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Mobile Application for Communication Increases the Efficiency of Organ Procurement and Transplantation

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Abstract

Background: Donor organ recovery is a complex process involving organ procurement organizations and multiple surgical teams from various transplant centers. Nearly 30% of discarded organs are wasted due to reasons related to improper coordination and communication. **Problem Statement:** Lack of real-time communication results in many hours of preventable delay between procurement and transplant teams resulting in the high volume of organ waste, clinical frustration, and critical delays. **Methods:** A Plan-Do-Study-Act performance improvement methodology was utilized to design and implement a dedicated mobile communication application (app). Critical time points in the organ offer, procurement, and transplant processes were analyzed from the report of organ offers, and relation coordination metrics were measured.[AQ1] **Processes Addressed:** Members of procurement and transplant teams in Iowa were interviewed and a dedicated smartphone application was implemented to replace phone calls, e-mails, faxes, and text messages during upcoming kidney offers from July 31, 2017 to July 31, 2018. **Outcomes:** Teams reported a substantial increase in clinical productivity and case progress awareness, including a noteworthy reduction in phone calls. The relational coordination data indicated substantially higher relationship and communication quality with the app. The report of organ offer data revealed a 35% increase in organs transplanted and a 50% reduction in time from initial organ offer to transplant with the use of the mobile application. **Implications for Practice:** The use of a dedicated communication application reduces clinical frustration and delays during the coordination of organ offer, procurement, and transplant. Technologies that improve communication have the potential to improve organ utilization.

Keywords

relational coordination, process improvement, clinical communication, mobile app, smartphone, medical group chat, information technology, deceased donor organ recovery, procurement, transplantation.

Background

Donor organ recovery is a complex process involving organ procurement organizations (OPOs) and multiple surgical teams from various transplant centers (TCs). The OPO professional facilitates these processes for up to 8 solid organs per donor on a nationwide basis. Multiple teams from TCs must arrive and recover the donated organs nearly simultaneously. Teams return to various TCs where the recipients and surgical teams are prepared for the transplant process. Several hundred phone calls among the many procurement and transplant teams are required to coordinate the activity that can lead to redundant, contradicting, inaccurate, and untimely phone calls, e-mails, and text messages.

Medical staff must overcome many logistical barriers to achieve proper organ placement, and these challenges are exacerbated by the expanding national allocation policies. The final rule mandates that the distribution of organs must be fair and equitable for all patients, resulting in a dynamic regulatory environment accounting for medical and technological advances.[1]

The work of OmniLife, Inc and partnered OPOs and TCs focused on an intervention that leveraged mobile application

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software technology and provided a dedicated, real-time, HIPAA[AQ2]-compliant, secure, team-based communication method. In this performance improvement Plan-Do-Study-Act (PDSA), the clinical sites implemented a mobile application that improved the donor organ procurement and transplantation process with team-based communication.

Problem Statement

Research studies report that 30% to 61% of discarded organs are wasted due to reasons related to improper coordination and communication.[2-4] Intuitively, more time-sensitive organs have higher waste rates due to delays resulting from poor communication. Lack of a dedicated and real-time communication process and technology results in hours of preventable delay between procurement and transplant teams and increased organ waste, clinical frustration, critical delays, and poorer patient outcomes.[5]

Methods

The model for improvement was the PDSA cycle. The PDSA cycle guided the test of a change to determine if the change was an improvement and is recognized as a valid scientific method adapted for action-oriented learning.[6] The Iowa OPO and TC implemented the PDSA, starting with an extensive planning phase where input was gathered from organ procurement and transplant teams at industry conferences and a mobile application was designed and developed. Next, the procurement and transplant teams deployed the new communication process and utilized a mobile application for all deceased donor kidneys for a year. After that, a contract research organization studied multiple team communication performance metrics, measured the mobile application usage, and analyzed the report of organ offers from the implementation. Finally, the mobile application substantially benefitted most team members and became the standard process for communication during abdominal procurement and transplant activity in Iowa.

A best practice model for communication processes during organ offer, procurement, and transplantation did not exist. OmniLife, Inc sponsored focus groups of procurement and transplant team members at relevant society meetings. Professional independent researchers facilitated and recorded the focus groups and analyzed the resulting transcripts. Qualitative analysis uncovered the crux of the issue behind wasted organs—a lack of team cohesiveness. The researchers gathered common needs and solution requirements from the participants and collected feedback about prospective solution concepts and prototypes. The focus groups supported our efforts and provided validation that the concepts were ready to be tested in the clinical workflow.

