Use, Refine, Repeat: Implementation of a mobile application for patient education

Benjamin R. Childs MD[4], Mary A. Breslin BA[1], Anna Swetz[1], Mai P. Nguyen MD[5], Natasha M. Simske BS[3], Paul S. Whiting MD[3], Aswinkumar Vasireddy MD[2], Eleanor Wilson BA[1], Heather A. Vallier MD[5]

1)MetroHealth Medical Center, Cleveland, Ohio 2)King's College Hospital, London, UK 3)Medical College of Wisconsin, Milwaukee, Wisconsin 4) Texas Tech University Health Sciences Center, El Paso, Texas 5) Case Western Reserve University

Objectives: To identify how implementation strategies impact adoption of a patient education application by orthopaedic trauma providers and patients.

Design: Unstructured narrative interview and retrospective review

Setting: Four Level 1 Trauma Centers

Participants: Seven researchers responsible for enrolling orthopaedic trauma patients

Intervention: Development and implementation of a mobile application (app) (http://bit.ly/traumaapp) for patient education regarding orthopaedic trauma at three hospital sites.

Main outcome measurements: Unstructured narrative interviews were gathered from seven investigators (attendings n = 3, research personnel n = 4). Standard usage statistics were obtained from the google play and apple app stores including active users, time in app, user download geographic region. Download ratios were calculated from investigator logs of approaches and success.

Results: In the 39 months between January 2017 to April 2020, there were 144 downloads by patients at the original center. In the three other centers added in October 2018, there were 404, 109, and 34 downloads over an 18-month period until April 2020. The mean number of downloads per center was 173±161. Quotes from unstructured narrative interviews by investigators described promotional materials as "effective" and the app as "easy to use" with "relevant content." Additionally, all investigators reported that patients were able to find the app easily and that a majority of patients had devices capable of using the app. Four investigators report that they believe intentional provider interaction with the patient and app increased the download ratio, which ranged from 0.7% to 9.8% of all trauma admissions at each center. Active champions were referenced by all investigators as leading to increased downloads regardless of provider level of the champion. All centers struggled to influence providers beyond the study investigators to adopt the app. All investigators reported poor cell reception and problems with internet connection in hospitals as barriers to facilitating patient downloads.

Conclusion: This study documents the successes and challenges of implementing patient education app for orthopaedic trauma patients presenting to four Level 1 trauma centers in the US and UK. At our institutions, downloads were driven by organizational champions at each center who actively promoted the app to patients using standard promotional materials. However, organizational challenges and unreceptive healthcare workers remain a challenge and adoption was not widespread among non-participant providers at each institution. Ultimately, our experience identified iteratively improving implementation strategies and empowering an organizational champion who can lead iterations of implementation, improve relevant technology, and prepare the organization for app adoption as strategies critical to our success.

Level of Evidence: IV

Keywords: Patient education, technology, mobile application, app, trauma, orthopaedic, champion, iteration, multicenter

(J Ortho Business 2022; Volume 2, Issue 3:pages 12-17)

INTRODUCTION

At the first postoperative visit, less than 50% of orthopaedic trauma patients know which bone they injured, less than 50% know their weight bearing status, and less than 20% are aware of expected healing times.[1] Subsequently, wielding widely accessible technology to improve patient education may be valuable in addressing postoperative knowledge discrepancies. Although patient education apps have the potential to impact patient outcomes, their use is not yet widespread.[4-9] There are over 100,000 mobile applications (apps) classified as "health apps" in the Apple App Store with topics including arrythmia, cancer, endoscopy, smoking cessation, and hematology; however, most are not focused on patient education or written by physicians.[2,3] Furthermore, the authors of the present study are unaware of any app specific to patient education for orthopaedic-trauma.

The frequency and burden of daily interaction with electronic medical record systems has left physicians skeptical of new technology and increasingly protective of their time.[17] Concepts from both the technology acceptance model for physicians (TAM)[18] and the multilevel model of resistance[19] suggest that successful implementation of new technology depends on the design of the technology, the beliefs and attitudes of the users, and the culture of the organization. While the TAM and the multilevel resistance models differ, there is substantive overlap in three concepts: first, the

Table 1: Strengths of the app and challenges to implementation of a patient education app at 4 level 1 trauma centers.

