The effects of a hands-free communication device system in a surgical suite

Joshua E Richardson,1 Sina Shah-Hosseini,2 John E Fiadjo,2 Joan S Ash,1 Mohamed A Rehman2

ABSTRACT

This case report describes a qualitative investigation into how a Hands-free Communication Device (HCD) system impacted communication among anesthesia staff in a pediatric surgical suite. The authors recruited a purposive sample that included anesthesiologists, certified registered nurse anesthetists, circulating nurses, a charge nurse, and a postanesthesia care unit nurse. Data were collected using semistructured interviews and observations, then analyzed using a constant comparison approach. The results corroborate and enrich themes that were discovered in a previous qualitative study of HCD systems: (1) communication access, (2) control, (3) training, (4) environment and infrastructure. The results also generated new subthemes and themes: (1) technical control, (2) choosing communication channels, and (3) reliability. The authors conclude that HCD systems profoundly impacted communication in a largely positive way, although reliability of the technology remained an issue. The authors’ findings contribute a valuable insight into the growing body of knowledge about implementation and use of HCD systems.

INTRODUCTION

Surgical suites are dynamic environments in which clinicians rely on a number of information and communication technologies (ICTs) such as mobile phones, pagers, and overhead pages to communicate and coordinate patient care.1 This type of ICT infrastructure is what Coiera and Alvarez describe as a ‘multilayered approach to communication’ and is common to hospitals.2 The addition of another ICT may address particular needs among users and organizations, but as biomedical informatics research has often shown, the introduction of any new technology into a clinical environment may have unintended consequences.3 4

Hands-free communication device (HCD) systems (Vocera Communications, San Jose, CA, USA) are ICTs that: (1) provide wireless verbal communication among users by utilizing voice-over internet protocol over a wireless local area network; and (2) utilize wearable HCDs (‘badges’) that enable users to make outgoing calls, pick up incoming calls, or dictate other call-handling instructions by using verbal commands.5 6 Published reports describe HCD systems as having varying degrees of impact5–9 and call for additional research into HCD systems’ effects on particular ‘work environments’.10

We explored clinician perceptions of how an HCD system impacted communication among anesthesia staff in a pediatric surgical suite. The purpose is to add to a growing and evolving body of knowledge around HCD systems and their impact on communication in clinical settings.

CASE DESCRIPTION

In fall 2008, we observed an HCD system being used in a 15-room pediatric surgical perioperative complex (‘surgical suite’). The HCD system installation was completed in 2006. The unit’s wireless network (Cisco Systems, San Jose, CA, USA) consisted of 45–50 wireless access points (antennae) installed to product specifications. An HCD system installation had occurred in 2003 but was taken offline due to clinician complaints of dropped calls and inconsistent connections. We did not investigate the installation history and instead focused on how users perceived the current HCD system impacted communication.

HCDs were managed so that specific badges were assigned to specific anesthesiologists, and other badges were generally assigned to people by their role, for example ‘circulating nurse.’ The department as a whole was responsible for HCD badge storage, inventory management, and accessories such as batteries and lanyards. Users received 30 min of training which covered basics such as logging on and off the HCD system, an overview of the personnel naming structure, and basic features such as volume control.

METHODS OF IMPLEMENTATION

Qualitative methods enable researchers to utilize subjects’ explanations and perceptions of a technology’s usefulness to gain a greater understanding from a user-centered perspective. Researchers are able to generate theories and hypotheses about a technology’s impact, its real-world use, and its effect on organizational strategies.11–14

Out of 90 staff, 18 participated in digitally recorded semistructured interviews that ranged in duration from 8 min to 38 min. Participants represented a range of roles within the surgical suite (see table 1). The first author also observed an anesthesiologist and a certified registered nurse anesthetist (CRNA) wearing HCDs for a total of 2 h. Observation participants were asked questions at opportune moments, and notes were taken with pen and paper. Observations confirmed that HCDs were worn by a variety of users: anesthesiologists, CRNAs, circulating nurses, and additional staff.

