The Kiosk Will See You Now:
Lessons from an ED Experiment

California HealthCare Foundation

CASE STUDY

While innovative technologies have transformed and improved almost every aspect of health care, most new technologies must undergo significant change after the initial introduction, and many are abandoned altogether. To find out what determines the success and spread of technologies, a developing field of research called science and technology studies conducts in-depth qualitative research on the interaction between the technical and human aspects of an innovation.

The following case study explores this interaction through the story of a computer kiosk designed to expedite care in acute care settings for women with urinary tract infections (UTIs).

The UTI Kiosk Design

Dr. Ralph Gonzales and his team at the University of California, San Francisco (UCSF) designed and implemented the free-standing, touch-screen kiosk in an urgent care clinic located at UCSF Medical Center. The kiosk enables English-speaking patients with minimal computer skills and all levels of literacy to receive a rapid diagnosis.

The kiosk process works as follows: When a woman signs in with a suspected UTI, she is offered the kiosk as an alternative to waiting for a physician. Based on established telephone treatment algorithms, women eligible for computer-assisted treatment are 18 to 64 years of age, have had a previous UTI, have pain when urinating, and no complicating features.

If the referred patient opts for the kiosk, she is asked a series of questions and enters her answers on a touch screen. The questions are based on a diagnostic algorithm that rules out complications or more serious conditions. If any of her answers indicates a potential complication, she is instructed to wait as usual to be seen by the clinician. If she is deemed appropriate for rapid prescription, a clinician reviews her illness and medical history, selects one of several recommended antibiotic regimens, and personally hands the prescription to her after confirming her responses to kiosk questions. If the patient has insurance, the clinic submits a bill for a level 2 office visit.

During a study of the kiosk, 162 women accessed the module, and 35% received computer-assisted treatment. Fully 98% of users found the program "easy to use" and 95% said they would recommend it to friends/family. The average time for patients to complete the kiosk module and receive treatment was about 20 to 30 minutes — versus a typical two-to-three-hour wait to be seen by a clinician. Since the kiosk module (with some minor modifications to screening questions) was fully implemented, about 40% to 50% of women with suspected UTIs were eligible for computer-assisted treatment. (In the study, the kiosk module was validated against clinician diagnosis and urine culture.)

Dissemination at ED Sites

With good results from the initial pilot, the study team created a plan to test kiosks at four emergency departments. They started by recruiting the support of local leaders or "champions," a strategy that is generally agreed to be essential for new health care IT projects. All sites received

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financial support that was linked to an agreement that a minimum proportion (70%) of eligible patients would be referred to the kiosk during the three-year study period.

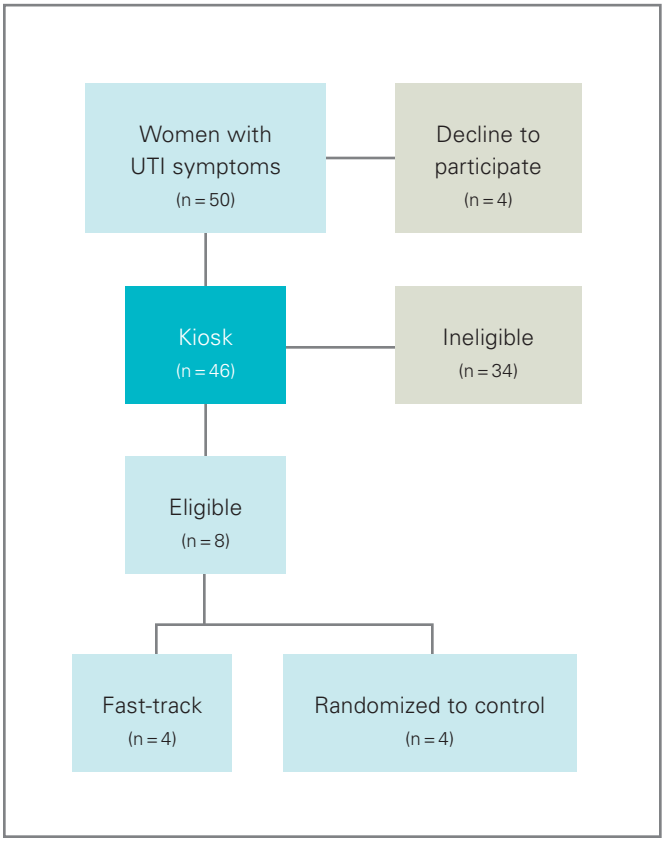
At three of the four ED sites, physician and administrative leadership buy-in was quickly established. Local opinion leaders and front-line staff expressed enthusiasm about the kiosk's potential to expedite UTI care and offer new services for patients (chlamydia and contraception modules were to be added later).