Strengths	Challenges
• Design of app • Content of app • Access to app • Replication of level of downloads at new centers • Patient access to capable devices • Increased use of the app with the patient by providers led to increased download rate • Active "champions" led to increased downloads regardless of provider level • Promotional materials worked in all facilities • Use by non-study providers led to consistent patient downloads • Use of the app for non-research purposes did not require IRB approval at any site.	• Difficulty spreading use of app to providers not associated with study • Difficulty with Wifi and cell phone signal in the hospital and clinic • Content only in English • Permanent display of materials requires approval of facility • Perceived division of roles between research staff and clinical staff may cause conflict. • App does not provide feedback regarding use or effectiveness of patient education.

"object" (technology) must be easy to use and designed to fit into the workflow; second, the "subject" (or physician) must be confident in not only the patient's but also their own ability to use and derive benefit from the technology; and third, the "initial conditions" (attitudes, organizational structure and normative behaviors of the organization) must not obstruct the use of the technology. Ideally, an organization that is ready for change is one in which people value the change and believe they can carry out the change with the given resources.[20]

To facilitate adoption of new technology, implementing organizational changes is described as an iterative process that repeats four phases: enrollment of the participants, preparation for implementation, trial of implementation, and reflection[16]. Effective implementation is rarely successful immediately. During the preparation phase, it is crucial to prepare not only the technology but also the stakeholders and the organization. The final step, reflection, is critical to promoting growth and evolution. Especially in medicine, the implementation of any new technological protocol accrues challenges.[14,15] To address these challenges, implementation science offers many frameworks to analyze the process, including three important concepts we will reference throughout our paper: first, that implementation is an iterative process; second, that resistance can spring from shortcomings with preparation of the technology, the physician, or the institution; and finally, that a champion, defined as a committed and enthusiastic proponent of change who provide the sustained and active effort throughout implementation, can effectively address many of the challenges to implementation of a new idea.[21,22]

As applied to the adoption of technological changes in a healthcare setting, implementation is considered an iterative process that requires appropriately designed technology, receptive healthcare workers, an accommodating healthcare organization, and facilitation by a champion. In this study, we examine our experience implementing a patient education app for orthopaedic trauma at four Level 1 trauma centers on two continents and compare our experiences to those in existing literature. We hypothesize that strategies that were successful at multiple centers are generalizable to aid other organizations in successfully implementing a healthcare app.