Interview recordings, handwritten observation notes, and daily journals were transcribed into 115 pages of single-spaced textual data. The first author analyzed the data using a constant comparative method: textual data were coded (categorized)

1Department of Medical Informatics and Critical Care Medicine, Children’s Hospital of Philadelphia, Philadelphia, Pennsylvania, USA
2Department of Anesthesiology and Critical Care Medicine, Children’s Hospital of Philadelphia, Philadelphia, Pennsylvania, USA

Correspondence to
Dr Joshua E Richardson, 3181 SW Sam Jackson Park Rd, M/S BICC, Portland, OR 97239, USA; nichajos@ohsu.edu

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through comparison and contrast with themes developed by Richardson and Ash.6 Then, codes were coalesced into ‘themes’ which we introduce in this article. The authors took a number of steps to address validity of the results using Johnson’s framework.15 The researchers received IRB approval to conduct interviews and observations of HCD users.

EXAMPLE AND OBSERVATIONS

Some results from this study aligned with themes Richardson and Ash previously identified: (1) communication access, (2) control, (3) training, (4) environment and infrastructure (see appendix A, available as an online data supplement at www.jamia.org). The results also generated new themes and subthemes that we report here: (1) technical control, (2) choosing communication channels, and (5) reliability.

Technical control

‘Technical control describes users’ ability to manage the technical use of HCDs, and we discovered new subthemes not entirely described by Richardson and Ash: (1) call prioritization, (2) HCD ease of use, (3) the command recognition functions that enable users to make verbal call handling commands, and (4) utilizing the HCD address book to appropriately route calls to intended recipients.

First, subjects expressed a desire for the ability to filter calls by degree of urgency and suggested both technical and group practice solutions. Second, many subjects appreciated HCD ease of use and the hands-free design. Although the HCDs are beneficial in that they are lightweight and relatively easy to use, subjects explained that the devices could be difficult to maintain, and sound quality could be less than satisfactory. Subjects expressed concern, and observations confirmed difficulties with the HCD sound quality within the OR’s sometimes noisy and hectic environment. Earpieces were reportedly rejected because they interfered with the use of stethoscopes. Third, ‘command recognition’ describes the HCD system’s ability to recognize a user’s verbal command. Subjects expressed deep frustration when command recognition failed, particularly when HCDs failed to recognize stressed voices during emergency situations. Fourth, and related to command recognition failures, was the issue related to the HCD system address book. The HCD system address book’s purpose is to store personal names, nicknames, role names, and group names. Subjects appreciated the ability to ‘broadcast’ a call to a group of HCD users thereby eliminating multiple pages or calls to individuals. Subjects also made use of nicknames for those recipients with hard-to-pronounce names, yet staff learnt of nicknames serendipitously and not systematically.

Choosing communication channels

The HCD system added another communication channel from which users had to choose before communicating with each other. Having to choose communication channels caused subjects to think not only about the message they wanted to convey but also about who was going to be available via the HCD system. Furthermore, subjects described having to be cognizant of a fallback communication channel should the HCD system not successfully transmit an HCD call. To choose a communication channel, subjects had to be aware of: (1) the urgency of the message they wanted to send and (2) the perceived availability of the recipients to whom they wanted to send a message (see table 2, available as an online data supplement at www.jamia.org).

Reliability

After taking into the account the benefits and shortcomings of the aforementioned themes, there was an emerging consensus among staff that the HCD system was reliable for non-urgent rather than urgent scenarios. A circulating nurse emphasized the importance of the HCD system’s reliability because, ‘Wherever an anesthesiologist goes, it has to work.’ In fact, a recurring phrase throughout the interviews was that the HCD system was beneficial ‘when it works,’ such as, ‘I like when it works…I can get hold of an attending.’ Some subjects did not report having HCD difficulties themselves but had heard about examples of difficulties from others. Different experiences with HCD communications fed competing perceptions about the HCD system’s overall reliability. Subjects estimated that the HCD system worked anywhere from 50% to 100% of the time.