To examine the accuracy and safety of the kiosk programs during the study, it was necessary to assign a proportion of patients to a control group, which would reduce the number of patients who could benefit from the program. Despite this problem, which was discussed with the hospital leaders and front-line staff at the outset, the interests of all parties appeared to be in alignment, and the kiosk technology seemed poised to achieve the same success at the new sites that it had at the urgent care clinic. Figure 1 depicts the actual UTI kiosk experience in an ED.

Kiosks with the UTI module were then placed in waiting rooms and check-in areas at three hospital EDs, and front desk staff and triage nurses were given in-service presentations and clear instructions to refer all women with suspected UTIs to the kiosk.

At the fourth site, however, there were approval difficulties. Although ED project leaders supported the kiosk test, nurses and staff were concerned that it would offer expedited care to some people at the expense of lengthening the wait times of others. Because fairness and equity were thought to be built into the hospital's triage process, any perceived unfairness of the UTI program was controversial. At this site, senior administrators created a lengthy approval process, and during the interval, staff enthusiasm and knowledge of the project waned. The UTI module was not implemented in this ED during the study.

Figure 1. UTI Kiosk Experience in an ED: 1 month



Varying Referral Rates

Several months after the initial launch at the three active sites, the research team noticed that referral rates differed considerably among sites, and that these rates were highly variable over time at some sites and more consistent at others. The goal for kiosk referrals was 70% of eligible women, but the proportion of patients with suspected UTIs who were actually referred to the kiosk varied over the course of the study from 61% to 84% during measurement periods at one site, 13% to 20% at another, and 34% to 65% at a third.

Moreover, eligibility for the expedited UTI care pathway was not as high as expected. While 40% to 50% of women who completed the UTI module in the urgent care clinic met eligibility criteria for expedited care, only 10% to 20% of women in the EDs did so. Clinicians surmised that this might be due to ED patients being

sicker than patients in the acute care clinic, as well as the possibility that some patients might exaggerate their symptoms in the hopes of being seen by a clinician sooner. Both cases would result in lower rates of eligibility, given that the kiosk algorithm offered expedited care only to patients without unusual symptoms or possible complications.

At all the sites, referral rates fluctuated unexpectedly, and nurses did not consistently refer patients to the kiosk. Researchers initially assumed that this was because nurses had either forgotten about the kiosk or failed to adequately prioritize it among their many tasks. It appeared that triage nurses were insufficiently motivated to refer patients to the kiosk for a number of possible reasons: research projects were not a priority for them; they were strictly focused on patient care; they didn't want to change their behavior; and/or their leadership failed to educate them about the kiosk. Because the nurses had verbally expressed support at the beginning of the project, the researchers were disappointed that they didn't seem to be following through.

To lower these perceived barriers, research staff stepped up the distribution of reminders and incentives (usually gift cards or candy) handed out to triage staff. At one site, nurses were asked to compete with each other, with a prize awarded to the person who made the highest number of referrals in a one-month period. The success of these efforts was short-lived, at best.

An implementation evaluation was conducted near the end of the project period to examine reasons for the apparent disconnect between the sites' initial support for the project and inconsistent use of the kiosks. Individual interviews were conducted with research team members and site staff, and observations were made of ED activities at each of the four sites.

The Triage Staff Experience

The evaluation revealed that the nurses' initial support for the project faded when the kiosk performed differently than expected. Nurses stated that the kiosk had initially been described as a device that would help move patients more quickly through the ED. They explained that they often decided not to refer patients to the kiosk because the UTI program did not actually improve efficiency as promised. In fact, most of the women they sent to the kiosk did not ultimately receive expedited care (the proportion ranged from 3% to 30% across sites and over the course of the study).

Ineligibility for expedited care actually led to more work because a nurse or staff member was required to re-insert women who returned to the front desk into the queue for regular care. This was frustrating for ED triage staff, since it added an extra, seemingly futile, step to the already complex, time-sensitive, and high-stakes sequence of tasks they performed.