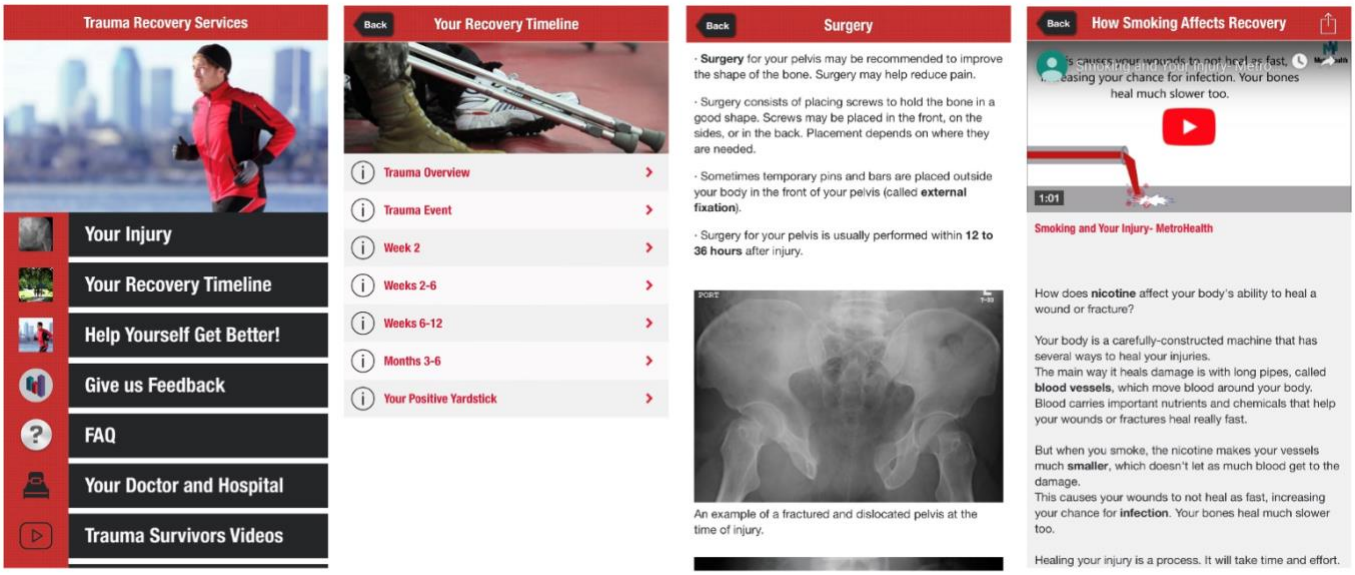
METHODS

We developed an app for patient education titled "Trauma Recovery Services" that can be found at http://bit.ly/traumaapp. The app is written at the eighth grade reading level and contains information about common injuries, treatment options, recovery information, and relevant images.[10] It also provides a link to trauma support groups as well as physician and clinic information.[11] The app includes additional information about nutrition, medication, exercise, and rehab. Based on user feedback obtained by narrative survey after initial implementation, content about general trauma injuries common in our population was added. Physician biographical information from public website data was also added.

The initial pilot Level 1 trauma center began using the app in January 2017 with the additional three centers joining in October 2018. The implementation phase of app use at each trauma center began with a researcher meeting with clinic staff including physicians, nurses, and residents to facilitate awareness of the app as a resource. Posters detailing the app were hung and flyers were given out on the orthopaedic floor and in orthopaedic trauma clinic (Figure 2). Each center had one or more champions to lead implementation. Champions included pre-medical and medical students, resident physicians, nurse practitioners, and attending physicians.

De-identified data was collected from the app including downloads, download location (region), frequently

Figure 1: Examples of content from the Trauma Recovery Services app



used features, overall usage volume per day, and time spent in app. Patients were offered a brief survey regarding their experience with the app approximately 24 hours after exposure. Age, relationship to patient, functionality, and desired improvements were gathered from the survey. Ratio of views to downloads and overall usage was collected from the app retailer. Unstructured narrative interviews with seven individuals (four coordinators and three physicians) who participated in implementing use of the application at each center. Narrative reports of answers to questions concerning strengths and weaknesses of the app, the number and position of people promoting the app, strategies used, and time dedicated to the app were collected and assessed. Information on promotional materials use and objections encountered from patients, healthcare workers, and the organization was also assessed. This information was combined with usage statistics from Google Play and Apple App Store to determine successful strategies for adoption of the app.

RESULTS

From January 3rd, 2017 through April 6th, 2020 the app was downloaded 1,122 times from Google Play and Apple App stores. This period represents two iterations of implementation: the pilot trial and the multicenter implementation. The mean number of downloads per center was 173±161. During the pilot phase from January 2017 to April 2020, there were 144 downloads from the original institution. During the trial for three centers from October