Based on these reports, a centralized communication platform and mobile application (app) was designed and used by OPO and TC teams during organ allocation, procurement, and transplant processes. The software engineering team developed, performed an internal HIPAA compliance audit, and deployed the application for clinical use. The app was implemented for all staff members involved in kidney procurement and transplant activities at volunteer TCs and OPOs in Iowa during 2018.

A contracted research organization, Relational Coordination Analytics, Inc (RCA), surveyed and measured team cohesion and performance. Relational coordination process included 7 distinct dimensions: frequent, timely, accurate, and problem-solving communication, shared goals, knowledge, and mutual respect. These dimensions spanned the entirety of teams working together and were summarized into a comprehensive TeamScore.[7,8] Relational coordination processes were validated in numerous health-care settings as an appropriate metric for clinical team productivity and health.[9,10] To reduce variables, this project focused on kidney utilization from 1 OPO and 1 TC in Iowa. Historical data from the OPO and TC were also analyzed (2016 and 2017). Controls in nearby areas, Indiana and Ohio, supplied baseline metrics without any knowledge of the PDSA. Relational Coordination Analytics conducted all measurements with the study groups: Iowa (intervention), Ohio (control 1), and Indiana (control 2).

Processes Addressed

Communication traffic on the app was tracked and connected with the Report of Organ Offer (ROO) data from the United Network for Organ Sharing (UNOS). Case time (hours from initial organ offer to the transplant procedure) and the number of organs accepted and transplanted were collected. Users of the app were surveyed after 1 year postimplementation. Users ranked and scaled the key metrics of the procurement and transplant processes: redundant phone calls, clinical productivity, availability of relevant information, any app failures, and case time.

Outcomes

The mobile application facilitated the real-time transfer of information to individuals involved in donor management, organ procurement, and transplantation, helping clinical teams make more timely and informed decisions. Team members among TCs and OPOs in Iowa replaced internal and external communications normally conducted via phone calls, text messages, e-mails, and faxes with the dedicated mobile application. The app's features included team-based instant messaging, read receipts, pictures, videos, customized notifications, HIPAA compliance, admin user management, external (one-time) messages, and audit reporting and documentation. An illustration of the communication processes before and after the PDSA can be found in Figure 1.

Iowa OPO and TC implemented the app among the following user types (n): doctors and surgeons (8), transplant coordinators (16), procurement coordinators (15), HLA[AQ3] typists (4), and other supporting staff (14). Among the 57 active app users in Iowa, there were 8472 secure messages sent/received, and the median latency from sent to a verified read receipt was

