are more sought after in these regions than doctors on a day-by-day basis. There is little room for remedy of lifestyles: Women continue to take care of their children, collect firewood, use wood-based cooking stoves, work in the fields, collect fodder and fuel, and take care of their cows. Furthermore, there is a general lack of basic awareness of sanitation; as one leading nongovernmental organization (NGO) activist states, "To have them use a sanitary napkin is in itself a big deal!" Also, little attention is paid to their health, as they get consumed with survival; "I didn't even know I was pregnant until the fifth month," says a twenty-five-year-old mother of five.

When sick, almost half the villagers reported that they go to the *JarPhook* (the local shaman) for healing. Also, we must keep in mind that allopathy is not the only system at play. According to the chief medical officer (CMO), there are forty state allopathy dispensaries, fifty-one Ayurvedic treatment centers, and eleven homeopathy centers. However, given that there is far less regulation

of such alternative systems, allopathy continues to be the dominant choice (Bhola et al. 2008). Here, about half the villagers discussed going to private practitioners, mainly *Deenapani,* a private hospital, and some private practitioners in the town. The other common location was the district hospital, but few reported ever visiting the primary or community health-care centers (Berman 1998). It seems then that when the painkiller fails, the hospitals take over.

As for treatments, getting drugs can be expensive and cumbersome. While supposedly free, many villagers bought their medications. Sometimes it was a matter of timing, as a district hospital doctor reports:

> There is a local dispensary out here, which provides free medications. Monthly we send in our requests to the head office in Dehradun for quantity of drugs remaining every month and how much supply is needed. But often these meds take time coming here so patients go directly to pharmacists and buy instead.

Or perhaps it is about political deals with pharmaceutical companies that leave local government hospitals with little choice. A hospital staff gives some insight into the system:

> The problem is that with treatment drugs, we send requests every month about what we need, but the head officer sends us standardized drugs, some of them not useful to us in this area so it will just sit here. Or they get our forms but send us some packaged deals that they made with some pharmaceutical companies because they want to promote their drugs. It's all contracts here. Sometimes the delay itself makes the drugs useless like some seasonal viruses come, but they will send treatments after six-to-nine months then there's little use or we use expired medication. Either way the patient has to pay for their drugs many times.

And even when available, treatment is not "objective" but rather, based on referrals. Often doctors prescribe medications based on the incentives they get through referrals. In fact the lucrative part of practicing medicine lies in the commissions through tests and referred medications: ultrasounds, x-rays, and computed tomography (CT) scans are the norm (Bhat 1999). As one private practitioner admits:

> This health-care business is based on referrals. This product [RightChoice] will not work. Doctors recommend other specialists and drugs based on the commissions they get on them. There is a deep tie up with the pharmaceutical industries and other specialists with CT scans and x-rays . . . sometimes you will see a doctor recommend at least ten medicines for he can get a lot of commissions from that.

Sadly, this has created a behavior among patients of demanding tests and drugs as an indicator of good doctoring (Trostle 1999). As one medical technician remarks, "Nowadays everyone wants an ultrasound whether it's for their waist or neck or head or their back . . . they don't

understand what it is." Those who cannot afford to buy medications wait for the free prescriptions to come their way. Sometimes this can be harmful, as they can get expired medications and, worse, medications that are obsolete but continue to be prescribed. For instance, there were cases of sulfur drug prescription, which, as one of the doctors stated, had not been prescribed since the 1980s.

This is not to say that government healthcare practitioners are not eager for change. As one senior government doctor remarks:

> Why start from below? You should start from above. The government should make sites that are useful for us. See, they should keep information online on all the medications available, the credentials of pharmacists and which drugs are certified and which are not. We also wish we could communicate directly to them our needs and go directly to the seller or drug company. By the time we wait for the government to respond, our patients have bought the drug from elsewhere. Rate tenders, contracts and equipment purchase should all be open for us to see. The Central Drug Licensing Authority should make all their transactions online so we can be part of it also. Right now I Google if I want to see something. Say I want to refresh myself about an illness or treatment I just Google. But sometimes I go to the Web site of the government and download forms but it's in pdf form and it doesn't come on this computer. Maybe I'm not doing it right. Also, I want to see the company lists, so we can buy directly from companies. Why wait? We can also know medical updates, drug updates its side effects and all that information. We just got this computer about two months ago. They just placed it but we haven't used it much. It is in my office now. I'm interested in knowing new things but at my age, my learning is very slow. I call my daughter in Delhi and she tells me mum, it's because you don't have Adobe; that is why the pdf is not coming up. How do I know what's Adobe?

