A Mobile App to Facilitate Socially-Distanced Hospital Communication During the COVID-19 Pandemic: Implementation Experience

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Abstract

Background: The novel coronavirus (COVID-19) pandemic has significantly altered the delivery of healthcare, requiring clinicians and hospitals to adapt to rapidly changing hospital policies, as well as social distancing guidelines. To help address these challenges, we adapted an existing mobile app to communicate hospital policies, as well as enable direct communication between clinical team members and hospitalized patients.

Objective: To describe the features and utilization of a novel mobile application.

Methods: We implemented moblMD, a mobile app for iOS and Android. We worked with our Hospital Incident Command System to identify key policies to distribute using the app. The app was also populated with a searchable directory of numbers to patient bedside phones and hospital locations. We monitored anonymized user activity from February 1 – July 31, 2020.

Results: Following its announcement the app was downloaded by a total of 1104 clinicians during the observation period, with 504 downloads within 72 hours of the first announcement. Review of COVID policies using the app was most common during the first week. Users made sustained use of hospital phone dialing features throughout the observation period and its use mirrored hospital activity and call center volume trends.

Conclusions: We were able to rapidly develop and deploy a communication-focused mobile app in the early period of the COVID-19 pandemic that has demonstrated initial and sustained value for clinicians in communicating with inpatients and each other in the context of social distancing.

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JMIR mHealth Short Paper

A Mobile App to Facilitate Socially-Distanced Hospital Communication During the COVID-19 Pandemic: Implementation Experience

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Figures/Tables: 2
References: 20

Conflicts of Interest

ECA is the developer of the app. The app is not commercially available, and ECA receives no proceeds related to its use. The app was supported by the University of Chicago Medicine Center for Healthcare Delivery Science and Innovation. None of the other authors have disclosures.

Abstract

Background: The novel coronavirus (COVID-19) pandemic has significantly altered the delivery of healthcare, requiring clinicians and hospitals to adapt to rapidly changing hospital policies, as well as social distancing guidelines. In our large academic medical center, this prompted clinician feedback that existing information distribution channels, including email and hospital intranet, were inadequate to keep all abreast of these changes. To help address these challenges, we adapted an internally developed mobile app to communicate critical changes in hospital policies and enable direct phone communication between clinical team members and hospitalized patients, to support social distancing guidelines and remote rounding.

Objective: To describe the unique benefits and challenges of adapting an internal application rapidly to facilitate communication and remote rounding during the pandemic.

Methods: We implemented moblMD, a mobile app for iOS and Android. In conjunction with our Hospital Incident Command System, Resident Advisory Council, and health system innovation center, we identified critical and time sensitive policies to distribute using the app. A shared collaborative document was used to align communication on the app with more traditional communication channels. To minimize synchronization efforts, focus was directed towards high-yield policies, and the time of last review and reviewer were noted in each protocol. To facilitate social distancing and remote patient rounding, the app was also populated with a searchable directory of numbers to patient bedside phones and hospital locations. We monitored anonymized user activity from February 1 – July 31, 2020.

Results: Following the first announcement of its availability, the app was downloaded by a total of 1104 clinicians during the observation period, with 46% (508) downloads in the first 72 hours. Review of COVID policies using the app was most common during the first week (801 views). Users made sustained use of hospital phone dialing features, including weekly peaks of 2242 phone number dials, 1874 directory searches, and 277 room number searches in the last two full weeks of the observation period. Fifty-six content and phone number suggestions were submitted via the app.

Conclusion: We were able to rapidly develop and deploy a communication-focused mobile app in the early period of the COVID-19 pandemic that has demonstrated initial and sustained value for clinicians in communicating with inpatients and each other in the context of social distancing. Our internal innovation benefitted from our team's familiarity with institutional structures, short feedback loops, limited security and privacy implications, and a path toward sustainability provided by our innovation center. Challenges in content management were overcome by synchronization efforts and timestamping review. As COVID-19 continues to alter healthcare delivery, user activity metrics suggest that our solution will remain important in our efforts to continue providing safe and up-to-date clinical care.

Introduction

The coronavirus disease 2019 (COVID-19) pandemic has fundamentally altered healthcare delivery. Hospitals have rapidly established and revised protocols that promote optimal patient care while minimizing exposure[1], particularly in the context of limited supplies of personal protective equipment (PPE)[2]. Similarly, clinicians have altered the most basic aspects of patient care due to social distancing, all while adjusting to near daily changes in practice protocols. In this environment, the use of telehealth has increased substantially[3–5], bolstered by a temporary relaxation of technology requirements[6].

Faced with the challenges of disseminating rapidly changing policies via email and the hospital intranet to a newly remote workforce, we adapted an existing mobile application to improve information accessibility in our institution. The app also provided direct dialing to inpatient rooms, to facilitate clinician-patient communication while minimizing exposures and use of PPE. Here, we describe the implementation and use of this application during the early stages of the COVID-19 pandemic in our academic medical center, as well as the benefits and challenges encountered.

