

Applying User-Centered Design to Telemedicine in Africa

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INTRODUCTION

Telemedicine – network-mediated medical practice and consultation – is a well-established approach for sharing healthcare expertise across wide areas. A common genre of telemedicine is *remote consultation*, which aims to improve patient care by giving local health workers access to remote specialists’ skills and knowledge. Remote consultation has the potential for significant impact in developing regions due to chronic shortages of medical personnel (particularly specialists) in these areas.

While telemedicine is commonly conceived as requiring synchronous communication, notably videoconferencing, the applicability of such systems in developing regions can be severely reduced by economic and technical limitations on available network infrastructure. Reliability, bandwidth, and latency characteristics are typically insufficient to support real-time media. Asynchronous communication is often more appropriate in this context.

As part of the TIER project at U.C. Berkeley and Intel Research [2], we are designing and building a new remote consultation system for use in developing regions. In doing so, we draw on reports of past experiences with asynchronous (store-and-forward) telemedicine systems in developing regions (e.g., [1,5]). We also draw on our own design fieldwork in an attempt to ensure that the particulars of our design are appropriate for our use cases. The project is currently in the prototyping and iterative design stage.



Figure 1. Ghana fieldwork sites (partial).

FIELDWORK AND ITERATIVE DESIGN

To date, the project has proceeded in three main phases. The first phase was an initial survey of general opportunities for telemedicine in Ghana, which was selected for opportunistic reasons (other TIER projects were already in progress there) as well as practical reasons (it was known to suffer from severe medical “brain drain”). The second phase involved selection of a problem domain (remote consultation) and an initial iterative design process. The third phase, in progress, is design fieldwork intended to refine the system requirements and interaction design.

Phase 1: Initial Design Fieldwork

Phase 1 was conducted over a period of six weeks in nine institutions distributed throughout Ghana (Figure 1). Sites included the Bolgatanga and Wa regional hospitals (government hospitals located in the less-developed north), three of the larger hospitals and clinics located in the capital of Accra, and several smaller clinics in the greater Accra area. These sites represent different parts of the national healthcare network, in which regional hospitals refer difficult cases to specialists in urban teaching hospitals.

Visits included site tours, surveys of site ICT infrastructure, and the use of standard field methods such as semi-structured interviews, participant observation, and focus groups. Six site visits included semi-structured interviews of several doctors each. These centered on health care practice in Ghana, focusing on ICT infrastructure and key healthcare needs. The interviews also explored their opinions on whether and how telemedicine could play a role in meeting those needs. Participant observation was used to capture medical information exchange processes and artifacts (such as forms) *in situ*. Two clinic doctors were shadowed on their rounds as they checked on patients in the wards (Figure 2). To provide a different view of the doctors’ work practices, health workers other than doctors (e.g., administrators, nurses, data entry clerks, medical librarians) were studied as well. At the close of the fieldwork, a group workshop was held with a number of the doctors. This gave the opportunity to validate some of the conclusions, to collectively brainstorm a set of goals, and to envision a system for addressing key issues.

Four main themes resulted from this fieldwork. These themes are certainly not “novel” in themselves (see [3] for additional details):

- Failures in the existing patient referral system
- Healthcare practices that frequently do not require physical contact
- Perception of telemedicine as valuable but expensive
- Shortages of medical specialists resulting in severe overwork conditions

However, when taken together, they suggested the utility and potential support for adoption of a system for inexpensive (i.e., minimal infrastructure) remote consultation and referral.

Phase 2: Initial Iterative Design

Having narrowed the project scope to asynchronous remote consultation, we then turned to design. After a literature survey of over 100 telemedicine papers and a series of telephone interviews with six staff members of existing remote consultation projects, we identified three focus areas – personal accountability, social connectedness, and professional respect – that would be key issues for adoption and continued use (see [4] for additional details). These focus areas guided a series of semi-structured interviews with 15 medical practitioners, a mix of active telemedicine volunteers and medical practitioners interested (but not currently participating) in telemedicine. Most were telephone interviews, but face-to-face interviews included paper prototypes and other design exercises.

Phase 3: Refinement Design Fieldwork

Phase 3, still in progress, is intended to have the current architectural and interaction design decisions vetted by doctors in the field. In addition to follow-up visits in Accra and the north (Wa and Bolgatanga), Phase 3 adds visits to regional hospitals in the central (Sunyani, Kumasi), eastern (Ho) and coastal (Takoradi) areas of Ghana (Figure 1) since conditions vary widely across regions. As an example of a

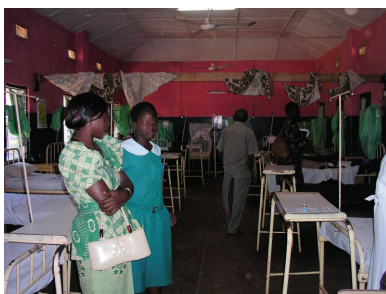


Figure 2. Site visits and participant observation.



Figure 3. Stakeholder interviews and iterative design sessions with paper prototypes.

refinement, it has already become clear that a flat structure of “treating” vs. “consulting” doctors is not enough, as there are sub-groups with varying practices and workflows, personal expectations, and social/organizational contexts:

- Doctors in Ghanaian district and regional hospitals
- Specialists in Ghanaian teaching hospitals (consulting)
- Diasporic overseas specialists (consulting)
- Non-diasporic overseas specialists (consulting)

Because of these differences, we expect each sub-group to use variants of a basic interface.

DISCUSSION

Many of the challenges in this work – lack of resources, distance – are well-known to anyone working in developing regions, but it does come with its own set of issues. First, the need to interact with the government and fit into established professional practices poses many constraints. For example, one might expect treating doctors to interact with any available consulting doctor – but bypassing the Ghanaian specialists (as overworked as they might be) becomes a tricky proposition. Second, the formulation of doing “development” work creates a set of constraints and expectations that do not always exist in conventional UCD processes. For example, one must be careful about assumptions about who can and will pay for what infrastructure (even intra-networking). Third, the fact that there are so many immediate healthcare needs can make it difficult to maintain focus. When UCD elicits so many critical user “priorities,” scope- and feature-creep must be even more tightly controlled than usual.

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