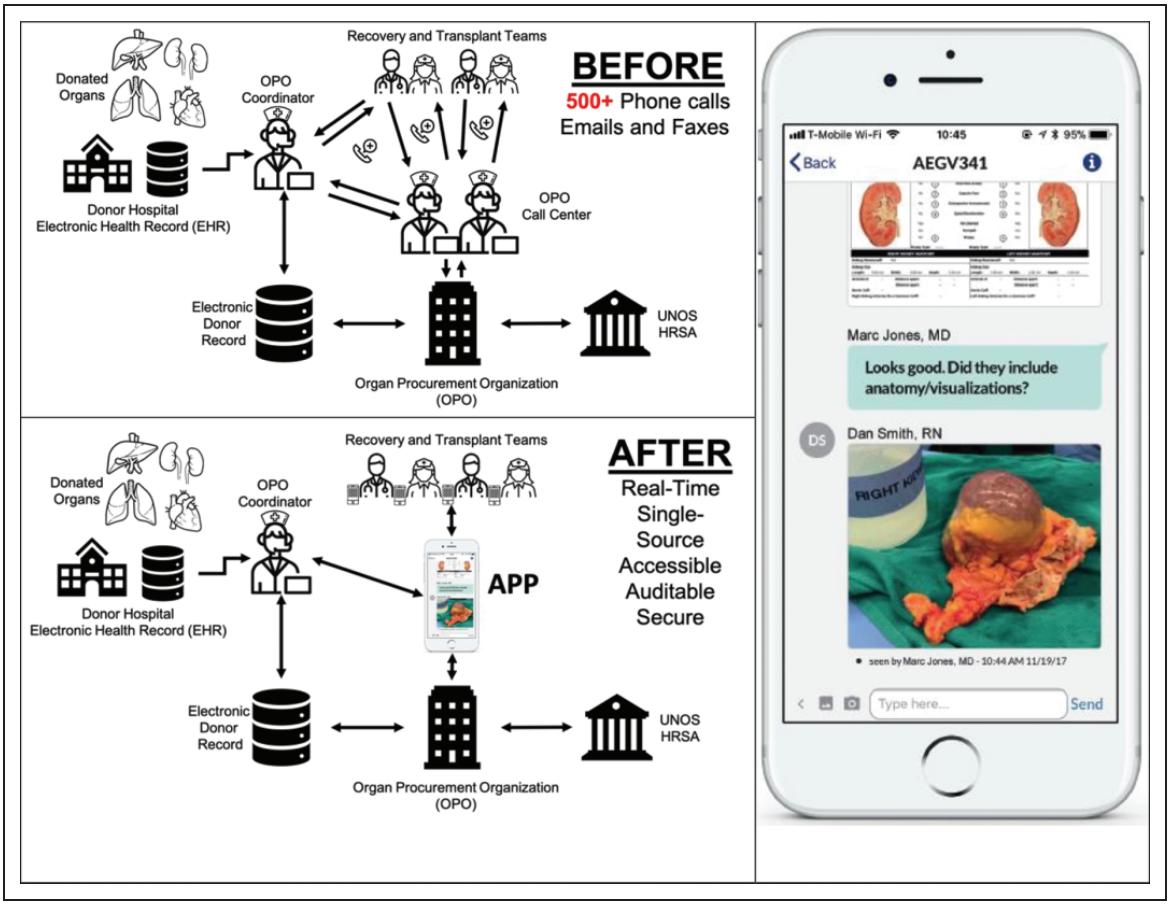

Figure 1. The communication process map before and after the development of mobile application. The data and images are fictitious and included for illustrative purposes only.

only 25 seconds. See Figure 2 for results from the surveys and RCA analysis. The team members reported that the app contributed to a substantial increase in clinical productivity, increase in case progress awareness, and reduction in redundant phone calls. The relational coordination measurements from 54 respondents indicated a higher mean TeamScore with the app (mean: 4.01) when compared with controls in Indiana (mean: 3.80) and Ohio (mean: 3.37). The intervention enhanced the review of the ROO report with automatically captured additional documentation (eg, message texts, pictures, videos, read receipts, and other activity).[AQ4]

Described in Table 1, the ROO data exhibited shorter case times (50% reduction from 20 to 10 hours) and additional transplanted kidneys (+35%) during the intervention when compared to the average of the control periods (previous 2 years). A total of 66 organs were transplanted with the app during the intervention period; however, the ROO only reported 22 due to a limitation on data acquisition from UNOS. All imported kidneys were offered and facilitated using the app by Iowa OPO to Iowa TC during the study, and only one-third of the kidney offers were available and documented in the Iowa OPO ROO.

Implications for Practice

Mobile and user-first design methodologies were frequently employed during the development of popular communication and social applications by companies such as Facebook, Apple, and Google. These same design principles guided the development of a clinically productive and value-adding app that alleviated a substantial limitation on organ procurement and transplant communication. The app was a dedicated, real-time, effective, primary communication tool for a variety of different work roles among professionals during the procurement period. The app increased team cohesiveness and relational coordination metrics among members. Users reported a substantial increase in productivity and case awareness simultaneously. The nature of the PDSA methodological design introduces a scientific limitation. A sole causal relationship cannot be attributed to the app for the substantial performance gains measured from the intervention group.