Methods

At the onset of the pandemic, the Hospital Incident Command System (HICS) was established at the University of Chicago Medical Center (UCMC) and began distributing institutional policies and guidelines via email and the hospital intranet. HICS soon determined that mobile communication might help overcome the limitations of messaging through email and the intranet encountered by many frontline workers, but developing a new mobile app was infeasible due to the overwhelming demands the pandemic had already placed on the information technology (IT) team. Leadership began considering how existing communication technologies could be adapted rapidly.

moblMD, a mobile application[7][Appendix 1], was initially implemented at UCMC in April 2018 as part of a feasibility study. The app provided a hospital directory, facilitated dialing of hospital phone numbers, and distributing institutional guidelines. Developed internally by a cardiology fellow, it was a project of the Resident Advisory Council and used by 156 housestaff prior to the COVID-19 pandemic.

As an alternative to novel app development, moblMD was quickly adapted to: 1) distribute COVID-19 policies from the HICS team; and 2) allow clinicians to search for and dial inpatient room phones, as well as charge nurse and unit secretary phones, to promote social distancing and remote rounding.

Members of the HICS team representing nursing, strategy, and communication were identified to validate information in the app. To align on messaging, shared documents were used to ensure updates distributed via email and intranet were reflected in the content of moblMD. This small group of test users were given preview access to updates before each release. After a rapid privacy and IT security review, instructions were distributed to all attending physicians, housestaff, and advanced practice providers on March 29, 2020, and all nurses on March 30, 2020. A new class of housestaff started on June 22, 2020, and a new version of the app with a more intuitive interface for dialing patient rooms went into production on June 25, 2020. Thus, a reminder announcement was

distributed on July 14, 2020.

Anonymized aggregate user activity data from the application server was reviewed from approximately two months before and four months following the initial announcement (February 1 – July 31, 2020). Outcomes included number of app users and user actions. User actions were categorized as: general phone directory search, patient room phone number search, phone number dialing, and policy content review (Figure 1). Policy content reviews were examined for both frequency and page viewed. The use of moblMD received approval from the Institutional Review Board.

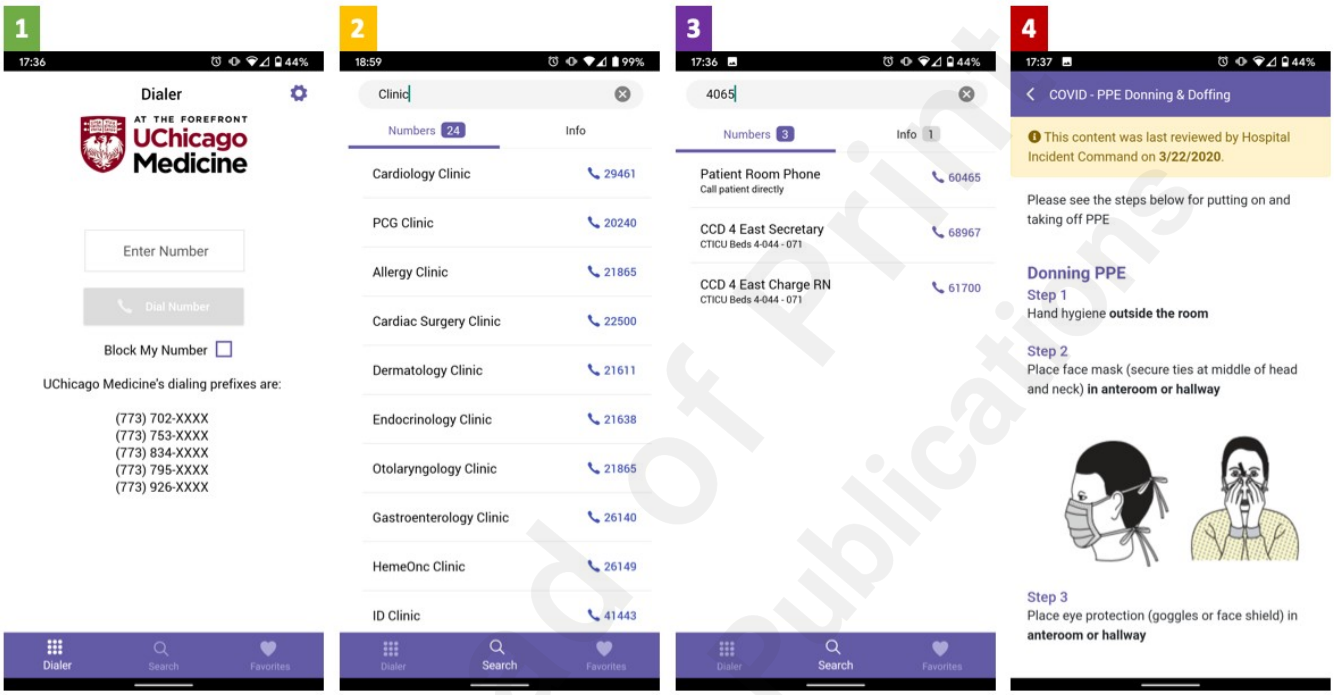

Figure 1 – Representative screenshots of user activity categories within the app, ranked in order of most to least used.