DISCUSSION

St. Jacques et al demonstrated faster call response times via HCDs than via pagers.7 Importantly, we found subjects themselves perceived faster response times than with pagers thereby improving the chances that users appreciate the HCD system.16–18 Like St. Jacques et al, the subjects we interviewed and observed expressed concerns about personal health information being broadcasted as well as frustration with the inconsistent command recognition within the OR’s noisy environment. Unlike St. Jacques et al, we discovered that anesthesiology staff did not uniformly prefer pagers to the HCD system; rather, preference for pagers and HCDs depended on the perceived availability of message recipients and perceived urgency of a communication.

Some results from this study parallel Richardson’s and Ash’s findings. Users in this study felt that interconnectedness increased the number of unwanted interruptions. To manage interruptions, subjects desired ways to control how they received calls, either by having the HCD system automatically prioritize calls or by assuring that users are knowledgeable about when and where not to make HCD calls. The desire to be interconnected with staff but not be interrupted by staff reflects the communication access-control balancing act.5 That this phenomenon arose in the OR environment, as it has in other clinical settings, leads us to believe that it is a common challenge associated with HCD systems. Further technical sophistication may address this concern. In the mean time, organizations would do well to address the issue with training.

Effective HCD training would go beyond individual use to group use of HCD systems. The additional focus requires explicit acknowledgment that an HCD system supports group processes, group decision-making, and collaboration.19 20 We therefore encourage organizations to consider group aspects of communication such as interruptions, patient confidentiality protocols, and agreed upon HCD communication etiquette. In addition, address-book updates such as new nicknames and new HCD functions could be systematically communicated to staff.

<table>
<thead>
<tr>
<th>Role</th>
<th>Interviewed (N = 18)</th>
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<tbody>
<tr>
<td>Anesthesiologists</td>
<td>10</td>
</tr>
<tr>
<td>Certified Registered Nurse Anesthetists</td>
<td>4</td>
</tr>
<tr>
<td>Circulating nurses</td>
<td>2</td>
</tr>
<tr>
<td>Post-Anesthesia Care Unit nurse</td>
<td>1</td>
</tr>
<tr>
<td>Charge nurse</td>
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Eighteen study participants of different roles were interviewed.
rather than leaving knowledge diffusion to social grapevines. Finally, training could give group-based feedback that conveys how well a group is using the system or how well the system is performing.

Subjects were uncomfortable relying on the HCD system for urgent or emergent situations. The recurring phrase, ‘when it worked’ revealed a degree of mistrust. This issue highlights how the HCD system itself heavily relies on the proper functioning of a wireless network system; that is, the HCD system and the wireless network system are not one and the same. This is a critical distinction for assessing the HCD system’s reliability. To the subjects in this study, however, the distinction was of little concern. What was of concern to the users was that HCD calls were either successful or not. Further research is required to determine a reasonable level of reliability for OR, and other clinical settings.

Anesthesiology staff described having to choose one or more communication channels through which to contact one another. They described traversing mental checklists that took into account a message’s urgency as well as users’ perceived availability and before sending a communication asking themselves: ‘How available is the person or persons to receive a call?’ and, ‘On which device would it be best to call?’ Traversing these mental checklists was described as tiring as a workday progressed. Therefore, it appeared the mental processes were adding cognitive effort to communication.

Given the ‘multilayered approach to communication’ in many hospitals, it is reasonable to expect that HCD users in clinical settings outside of surgical suites experience a similar cognitive challenge. We feel it would be valuable to learn if the effort or stress associated with choosing communication channels extends to other clinical settings, and if the phenomenon is associated with HCD systems alone or if it is associated with the number of communication ‘layers’ a hospital utilizes. The answers to these questions could have profound implications for how hospital communication networks are designed and supported, as well as how users communicate through the variety of ICTs that are increasingly available to them. We believe that further research on how layers of ICTs impact clinician cognitive load is warranted.

We conclude that the HCD system caused changes in communication whereby users appreciated communication access that provided situational information and workflow support. This result corroborates previous findings that HCD users perceive fewer communication delays. However, communication access costs users in terms of interruptions and concerns about revealing protected health information. Communication changes brought about by HCD systems require effective user training and organizational strategies that address user communication overload, team-based communication, patient privacy protocols, and address-book updates.

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