This performance improvement project concluded that the app was beneficial for use during procurement and transplant processes. While the PDSA applied to kidneys only, other organs that require faster procurement and transplant may

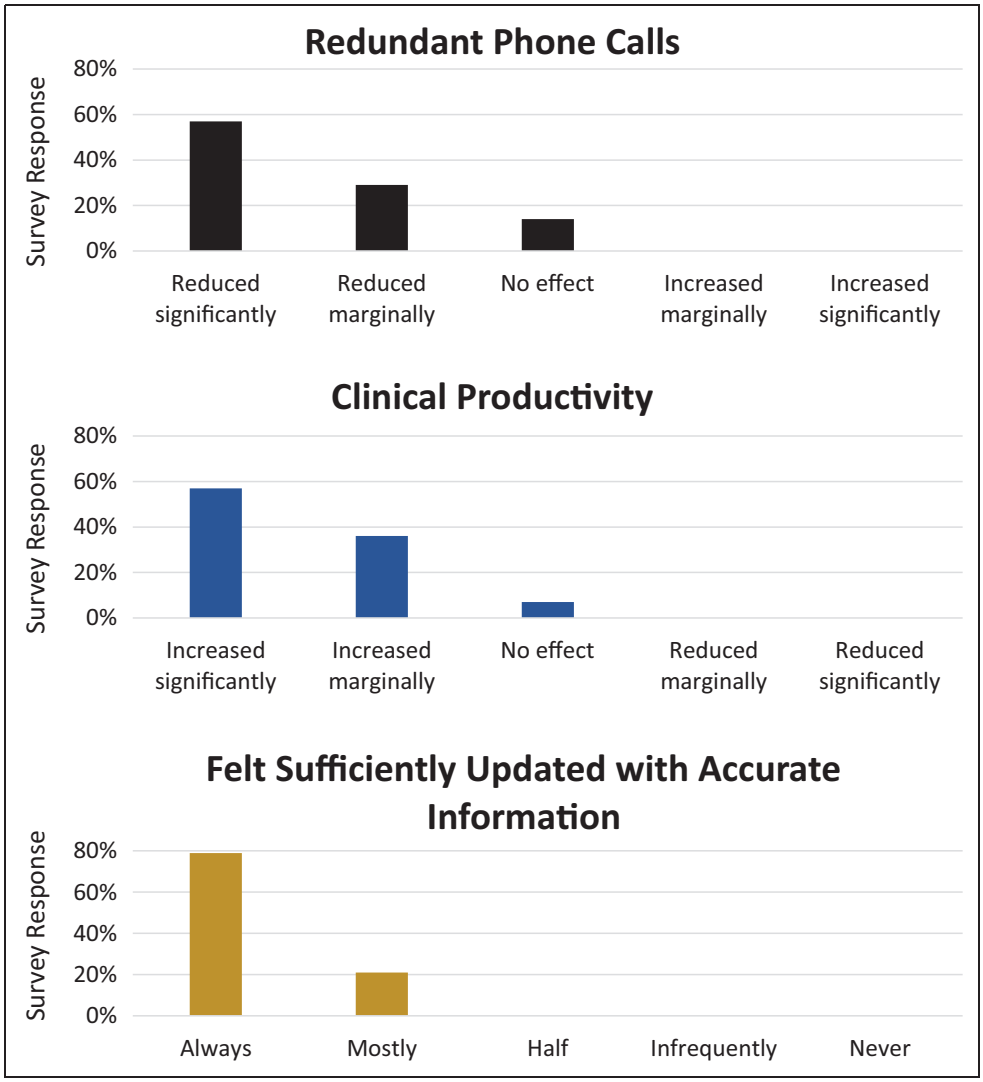

Figure 2. Process outcomes for team cohesion and perceptions of reduction in redundant phone calls, increase in clinical productivity, and accurate up-to-date information collected from the intervention group (Iowa).

Table 1. Report of Organ Offers Comparing Iowa's Historical Controls, 2016 (Control 1), 2017 (Control 2), and Intervention Period 2018.

Cohort	Case Time (Average, Hours)	Organs Transplanted
Control 1 (2016)	16	11
Control 2 (2017)	21	19
Intervention (2018)	10	22

benefit from a similar communication intervention (eg, heart and lungs). The use of the app contributed to an increased RCA TeamScore; decreased time from initial offer to transplant; increased number of organs transplanted; decreased extracorporeal transfer (cold ischemia time); reduced redundant, contradicting, and untimely phone calls; increased clinical productivity; and improved team confidence and information access. A communication app has the potential to improve organ utilization and patient outcomes while reducing clinical frustration and delays and improve the quality of life for all professionals involved in the process. The data indicated that all OPOs and TCs should formally evaluate their respective communication processes and introduce a dedicated real-time system for coordinating organ procurement and transplant.

Authors' Note

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Declaration of Conflicting Interests

The author(s) declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article: Eric Pahl and Robert Emery are officers of OmniLife and

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