Results

In the four months following the first announcement in March, the app was downloaded by 1104 unique users, with 46% (508) downloads in the first 72 hours following the first announcement, and 10% (110) downloads in the 72 hours following the second announcement.[Appendix 2] Weekly totals for user app actions are shown in Figure 2.

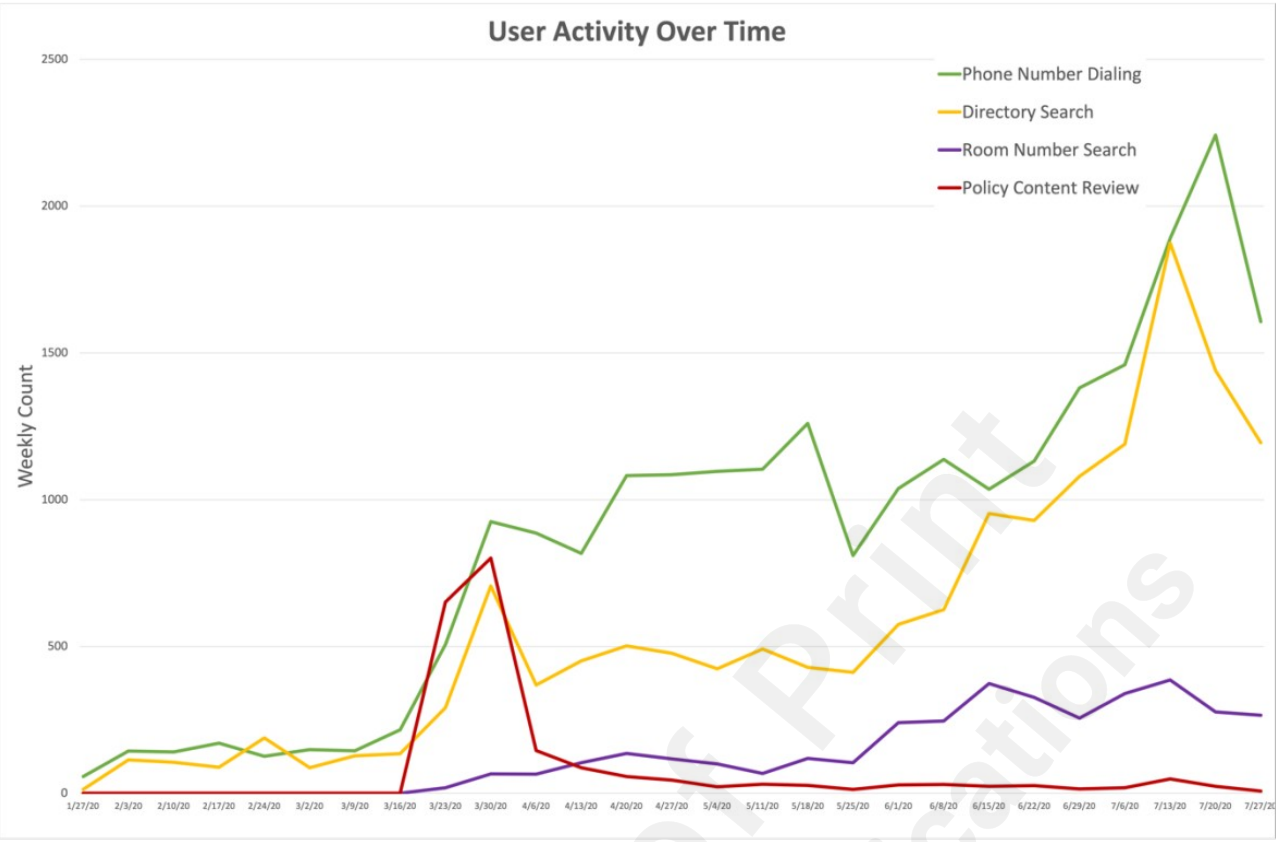

Figure 2 – Aggregate app user activity over the study period (February 1 – July 31, 2020). Note: The Policy Content Review and Room Number Search functions were not implemented until the March 14. The last charted week was not a full week.

In the 72 hours after the first announcement, policy content was accessed with similar frequency to directory searches and direct dialing, reaching a peak of 801 weekly views. The most viewed policy content during the study period were: COVID-19 Important Contacts (437 views); COVID-19 Frequently Asked Questions (410 views); and COVID-19 Testing, PUIs, and Exposure (253 views). [Appendix 3] In subsequent months, the most durable utilization of the app was hospital phone number dialing, including weekly peaks of 2242 phone number dials, 1874 directory searches, and 277 room number searches in the last two full weeks of the observation period. Users submitted 56 content suggestions through the app during the observation period and many others through informal channels.