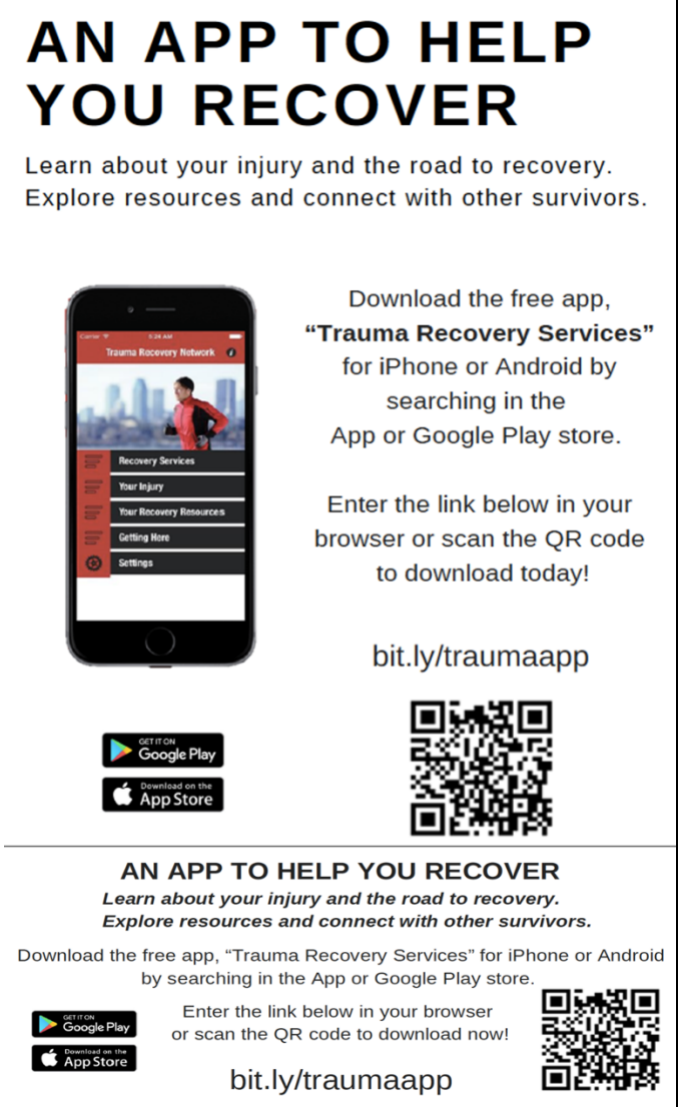
2018 to April 2020, there were 404, 109, and 34 downloads at each center. Overall, 62% of downloads (n=691/1,122) occurred in the metro areas of the study centers. Comparison with annual trauma admissions at each center shows that only 0.7% to 9.8% (mean 3.4± 4.3%) of trauma patients used the app (p=0.007.

From our assessment of narrative feedback, all investigators (100%, n=7/7) reported overall favorable impressions of the app regarding its content and ease of use. All expressed that they believed that patients could use the app and would benefit from it.

The same promotional materials were given out at all facilities. Two facilities allowed promotional material to be placed in patient rooms permanently. All respondents noted that a majority of patients had devices capable of using the app. Most centers (75%, n=3/4) had difficulties with WiFi or cell phone reception that interfered with patients' ability to download and use the app within hospital facilities. In one center, app use was limited by language availability as over a third of the patient population primarily spoke Spanish and the app was only available in English language at the time. The rate of app downloads in patients who were only given a flyer for the app was estimated at 1 in 20. In contrast, 1 in 5 patients who were personally shown the app on a device by a provider or researcher proceeded to download the app. Resistance to the app was encountered by all investigators (100%, n=7/7). Resistance was predominantly passive with the most prominent issue reported to be the lack of adoption of the app by other providers at the center despite repeated messaging about the availability of the app and its proposed benefit in delivering educational content (100%, n=7/7). Active resistance was also encountered by a nurse manager at one center who objected to research staff involvement in patient education. The majority of investigators (86%, n=6/7) were surprised by the difficulty they encountered in expanding app use to other healthcare providers beyond initial participants in this study. One center reported success in converting a team of orthopaedic nurse practitioners into regular users of the app.

The success of the champion in encouraging patient downloads was not dependent on the level of the provider with one of the two most successful centers having a nurse

Figure 2: Promotional materials used by all app teams. Poster version and Handout below



practitioner as the champion and the other having an attending physician. The center with medical student champion surpassed the highest performing centers while the medical student was present with 30 downloads in a month, but then regressed to near zero downloads per month without the presence of this champion.

