

Prospective Trial of House Staff Time to Response and Intervention in a Surgical Intensive Care Unit: Pager vs. Smartphone

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OBJECTIVE: The objective of the study was to characterize house staff time to response and intervention when notified of a patient care issue by pager vs. smartphone. We hypothesized that smartphones would reduce house staff time to response and intervention.

DESIGN: Prospective study of all electronic communications was conducted between nurses and house staff between September 2015 and October 2015. The 4-week study period was randomly divided into two 2-week study periods where all electronic communications between intensive care unit nurses and intensive care unit house staff were exclusively by smartphone or by pager, respectively. Time of communication initiation, time of house staff response, and time from response to clinical intervention for each communication were recorded. Outcomes are time from nurse contact to house staff response and intervention.

SETTING: Single-center surgical intensive care unit of Cedars-Sinai Medical Center in Los Angeles, California, an academic tertiary care and level I trauma center.

PARTICIPANTS: All electronic communications occurring between nurses and house staff in the study unit during the study period were considered. During the study period, 205 nurse-house staff electronic communications occurred, 100 in the phone group and 105 in the pager group.

RESULTS: House staff response to communication time was significantly shorter in the phone group (0.5 [interquartile range = 1.7] vs. 2 [3] min, $p < 0.001$). Time to house staff intervention after response was also significantly more rapid

in the phone group (0.8 [1.7] vs. 1 [2] min, $p = 0.003$).

CONCLUSIONS: Dedicated clinical smartphones significantly decrease time to house staff response after electronic nursing communications compared with pagers. (J Surg Ed ■■■■-■■■. © 2017 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

KEY WORDS: surgical critical care, clinical communication, pager, smartphone

COMPETENCIES: Interpersonal and Communication Skills, Systems Based Practice

INTRODUCTION

In U.S. hospitals in 1994, there were 61 million pagers in use, and despite significant advances in technology over the decade that followed, there were still 5 to 6 million pagers in use in 2014.¹ Poor communication is often at the root of sentinel events in health care settings, and this is particularly true in the intensive care unit.² Communication failures cause critical delays in treatment and adversely affect outcome.

Text messaging patient health information using personal cell phones is a clear breach of the Health Insurance Portability and Accountability Act (HIPAA) laws, which can lead to significant consequences. The minimum penalty for breach is \$50,000 and the maximum penalty is \$1.5 million.³ This demonstrates a clear need for reliable and safe methods of communication between physician and nursing staff, which are reliable, easy to use, efficient, and privacy compliant. Text messaging can be HIPAA compliant provided it meets certain criteria; the messages must be encrypted, they can only be sent among colleagues within a

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covered entities communications network, the messages must be archived on a separate and secure server with administrative controls enabling remote retraction and deletion of messages if a mobile device is lost, and there must be a personal identification number to access the device.⁴ There are a multitude of HIPAA-compliant text messaging devices available for institutional purchase.

Replacing pagers with dedicated clinically compliant smartphones capable of both direct voice calls and text messages may be an improvement on paging-based communications among health care personnel.⁵⁻⁷ We hypothesize that the use of clinically dedicated voice- and text-enabled phones would shorten house staff response time and time to intervention compared with pagers.

MATERIALS AND METHODS

A single-center prospective study of all electronic communications was conducted between surgical intensive care unit (SICU) house staff and SICU nurses in a 24-bed dedicated SICU at a tertiary care urban academic medical center with Magnet nursing status. The study period was September 2015 to October 2015. Unit occupancy during the study period was 80% or higher. Study data were collected exclusively during house staff day shift, from 6:00 AM to 6:00 PM. House staff-to-nurse ratio is between 1:6 and 1:8. Our SICU is staffed by 2 to 4 house staff at any given time. Nursing-to-patient ratio in the unit is never lower than 1:2 and typically 1:1, and house staff-to-patient ratio is between 1:5 during day shifts and 1:12 during night shifts and these depend on unit census.

The 4 weeks of the study were randomly divided into separate 2-week study periods where all electronic communications between house staff and nurses were exclusively by smartphone or exclusively by pager, respectively. This was accomplished by house staff carrying either only the smartphone or only the dedicated SICU nurse-house staff pager. Nursing staff in the SICU had been using HIPAA-compliant smartphones for nurse-to-nurse communication for > 1 year before the study period and were familiar with their ability to either message or voice call colleagues as needed or convenient. The introduction of physician HIPAA-compliant smartphone use is the intervention under evaluation in this study.

Primary outcomes are time from pager or phone call until the time the house staff spoke to the nurse and is recorded as “time to response”. Time from response until the nursing issue was addressed is recorded as “time to intervention”. Communications on pagers were numeric call back numbers only and communications by smartphone were either by text message or by voice call. Intervention was simple acknowledgment of nursing issue, new order issued, or house staff presenting to the bedside as

needed given the issue raised by the communicating nurse. Communication initiation times were stored in the memory of phone and pager, and they were prospectively collected by house staff on a data collection sheet on a daily basis during the study period. All information was entered to an electronic database at the end of each 12-hour shift by the house staff. Electronic communications are characterized by reason for nursing communication: clinical update, laboratory value notification, medication issue, nursing concern, or nonclinical concerns. Communications are also characterized by the primary organ system addressed during the communication.

Secondary outcomes are observed differences in the urgency (urgent communication defined as communication requiring response within 5 min or less to avoid negative patient effect in the opinion of the house staff) and reason for nursing communication. Patient characteristics are summarized with descriptive statistics including Student *t*-test, Mann-Whitney *U* test, or chi-square test as appropriate for comparisons between means. Data were collected and analyzed using a Microsoft Excel spreadsheet (Microsoft Corp., Redmond, WA) and Statistical Package for Social Sciences Statistics (SPSS v. 24.0, IBM, Chicago, IL).

RESULTS

During the study period, there were 205 electronic communications between SICU nurses and house staff. The proportion of communications by smartphone vs. pager did not significantly differ (48.7% vs. 51.1%, $p = 0.73$). Neither did the proportions of urgent or routine pagers significantly differ between smartphone and pager (urgent 9.5% vs. 13%, $p = 0.53$ and routine 90.5% vs. 87%, $p = 0.55$), respectively.

Time to response was at a median of 1 [interquartile range = 2.5] minute overall and was significantly shorter for phone communications than for pager communications (0.5 [1.7] vs. 2 [3] min, $p < 0.001$). Time from response to intervention was 1 [1.25] minute overall and was significantly shorter for phone communications than for pager communications (0.8 [1.7] vs. 1 [2] min, $p = 0.033$) [Table 1](#). The distribution of time to intervention and time to response for each electronic communication is illustrated in [Figure 1](#). Differences in distributions of time to response and intervention over the hours of the study period between devices are illustrated in [Figure 2](#).

Electronic communications are characterized by reason for communication in [Table 2](#) with pertinent comparison made in [Table 3](#). Analysis of care system classifications of communications shows that phones are significantly more likely to be used for non-organ system issues than pagers (34% vs. 10%, $p = 0.01$). Reason for communication analysis shows that a greater proportion of phone communications are for general house staff updates than the proportion of pager

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