Discussion

Summary of Experience

During the early stages of the COVID-19 pandemic, we found that an internally designed mobile app provided access to rapidly evolving institutional policies and protocols, facilitated remote patient care, and gained widespread durable use in our large academic medical center.

The most immediate impact of our intervention was to provide mobile access to new and changing hospital protocols in response to the pandemic. Prior to this, frequent communications from our HICS team with rapidly changing policies were only accessible via a series of emails and on the intranet. These channels could be particularly ineffective and overwhelming for clinicians redeployed to new clinical roles.[8] While a mobile format improved information accessibility for

frontline clinicians, it was challenging to keep disparate information sources synchronized. Aligning moblMD content with traditional communication channels, focusing on policies of high impact to direct patient care (e.g. PPE use, ICU guidelines), and labelling entries with the time of last review and reviewer (Figure 1, box 4) helped address these challenges. Another challenge in managing content was curating full-length Microsoft Word and Portable Document Format (PDF) content for brevity and mobile-friendly formatting. In a subsequent update, the ability to link PDF documents was added. As might be expected, content views, such as PPE instructions and exposure protocols, peaked in the first 72 hours following the first announcement of the app as clinicians first consumed content, less likely to require repeated views.

The most durable impact of our mobile application was the facilitation of remote patient care. Prior to the pandemic, our clinicians like many others[9], routinely used their smartphones at the point of care. Although patient bedside phone numbers were previously accessible via the hospital call center or within the electronic health record, our mobile solution decreased friction by providing a faster alternative. By making mobile communication easier, we reduced the need for in-person communication as remote patient care became the norm to minimize PPE use and clinician exposure.

Many institutions have implemented other forms of “inpatient telehealth” or “ePPE” by which patients video chat with clinicians via hospital-owned devices.[10–12] While this is a viable solution, it is more costly and cannot be rapidly implemented for most institutions. Our intervention allowed similar remote patient contact in a matter of days, all accessible from a clinician’s smartphone.

As others have noted, there are benefits and unique challenges to internally-sourced innovation.[13] Developed internally, our app benefitted from our team’s understanding of institutional culture and structure. This resulted in shorter feedback loops for content and feature updates. Feedback to the HICS team was passed along quickly to the developer, and the app also included a feedback feature allowing clinicians to request updates. Clinicians were quick to suggest phone numbers relevant to their practice areas. Additionally, early user feedback prompted an interface update to better communicate the patient room search function. Finally, distribution on Google and Apple marketplaces, while familiar for users, required app review that took several days and needed to be factored into the discussion of feature requests.

Mobile communication and app use in healthcare has led to concerns for patient privacy[14] and information security.[15–17] Prior to release, an internal security and IT review was conducted in 5 business days despite the process typically taking much longer. moblMD was granted security approval expeditiously because it did not interface with hospital infrastructure or collect user information other than an email address used for authentication. As a one-way communication channel, there was little risk of inappropriate patient information transmission. Following approval, the security team recommended follow up after the pandemic to address non-critical concerns.

Support and sustainability also had to be addressed in our rollout of moblMD. Fortuitously, our Center for Healthcare Delivery Science and Innovation (HDSI) had just announced an internal funding opportunity for COVID-19 innovations that provided a critical path towards sustainability. This helped advocate for our innovation within hospital leadership, financially supported app infrastructure, and provided personnel time to update content. Informed by our experience, HDSI has adopted an innovation intake process to connect internal innovators with funding and resources in IT, compliance, and legal to facilitate early growth and validation.[18]

Conclusion

We successfully adapted a mobile application to facilitate remote patient care and disseminate COVID-related hospital protocols in a short period of time. Our mobile solution scaled without issue following announcements to thousands. Key to our implementation's success were the team's familiarity with institutional structures, short feedback loops, limited security and privacy implications, and a path toward sustainability provided by our innovation center. Challenges in content management were overcome by synchronization efforts and timestamping review._As COVID-19 continues to alter healthcare delivery, user activity metrics suggest that our solution will remain important in our efforts to continue providing safe and up-to-date clinical care.