DISCUSSION

In this paper, we examine the pilot trial and initial multicenter implementation of an orthopaedic trauma patient education app which resulted in over 1,000 downloads.[24] There are few studies to show the impact of apps on patient education[25] and most published interventions with patient education apps have less than 200 downloads.[26 27 28 29 30] However, the app use at each center ranged from under 1% of all trauma admissions to nearly 10% of trauma admissions, leaving significant room for progress in reaching a greater portion of patients. To our knowledge, this is the only published series of an app for orthopaedic trauma patient education. Despite the overall success of this project, results at each institution varied widely. We hope that combining our lessons learned with literature to frame them can help others have greater success implementing technology to improve patient education and we suggest taking an iterative approach to review what is working and reproduce it, empowering a champion who believes in the technology to lead its adoption, and working slowly to overcoming institutional objections while recognizing change will take time.

The first lesson we have taken from our experience is the importance of an iterative approach to the development and implementation of healthcare related technology. During the pilot trial and initial implementation phases, smaller iterations helped the project to be successful; for example, we sought constant feedback to develop and revise content that encouraged us to develop content about related non-orthopaedic injuries and to lower the reading complexity to Figure 3: Promotional materials used by all app teams. Poster version and Handout below

below an eighth-grade level, improving the overall content and layout. Additionally, successful centers shared techniques such as involving nurse practitioners and medical students. These techniques were later applied at other centers to increase app downloads. An additional benefit of the process of discussion, feedback, and revision was that it empowered additional stakeholders to buy in to the concept.

Another lesson from our experience is that resistance can come from multiple levels. While there will always be resistance when implementing change in medicine, particularly when that change involves technology, various challenges can be anticipated and addressed regarding the app, hospital personnel, operational flows, and other conditions in the hospital and clinic. One of the major challenges was resistance encountered from other physicians introduced to the app at research sites through individual meetings with research personnel. While physicians frequently expressed that they appreciated the concept, their main concerns focused on efficiency and they endorsed concern that the app would take too much time, that the clinic staff would not assist them in using or promoting the use of the app, and that their patients would not use or benefit from the app. Physicians also expressed concern regarding the lack of feedback capabilities through the app. The authors' main approach to addressing concerns was to attempt improvement of the app. For example, creating the resources that explained Intensive Care Unit (ICU) care and non-orthopaedic injuries led more providers to use the app, because it was useful for broader range educational needs.

Initial conditions within the hospital must also be analyzed as sources of resistance that can take time to change.[33] One example includes objections by office staff. At the highest performing center, office staff who believed the app was useful to patients used the app with patients as part of the clinic routine. In other centers, research staff were blocked

from clinics, posters were not allowed to be hung, and there was no public WiFi available to download the app.

Countering these objections by fostering a team-based approach including staff from medical assistants to hospital administration is critical to overcoming adverse initial conditions in hospitals. However, team-based approaches require substantial investment to foster.[34] While most initial operational barriers did not change during the study, approval for posters was obtained, and clinical staff initially unwilling to pilot the app were engaged though consistent communication. The recent need for a rapid transition to telemedicine during the COVID-19 pandemic provides an opportunity to integrate the use of a patient education app into these encounters.[35] Although the pandemic occurred after the study period, electronic patient education resources have the flexibility to be shared without in person visits.

One of the keys to overcoming resistance and eliciting feedback was to have a champion at each center.[36] The level of success of the champion was not dependent on their seniority. The champion for one of the most successful centers was a pre-medical student who was able to work with patients and to influence clinical staff at multiple levels. This eventually led to the integration of the app into clinic protocols. In the least successful center, a champion was recruited and had immediate success that regressed immediately after they left. Institutional conditions that facilitate use, positive normative beliefs, and habit formation are the strongest predictors for successful adoption of health technology by orthopaedic providers.[37] Champions were vital to influence these characteristics in addition to actively participating in patient education.