For triage nurses, then, low rates of expedited patients represented not just an absence of efficiency, but an active, unpredictable, sometimes disruptive force in the midst of pragmatic triage work. This sense of disruption was even true at sites with relatively high rates of referral — a contradiction that can perhaps be explained by nurses' conflicted interests: Even though the kiosk did not deliver as promised, they supported its potential to improve care as well as the research effort behind it.

Nurses also reported that patients sometimes expressed frustration with ED staff after spending time answering questions on the kiosk with the hope that they would be "fast-tracked," only to be returned to the front desk and to hours of waiting. This had a corrosive effect on relations between nurses and patients, although overall patient satisfaction obtained in telephone follow-up was good and did not differ between expedited and control groups.

After chlamydia and contraception modules were added to the kiosk, nurses became even more reluctant to refer patients, insisting that most patients were resistant to engaging with the kiosk on a health topic unrelated to their reason for visiting the ED.

Overall, nurses' responses to the kiosk can be understood as a rational choice, rather than merely resistance or forgetfulness. This helps to explain why researchers' attempts to increase referral rates through reminders and incentives were for the most part unsuccessful. It also illustrates how both use and non-use of a technology affect how it is adopted, redesigned, or abandoned. As a necessary conduit between patients and the kiosk, ED nurses were a key "user" in determining the machine's success at each site.

Differing Patients

The evaluation also sought reasons for the low proportion of ED kiosk users found eligible for expedited care, compared to users in the urgent care clinic. The program design had anticipated similar rates of simple, uncomplicated UTIs in the two types of settings. In reality, the women visiting EDs more frequently reported complicating factors such as duration of illness greater than seven days, new back pain, or vaginal symptoms. Researchers surmised that the very low prevalence of uncomplicated UTI in EDs contributed to the perception among staff that the kiosk was ineffective or not functioning properly.

It remained somewhat unclear why referral rates for the chlamydia and contraception programs were consistently low at all sites. Some triage nurses said that while they support a more overt incorporation of preventive medicine into ED care, such a change is controversial and may have led to reluctance to fully incorporate the programs into routine practice. More often, however, triage staff said that patients reacted negatively when referred to the kiosk, which increased their reluctance to make referrals.

To work around the referral problem, researchers decided to put the chlamydia and contraception modules on a tablet computer to be handed directly to patients by a research assistant in the ED waiting room. After several weeks, however, this project was abandoned due to lack of patient interest. However, patients who completed the chlamydia and/or contraception programs provided consistently positive feedback about their experience.

Technical and Spatial Problems

Triage nurses were also frustrated by intermittent software problems and paper jams with the kiosks. Unlike airports, which provide multiple check-in kiosks, each ED had only one kiosk, so its malfunction was a serious impediment to an efficient triage process. The perception among ED staff was that these were frequent events, and each breakdown transformed the kiosk from a proxy doctor into a disruption that staff had to contend with. Patients also became frustrated. Regardless of whether these breakdowns were directly experienced by an individual staff member, they occurred with enough frequency to contribute to a growing climate of resistance among all staff.

As a large, free-standing device, the kiosk was also difficult to position spatially in crowded waiting rooms and emergency departments. Concerns about patients' privacy, as well as accessibility and proximity for both staff and patients, were all weighed in decisions about the ideal location for the kiosk. In waiting rooms, kiosks were accessible to patients and relatively easy for staff to monitor, but they were also subject to unwanted use by family members and friends of patients and were felt by patients and staff to be less private. In the waiting room environment, the kiosk became a more "public" device, which at times undermined its clinical purpose. The rooms and hallways used for triage, however, were often too small to house the kiosk or to ensure a zone of privacy around it. At one site, the kiosk was moved repeatedly in a search for the best location.

Lessons for Technology Implementation

1. **Think broadly about the "users."** Use ethnographic methods, including close observation and open-ended interviews, to understand the work practices and the social and institutional systems of those who will interact with the technology. Involve them throughout the design, implementation, and evaluation phases of a project. User involvement fosters a sense of ownership of a project, and it enables future users to better understand how a new technology might fit into or enhance their own work.
2. **Approach technology implementation as an institutional, social, and behavioral change process, not just a technical project.** Attend to how technology affects clinical work itself, how it affects relations between groups of workers and between staff and patients, and how workers attempt to change or work around the technology.
3. **Understand that "success" and "failure" are in flux and subject to opinion.** A project may produce good results in terms of efficiency, effectiveness, worker satisfaction, patient satisfaction, and/or statistical significance, but will rarely succeed in all of these all of the time. Establishing success criteria in complex health care settings should be recognized as a political negotiation, rather than a top-down process in which criteria are decided outside of the context of implementation.
4. **Balance the needs of research with those of implementation.** The cost of experimental designs should be carefully weighed when the activities necessary to perform the experiment — such as informed consent and randomization — jeopardize the service delivery system that is being tested. Flexibility and the ability to respond to local needs and circumstances are crucial. A new technology will be more likely to succeed if it is relevant to, and perceptibly improves upon, the work tasks of intended users, and if these people are able to modify the innovation to fit their needs.