Acknowledgements

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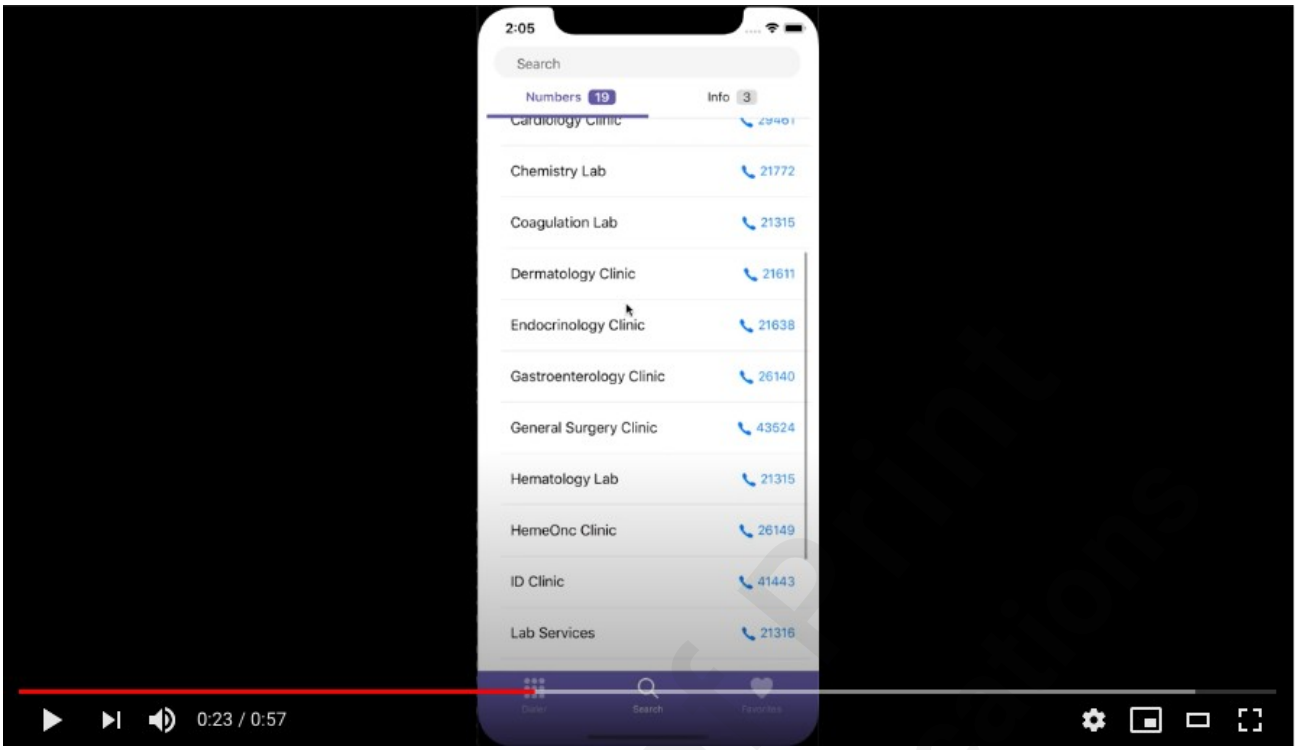
References

1. The Lancet. COVID-19: protecting health-care workers. Lancet (London, England) 2020;395(10228):922. PMID:32199474
2. Kamerow D. Covid-19: the crisis of personal protective equipment in the US. BMJ 2020 Apr;369:m1367. PMID:32245847
3. Gilson SF, Umscheid CA, Laiteerapong N, Ossey G, Nunes KJ, Shah SD. Growth of Ambulatory Virtual Visits and Differential Use by Patient Sociodemographics at One Urban Academic Medical Center During the COVID-19 Pandemic: Retrospective Analysis. JMIR Med informatics [Internet] 2020 Dec 4;8(12):e24544. PMID:33191247
4. Wosik J, Fudim M, Cameron B, Gellad ZF, Cho A, Phinney D, Curtis S, Roman M, Poon EG, Ferranti J, Katz JN, Tcheng J. Telehealth transformation: COVID-19 and the rise of virtual care. J Am Med Inform Assoc 2020;27(6):957–962. PMID:32311034
5. Vilendrer S, Patel B, Chadwick W, Hwa M, Asch S, Pageler N, Ramdeo R, Saliba-Gustafsson EA, Strong P, Sharp C. Rapid Deployment of Inpatient Telemedicine In Response to COVID-19 Across Three Health Systems. J Am Med Inform Assoc 2020 Jun; PMID:32495830
6. The Office for Civil Rights (OCR) at the Department of Health and Human Services (HHS). Notification of Enforcement Discretion for Telehealth Remote Communications During the COVID-19 Nationwide Public Health Emergency [Internet]. HHS.gov. 2020. Available from: https://www.hhs.gov/hipaa/for-professionals/special-topics/emergency-preparedness/notification-enforcement-discretion-telehealth/index.html
7. moblMD [Internet]. Available from: https://mobl.md
8. Moyal-Smith R, Sinyard RD, Goodwin C, Henrich N, Molina G, Haas S. Rapid Onboarding: A Toolkit for Redeployed Clinicians. NEJM Catal Innov Care Deliv [Internet] 2020; Available from: https://catalyst.nejm.org/doi/full/10.1056/CAT.20.0570
9. Martin G, Khajuria A, Arora S, King D, Ashrafian H, Darzi A. The impact of mobile technology on teamwork and communication in hospitals: a systematic review. J Am Med Inform Assoc [Internet] 2019;26(4):339–355. PMID:30689893
10. Hron JD, Parsons CR, Williams LA, Harper MB, Bourgeois FC. Rapid Implementation of an Inpatient Telehealth Program during the COVID-19 Pandemic. Appl Clin Inform [Internet] 2020 May;11(3):452–459. PMID:32610350
11. Grange ES, Neil EJ, Stoffel M, Singh AP, Tseng E, Resco-Summers K, Fellner BJ, Lynch JB, Mathias PC, Mauritz-Miller K, Sutton PR, Leu MG. Responding to COVID-19: The UW Medicine Information Technology Services Experience. Appl Clin Inform [Internet] 2020;11(2):265–275. PMID:32268390
12. Turer RW, Jones I, Rosenbloom ST, Slovis C, Ward MJ. Electronic personal protective equipment: A strategy to protect emergency department providers in the age of COVID-19. J Am Med Inform Assoc [Internet] 2020;27(6):967–971. PMID:32240303
13. Asch DA, Terwiesch C, Mahoney KB, Rosin R. Insourcing health care innovation. N Engl J Med [Internet] 2014 May 8;370(19):1775–7. PMID:24806157
14. Prochaska MT, Bird A-N, Chadaga A, Arora VM. Resident Use of Text Messaging for Patient Care: Ease of Use or Breach of Privacy? JMIR Med informatics [Internet] 2015 Nov 26;3(4):e37. PMID:26611620
15. Dehling T, Gao F, Schneider S, Sunyaev A. Exploring the Far Side of Mobile Health: Information Security and Privacy of Mobile Health Apps on iOS and Android. JMIR mHealth uHealth [Internet] 2015 Jan 19;3(1):e8. PMID:25599627
16. Müthing J, Jäschke T, Friedrich CM. Client-Focused Security Assessment of mHealth Apps and