Successful implementation shared common features at each center including having a champion, prioritizing patient interaction, and overcoming initial resistance; however, there were benefits to individual centers' different approaches. Randomized trials of implementation strategies demonstrate that a variety of tactics are successful if they are thoughtful and applicable to the organization.[38] Improving content, engaging nurses and other practitioners, and empowering students to serve as champions were variations recognized as successful strategies at a particular institution before adoption by other centers. For any orthopaedic trauma center or surgeon who would like to use the Trauma Recovery Services app with their patients, we recommend engaging the providers who care for patients in clinic and on the floors, which are nurse practitioners at our institution. We also recommend engaging medical students to act as champions who can use the app with patients given our success with this strategy. We believe that both the strategies suggested for success and the challenges would be the same for anyone looking to develop a patient education app for another subset of patients.

Limitations are presented in Table 1. Key weaknesses include a lack of multilingual content, the lack of feedback to in the app, and lack of data on the clinical impact of the app. In addition, the experience at these four level 1 trauma centers ranged widely and may not represent the full range of technical and administrative challenges faced at other institutions.

CONCLUSION

This study documents the successes and challenges of implementing patient education app for orthopaedic trauma patients presenting to four Level 1 trauma centers in the US and UK. At our institutions, downloads were driven by organizational champions at each center who actively promoted the app to patients using standard promotional materials. However, organizational challenges and unreceptive healthcare workers remain a challenge and adoption was not widespread among non-participant providers at each institution. Ultimately, our experience identified iteratively improving implementation strategies and empowering an organizational champion who can lead iterations of implementation, improve relevant technology, and prepare the organization for app adoption as strategies critical to our success.

REFERENCES

1. Kadakia RJ, Tsahakis JM, Issar NM, Archer KR, Jahangir AA, Sethi MK, Obremskey WT, Mir HR. Health literacy in an orthopedic trauma patient population: a cross-sectional survey of patient comprehension. Journal of orthopaedic trauma. 2013 Aug 1;27(8):467-71.
2. Pires IM, Marques G, Garcia NM, Flórez-Revuelta F, Ponciano V, Oniani S. A Research on the Classification and Applicability of the Mobile Health Applications. *J Pers Med*. 2020;10(1):11. Published 2020 Feb 27.
3. Dattilo JR, Gittings DJ, Sloan M, Hardaker WM, Deasey MJ, Sheth NP. "Is There An App For That?" Orthopaedic Patient Preferences For A Smartphone Application. Appl Clin Inform 2017; 8: 832–844
4. Guo Y, Chen Y, Lane DA, Liu L, Wang Y, Lip GY. Mobile health technology for atrial fibrillation management integrating decision support, education, and patient involvement: mAF App Trial. The American journal of medicine. 2017 Dec 1;130(12):1388-96.
5. Greer JA, Jacobs JM, Pensak N, Nisotel LE, Fishbein JN, MacDonald JJ, Ream ME, Walsh EA, Buzaglo J, Muzikansky A, Lennes IT. Randomized trial of a smartphone mobile app to improve symptoms and adherence to oral therapy for cancer. Journal of the National Comprehensive Cancer Network. 2020 Feb 1;18(2):133-41.
6. Pecorelli N, Fiore JF, Kaneva P, Somasundram A, Charlebois P, Liberman AS, Stein BL, Carli F, Feldman LS. An app for patient education and self-audit within an enhanced recovery program for bowel surgery: a pilot study assessing validity and usability. Surgical endoscopy. 2018 May 1;32(5):2263-73.
7. Finkelstein J, Cha EM. Using a mobile app to promote smoking cessation in hospitalized patients. JMIR mHealth and uHealth. 2016;4(2):e59.
8. Ward R, Taha KM. Patient involvement as experts in the development and assessment of a smartphone app as a patient education tool for the management of thalassemia and iron overload syndromes. Hemoglobin. 2016 Sep 2;40(5):323-9.
9. Timmers T, Janssen L, Kool RB, Kremer JA. Educating patients by providing timely information using smartphone and tablet apps: Systematic review. Journal of Medical Internet Research. 2020;22(4):e17342.
10. Childs BR, Breslin MA, Andres BA, Swetz A, Hendrickson SB, Moore TA, Ho V, Vallier HA. Enhancing Trauma Patient Experience Through Education and Engagement: Development of a