TEN DOCTORS GIVE YOU TEN DIAGNOSES

One physician remarks: "Doctors will always appear to be indispensible. You put ten doctors in a room and get them to give a treatment and you will see that nobody will agree with one another. They play God here . . . why do they want to invite a challenge or test their status?" The idea that a digitalized diagnostic system can come up with a standardized and single treatment goes against how medicine is perceived and practiced across cultures and communities. Besides the obvious tension between allopathy, ayurvedic, homeopathic, and other approaches to medicine, there is tension even within allopathic circles. Making a decision based on, for instance, "waist pain, right arm pain, migraine, frequent fever, burning palm and foot, white dots on chest," as shared earlier by one of the villagers, is not an easy task. There is a good chance that

three different doctors may come up with three different strategies to address this.

Besides, diagnostics does not happen in isolation but often with the aid of tests. Even if this tool was to succeed in helping a nondoctor correctly diagnose a patient's symptoms, the patient would still have to seek a doctor for further tests and prescriptions for medication. In other words, the trip to the hospital is inevitable and the need for a doctor is unavoidable.

CONCLUSION

Digital diagnostics excites for a simple reason—it's a fresh idea. New perspectives and innovations are needed to counter the growing shortage of doctors in rural areas. Holding back or attracting good doctors to rural areas has not worked. The fact that the majority of the Indian population continue to reside in the rural areas and are subjected to often abysmal standards of health care requires must be urgently addressed. This demands a comprehensive outlook that takes into account the current health-care system of referrals, incentives, user behavior, private and public medicine, alternative medical approaches, current manual data management, the government's information-usage mentality, access to and cost of treatment, and the lifestyle of the patients. The fact that the manual health-care data system exists reflects an understanding of the importance of information. The fact that health information continues to be used as primarily census data and not for learning is a formidable challenge that will require some serious effort at creating buy-in on both ends—the public and the private sector.

RightChoice has successful clinical trials to its name. It definitely can serve as a health-care data-management tool. It can also be an excellent learning tool, allowing healthcare workers, practitioners, and doctors to improve their skills and knowledge. It could also offer a valuable second opinion to doctors, helping them in their decision-making process. But so can other tools out there, many of them freely available.[6] *RightChoice*'s unique selling points are its ability to be used by nondoctors to diagnose and treat patients and its promised customization of rural diseases and symptoms. However, as we have seen, nonphysicians, such as the health-care workers, using this tool is in itself problematic at a legal and political level.

This article, however, is concerned with its customization aspect through localized healthcare information of villagers. Even if usage by a nondoctor was possible, both politically and legally, the very fact that information does not come "clean" or "easy" to fit into set categories makes this process "unintuitive." Taking this further, populating the treatment section is deeply political. Even if we are

to go beyond the politics of referrals and other systems at work, the notion that there is one way of interpreting "symptomatic" data to confidently lead to a diagnosis is, as we have seen, problematic. Even if this were to be compounded by visual data, this would require a doctor to make the final decision. Lastly, even if it were to circumvent these issues, the fact that this digital diagnostic tool does not come with actual treatment. Instead, it requires the patient to seek a pharmacist or other medical help, applying an added step in this process. Doctors know best, the old adage goes; digital doctors will have to do better than that.

NOTES

1. The name of the medical diagnostic product has been changed in this article to "RightChoice" for privacy purposes.

2. For more on the Third National Family Health Survey, see http://www.nfhsindia.org/nfhs3_national_report.html.

3. For more on the United Nation's Millennium Development Goals, see http://www.un.org/millenniumgoals/.

4. For more on India's National Rural Health Mission Policy, see http://india.gov.in/citizen/health/national_rural.php

5. See DataQuest (2008).

6. For example, the Mayo Clinic at http://www.mayoclinic.com/

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