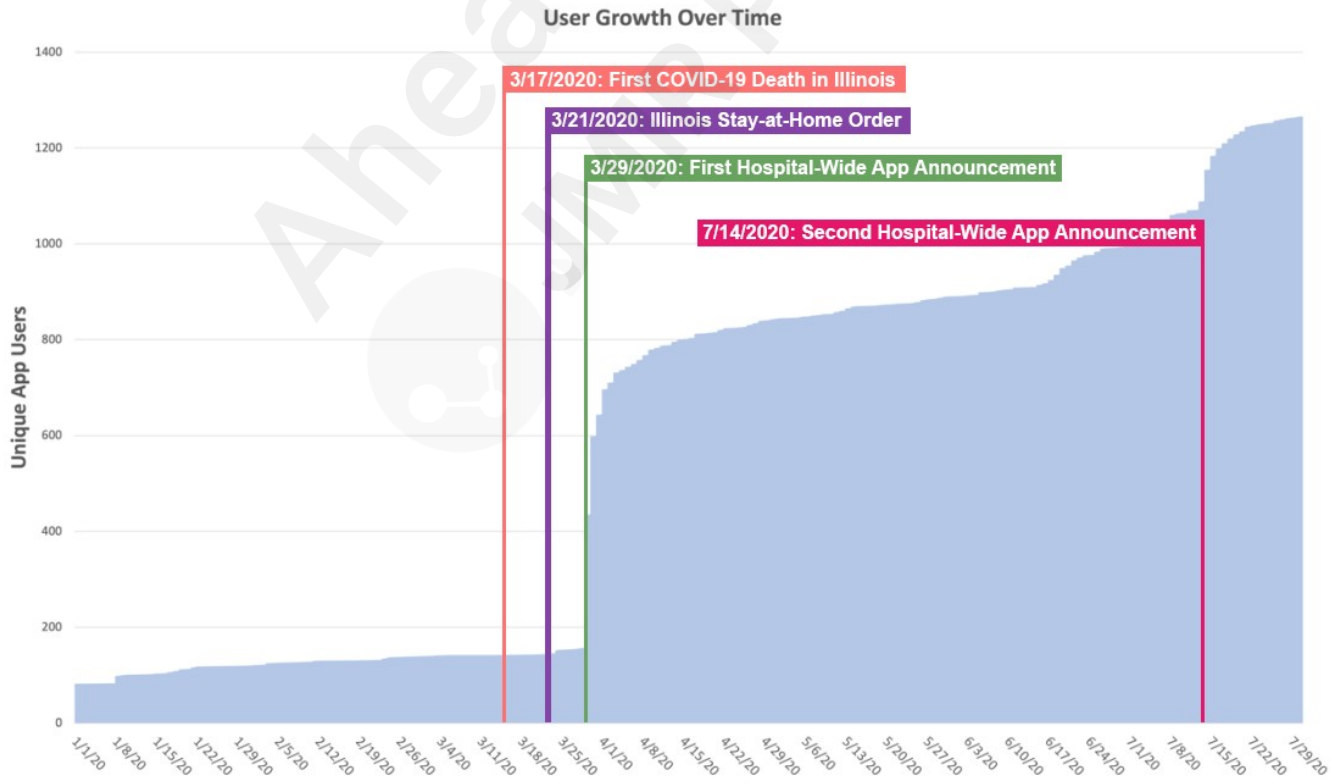
Recommended Practices to Prevent or Mitigate Transport Security Issues. JMIR mHealth uHealth [Internet] 2017 Oct 18;5(10):e147. PMID:29046271