Mobile Application. JAAOS Global Research & Reviews. 2020 Mar 1;4(3):e20.
11. Simske NM, Rivera T, Breslin MA, Hendrickson SB, Simpson M, Kalina M, Ho VP, Vallier HA. Implementing psychosocial programming at a level 1 trauma center: results from a 5-year period. Trauma Surgery & Acute Care Open. 2020 Jan 1;5(1).
12. Childs BR, Breslin MA, Andres BA, Swetz A, Hendrickson SB, Moore TA, Ho V, Vallier HA. Enhancing Trauma Patient Experience Through Education and Engagement: Development of a Mobile Application. JAAOS Global Research & Reviews. 2020 Mar 1;4(3):e20.
13. Childs BR, Breslin MA, Nguyen MP, et al Implementation of a mobile app for trauma education: results from a multicenter studyTrauma Surgery & Acute Care Open 2020;5:e000452. doi: 10.1136/tsaco-2020-000452
14. Schneider EC, Sorbero ME, Haas A, Ridgely MS, Khodyakov D, Setodji CM, Parry G, Huang SS, Yokoe DS, Goldmann D. Does a quality improvement campaign accelerate take-up of new evidence? A ten-state cluster-randomized controlled trial of the IHI's Project JOINTS. Implementation Science. 2017 Dec;12(1):51.
15. Lapointe L, Rivard S. A multilevel model of resistance to information technology implementation. MIS quarterly. 2005 Sep 1:461-91.
16. Edmondson AC, Bohmer RM, Pisano GP. Disrupted routines: Team learning and new technology implementation in hospitals. Administrative Science Quarterly. 2001 Dec;46(4):685-716.
17. Downing NL, Bates DW, Longhurst CA. Physician Burnout in the Electronic Health Record Era: Are We Ignoring the Real Cause? Annals of internal medicine. 2018 May 8.
18. Yarbrough AK, Smith TB. Technology acceptance among physicians: a new take on TAM. Med Care Res Rev. 2007; 64:650–672. [PubMed: 17717378]
19. Lapointe L, Rivard S. A multilevel model of resistance to information technology implementation. MIS quarterly. 2005 Sep 1:461-91.
20. Weiner BJ. A theory of organizational readiness for change. Implementation science. 2009 Dec;4(1):67.
21. Gagnon MP, Desmartis M, Labrecque M, Car J, Pagliari C, Pluye P, Frémont P, Gagnon J, Tremblay N, Légaré F. Systematic review of factors influencing the adoption of information and communication technologies by healthcare professionals. Journal of medical systems. 2012 Feb 1;36(1):241-77.
22. Schneider EC, Sorbero ME, Haas A, Ridgely MS, Khodyakov D, Setodji CM, Parry G, Huang SS, Yokoe DS, Goldmann D. Does a quality improvement campaign accelerate take-up of new evidence? A ten-state cluster-randomized controlled trial of the IHI's Project JOINTS. Implementation Science. 2017 Dec;12(1):51.
23. Childs BR, Breslin MA, Andres BA, Swetz A, Hendrickson SB, Moore TA, Ho V, Vallier HA. Enhancing Trauma Patient Experience Through Education and Engagement: Development of a Mobile Application. JAAOS Global Research & Reviews. 2020 Mar 1;4(3):e20.
24. Childs BR, Andres BA, Breslin MA, Nguyen MP, Simske NM, Whiting PS, Vasireddy A, Vallier HA. "Implementation of a mobile app for trauma education: results from a multicenter study" Trauma Surgery & Acute Care Open. 2020
25. Timmers T, Janssen L, Kool RB, Kremer JA. Educating patients by providing timely information using smartphone and tablet apps: Systematic review. Journal of Medical Internet Research. 2020;22(4):e17342.
26. Guo Y, Chen Y, Lane DA, Liu L, Wang Y, Lip GY. Mobile health technology for atrial fibrillation management integrating decision support, education, and patient involvement: mAF App Trial. The American journal of medicine. 2017 Dec 1;130(12):1388-96.