Finally, the kiosk's size called attention to its non-portability when compared to the constant mobility of staff and patients. The passage of patients through the ED — particularly low-acuity patients such as those with UTI symptoms — often involved movement from the front desk to the waiting room, to a triage room, back to the waiting room, then to an exam room. When a patient was called to see a clinician in the midst of answering questions on the kiosk, the kiosk's inability to move with the patient usually meant that it would be abandoned in favor of a routine (rather than expedited) encounter with a clinician.

It became clear that the kiosk contained contradictory principles in its design: On the one hand, it promoted the faster movement of patients through the clinic or emergency department; on the other hand, its size, intermittent technical breakdowns (a characteristic of most machines), and infrequent awarding of expedited status all contributed to the kiosk's impeding the typically rapid flow of ED work.

Midcourse Corrections

The research team was aware of the challenges being faced at the kiosk sites, and worked to overcome the barriers to implementation. Midway through the study, several strategies were developed to address two key challenges: low rates of referral to the kiosk and low numbers of patients being designated as eligible for expedited care.

An expanded criteria pathway was developed to identify women who could safely be treated with a longer duration of antibiotic therapy. Based on analysis of medical records from one of the study sites, the researchers developed an algorithm that could capture significantly more of the patients referred with suspected UTI. This programming change led to somewhat higher eligibility rates, but 50% of the newly eligible women were still randomly assigned to the control group (without expedited care) as part of the research protocol; the change was not perceptible

enough to staff to stimulate a shift in their use of the kiosk.

Further, while the new criteria seemed to increase eligibility rates at the ED site where they were developed, they did not appear to increase eligibility rates at the other ED sites. The research team also hoped that the introduction of the chlamydia and contraceptive programs partway through the study would re-ignite staff support for the kiosk. As described earlier, however, this did not happen. These experiences confirmed research suggesting that health care technology is more likely to "normalize," or become routine, when it has a positive impact on interactions between patients and medical staff and between different professional groups within a health care setting.

Conclusion

The kiosk was designed for and routinized in an urgent care clinic, where it resulted in reduced wait times and consistently satisfied patients, staff, and clinicians. However, when it was distributed to a group of EDs, the kiosk was inconsistently adopted and failed to produce expected benefits.

Whether or not the program was a success depends on which group is asked: researchers, patients, or staff. Researchers noted that only one site out of four actively resisted the program early on. The ED located in the study team's home institution, a research university, provided the highest referral rates; at this site referrals were high enough for researchers to consider the project a success. Patients were greatly pleased with the technology when it led to expedited service, but frustrated when it did not.

However, it was the triage staff whose opinions and actions counted most in determining the success or failure of the kiosk program. Their willingness to fully use the technology faded as the kiosks failed to make overall ED care more efficient.

The kiosk's design delegated only one action to triage nurses: referral. The designers anticipated that nurses would refer all women with suspected UTIs to the device, regardless of what the kiosk actually did. The design did not take into account the fact that ED nurses have considerable autonomy, and that they work in teams to move patients through the ED as quickly as possible. The UTI program's inconsistency and unpredictability made it an unreliable member of the team. Furthermore, the chlamydia and contraception programs shifted the kiosk's purpose from emergency to preventive medicine, making the kiosk's presence in the ED even more controversial and unstable.

Health IT projects may be more successful if they are designed and implemented with greater attention to how technology interacts with, affects, and is altered by the context in which it operates. Rather than a tool or engineered object with stable properties and capabilities, technology is more usefully thought of as a materialization of technical and social elements that are always intertwined and often unstable. This means that the success and failure of a technology cannot only be attributed to how it performs in a particular place, but for whom it works, and how its value is negotiated among different groups of people with a stake in its use or non-use.

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