17. Müthing J, Brüngel R, Friedrich CM. Server-Focused Security Assessment of Mobile Health Apps for Popular Mobile Platforms. J Med Internet Res [Internet] 2019;21(1):e9818. PMID:30672738
18. Center for Healthcare Delivery Science and Innovation. Available from: https://hdsi.uchicago.edu/innovation/
19. State of Illinois Coronavirus (COVID-19) Response [Internet]. Available from: https://coronavirus.illinois.gov/s/
20. Petrella, Dan; St. Clair, Stacy; Johnson, Steve; Pratt G. Gov . J . B . Pritzker issues order requiring residents to ‘ stay at home ’ starting Saturday. Chicago Trib [Internet] 2020; Available from: https://www.chicagotribune.com/coronavirus/ct-coronavirus-illinois-shelter-in-place-lockdown-order-20200320-teedakbfw5gvdgmnaxlel54hau-story.html

Appendix



Multimedia Appendix 1 – Video demonstration of the basic functionality of the moblMD app (Video uploaded to abstract website, also available on YouTube: https://www.youtube.com/watch?v=xwON5cunCdE)

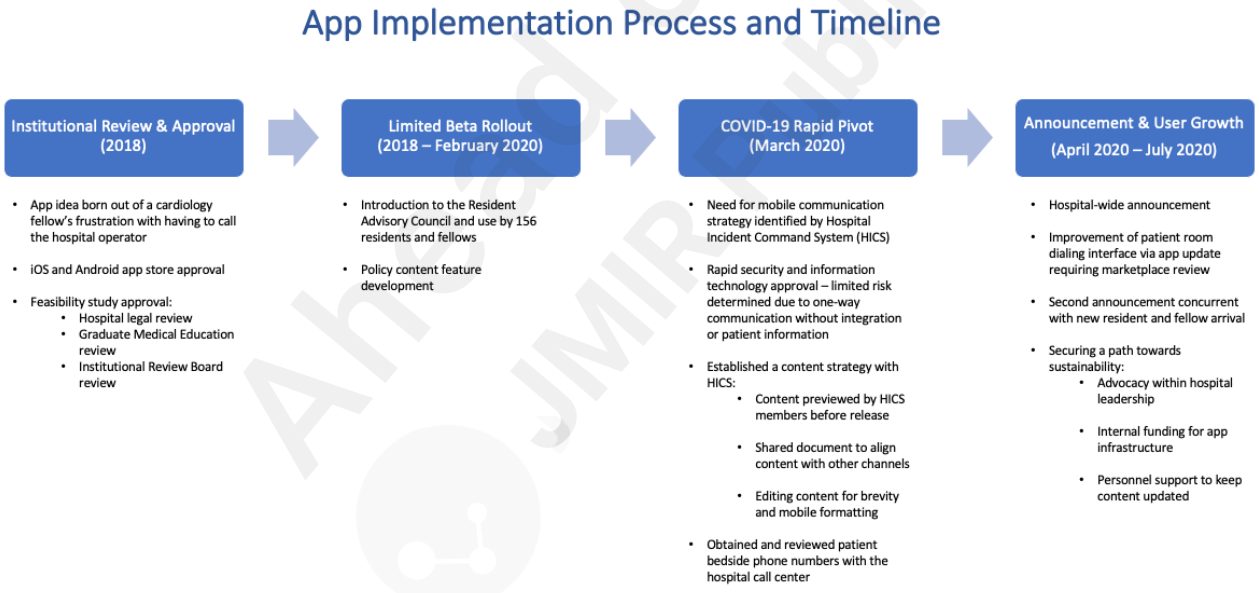


Multimedia Appendix 2 – moblMD app user account growth over time. Time markers highlighting the date of the first COVID-19 death[19], the start of Illinois' stay-at-home order[20], and our

hospital-wide app announcement.

Content Page	View Count
COVID - Important Contacts	437
COVID - Frequently Asked Questions[1]	414
COVID - Testing, PUIs, Exposure	253
COVID - ECMO & Mechanical Support	203
COVID - Admissions, Ambulatory, and Other Encounters	193
COVID - Employee Furlough & Universal Masking	173
COVID - Isolation & PPE Protocols	164
COVID - PPE Donning/Doffing Instructions	157

Multimedia Appendix 3 – Policy content view counts during the study period (February 1 – July 31, 2020) [1]Frequently asked questions included those regarding employee support resources, COVID-19 support clinics, blood donation/research, and PPE donations.