27. Greer JA, Jacobs JM, Pensak N, Nisotel LE, Fishbein JN, MacDonald JJ, Ream ME, Walsh EA, Buzaglo J, Muzikansky A, Lennes IT. Randomized trial of a smartphone mobile app to improve symptoms and adherence to oral therapy for cancer. Journal of the National Comprehensive Cancer Network. 2020 Feb 1;18(2):133-41.
28. Pecorelli N, Fiore JF, Kaneva P, Somasundram A, Charlebois P, Liberman AS, Stein BL, Carli F, Feldman LS. An app for patient education and self-audit within an enhanced recovery program for bowel surgery: a pilot study assessing validity and usability. Surgical endoscopy. 2018 May 1;32(5):2263-73.
29. Finkelstein J, Cha EM. Using a mobile app to promote smoking cessation in hospitalized patients. JMIR mHealth and uHealth. 2016;4(2):e59.
30. Ward R, Taha KM. Patient involvement as experts in the development and assessment of a smartphone app as a patient education tool for the management of thalassemia and iron overload syndromes. Hemoglobin. 2016 Sep 2;40(5):323-9.
31. Bradford AN, Castillo RC, Carlini AR, Wegener ST, Frattaroli S, Heins SE, Teter H, MacKenzie EJ. Barriers to implementation of a hospital-based program for survivors of traumatic injury. Journal of Trauma Nursing. 2013 Apr 1;20(2):89-99.
32. Varsi C. Implementation of eHealth patient–provider communication tools into routine practice: Facilitators and barriers from the perspectives of patients, middle managers and health care providers.
33. Koivunen M, Hätönen H, Välimäki M. Barriers and facilitators influencing the implementation of an interactive Internet-portal application for patient education in psychiatric hospitals. Patient Education and Counseling. 2008 Mar 1;70(3):412-9.
34. Vallier HA, Moore TA, Como JJ, Dolenc AJ, Steinmetz MP, Wagner KG, Smith CE, Wilczewski PA. Teamwork in trauma: system adjustment to a protocol for the Management of Multiply Injured Patients. Journal of orthopaedic trauma. 2015 Nov 1;29(11):e446-50.
35. Tanaka MJ, Oh LS, Martin SD, Berkson EM. Telemedicine in the era of COVID-19: the virtual orthopaedic examination. The Journal of Bone and Joint Surgery. American Volume. 2020 Apr 24.
36. Gagnon MP, Desmartis M, Labrecque M, Car J, Pagliari C, Pluye P, Frémont P, Gagnon J, Tremblay N, Légaré F. Systematic review of factors influencing the adoption of information and communication technologies by healthcare professionals. Journal of medical systems. 2012 Feb 1;36(1):241-77.
37. Gagnon MP, Sánchez E, Pons JM. From recommendation to action: psychosocial factors influencing physician intention to use Health Technology Assessment (HTA) recommendations. Implementation Science. 2006 Dec;1(1):8.
38. Seers K, Rycroft-Malone J, Cox K, Crichton N, Edwards RT, Eldh AC, Estabrooks CA, Harvey G, Hawkes C, Jones C, Kitson A. Facilitating Implementation of Research Evidence (FIRE): an international cluster randomised controlled trial to evaluate two models of facilitation informed by the Promoting Action on Research Implementation in Health Services (PARIHS) framework. Implementation Science. 2018 Dec;13(1):137.
39. Thomas, N., Sandler, A., Fernandez, I., Simson, J., Tihista, M., Wells, M., & Childs, B. (2022). Orthopaedic Business is the Focus of 3.4% of Articles in Top General Orthopaedic Journals. *Journal of Orthopaedic Business*, *2*(1), 10–18.