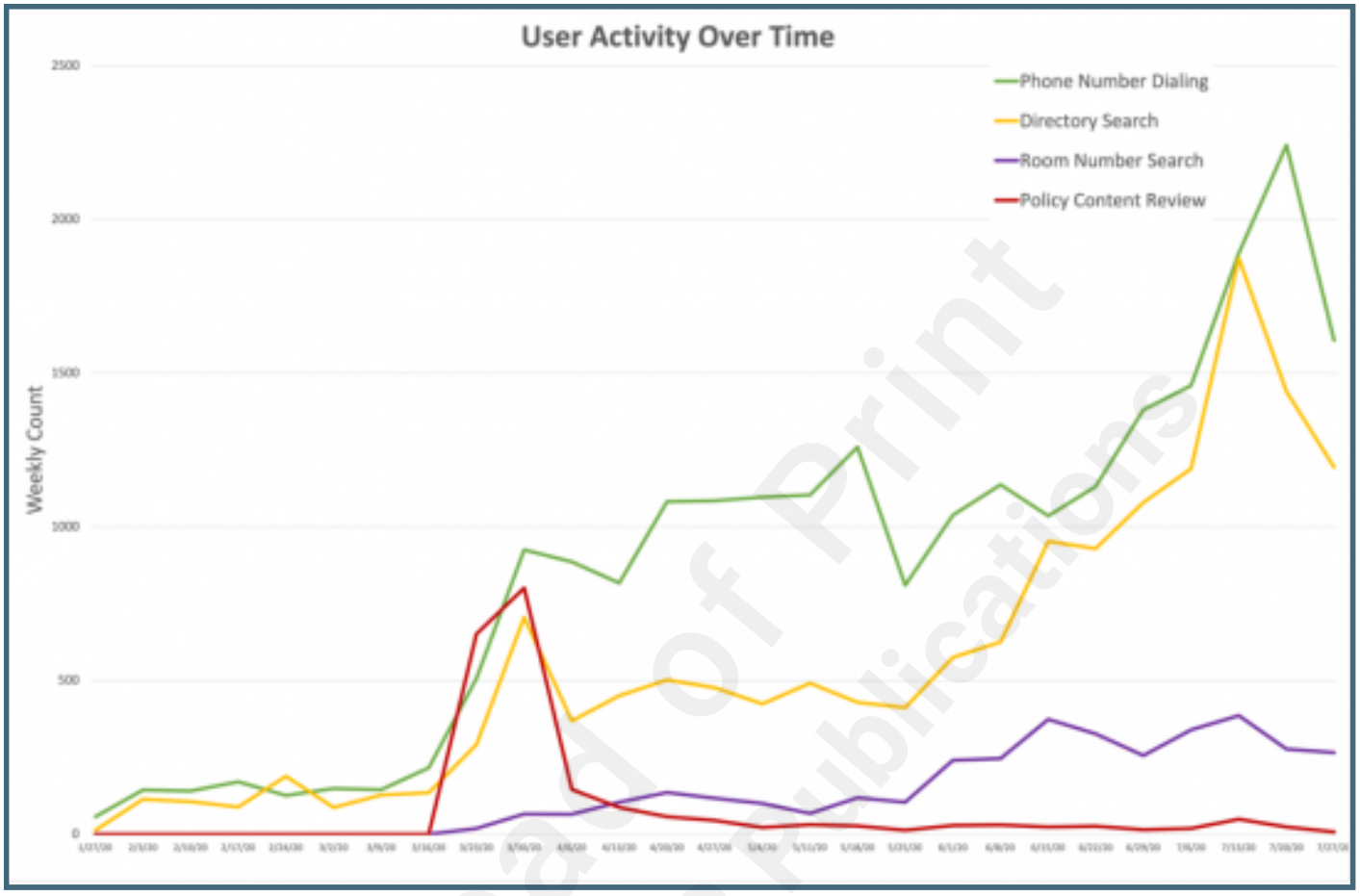


Multimedia Appendix 4 – Overview of the app implementation process and timeline.

Supplementary Files

Figures

Aggregate app user activity over the study period (February 1 – July 31, 2020). Note: The Policy Content Review and Room Number Search functions were not implemented until the March 14. The last charted week was not a full week.



Multimedia Appendixes

Video demonstration of the basic functionality of the moblMD app.
URL: http://asset.jmir.pub/assets/80864b6fb5662b16b6b2ad3b4395a619.mov

moblMD app user account growth over time. Time markers highlighting the date of the first COVID-19 death6, the start of Illinois' stay-at-home order7, and our hospital-wide app announcement.
URL: http://asset.jmir.pub/assets/c3f44d37d3947d76bfe292bd228e5289.png

Policy content view counts during the study period (February 1 – July 31, 2020) 1Frequently asked questions included those regarding: employee support resources, COVID-19 support clinics, blood donation/research, and PPE donations.
URL: http://asset.jmir.pub/assets/65462d84fcc1d426f938e89b07c3b79a.docx

Overview of the app implementation process and timeline.
URL: http://asset.jmir.pub/assets/9455f32f38067f932a6cb0da8982a132.png

TOC/Feature image for homepages

Representative screenshots of the communication functions of the moblMD app.