# MyEDCare: Evaluation of a Smartphone-Based Emergency Department Discharge Process

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## Abstract

**Background** Poor comprehension and low compliance with post-ED (emergency department) care plans increase the risk of unscheduled ED return visits and adverse outcomes. Despite the growth of personal health records to support transitions of care, technological innovation's focus on the ED discharge process has been limited. Recent literature suggests that digital communication incorporated into post-ED care can improve patient satisfaction and care quality.

**Objectives** We evaluated the feasibility of utilizing MyEDCare, a text message and smartphone-based electronic ED discharge process at two urban EDs.

**Methods** MyEDCare sends text messages to patients' smartphones at the time of discharge, containing a hyperlink to a Health Insurance Portability and Accountability Act (HIPAA)-compliant website, to deliver patient-specific ED discharge instructions. Content includes information on therapeutics, new medications, outpatient care scheduling, return precautions, as well as results of laboratory and radiological diagnostic testing performed in the ED. Three text messages are sent to patients: at the time of ED discharge with the nurse assistance for initial access of content, as well as 2 and 29 days after ED discharge. MyEDCare was piloted in a 9-month pilot period in 2019 at two urban EDs in an academic medical center. We evaluated ED return visits, ED staff satisfaction, and patient satisfaction using ED Consumer Assessment of Healthcare Providers and Systems (ED-CAHPS) patient satisfaction scores.

**Results** MyEDCare enrolled 27,713 patients discharged from the two EDs, accounting for 43% of treat-and-release ED patients. Of the treat-and-release patients, 27% completed MyEDCare discharge process, accessing the online content at the time of ED discharge. Patients discharged via MyEDCare had fewer 72-hour, 9-day, and 30-day unscheduled return ED visits and reported higher satisfaction related to nursing care.

**Conclusion** EDs and urgent care facilities may consider developing a HIPAA-compliant, text message, and smartphone-based discharge process, including the transmission of test results, to improve patient-centered outcomes.

**Keywords**
- smartphone
- text message
- patient education
- discharge instruction
- emergency medicine

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## Background and Significance

Successful care transition after emergency department (ED) encounters requires patient comprehension and adherence to post-discharge instructions. ED visits frequently last several hours, involving numerous tests and treatments resulting in new diagnoses and medications, changes to medication regimens and post-discharge appointments.[1] From a patient perspective, this can be the end of an exhausting health care encounter, a time when information comprehension and retention are suboptimal.[2–4] Research shows that both poor comprehension and low adherence to post-ED care instructions contribute to high ED return rates and adverse events.[5–7] Verbal ED discharge instructions alone are insufficient and lead to deficient patient comprehension on diagnosis, care plans, and return needs.[4,8,9] Many institutions provide written discharge instructions from the ED, but these paper documents are prone to be displaced by patients and caregivers, and in worst-case scenarios may result in patient safety events errors.[10]

Emergency medicine has increasingly embraced the concept of care coordination to improve the quality of transition of care, but randomized studies have showed variable impact in improving follow-up rates and repeat ED visits.[11,12] Other work has demonstrated that the use of web-based, standardized communication systems between ED and primary care physicians improves continuity of care, increasing the usefulness of transferred information and improving outpatient providers perceived patient knowledge and patient management.[13,14] The Health Information Technology for Economic and Clinical Health (HITECH) Act, established in 2009, encourages the meaningful use of electronic health records (EHRs) to further the quality of care received by patients.[15] Recent advances in communication technologies, as well as growing public interest, have facilitated the growth of personal health records (PHRs), with the AHA now reporting that 93% of the hospitals now allow patients online access to EHRs via patient portals.[16,17] PHR are web-based platforms "tethered" to an EHR, designed to give patients improved access to their health care information.[18,19] Many current PHRs have interactive functionality such as ordering prescriptions, scheduling appointments, secure messaging with providers, and remote patient monitoring, and have demonstrated improvements in medication adherence, disease management, patient–provider communication, and satisfaction with care.[20–25] However, there is variable patient engagement with PHRs, including large racial/ethnic disparities.[26] Furthermore, not every patient visiting the ED is part of the associated health care system, reducing the incentive for portal use. Despite the critical importance of care transitions and the progress in PHRs, technological innovation focused on the ED discharge process has been limited.[27] Recent literature suggests that digital communication incorporated into post-ED care can improve patient satisfaction and care quality.[28,29]

In 2019, a smartphone-based, electronic ED discharge process, MyEDCare, was piloted at an urban academic medical center. The medical center is composed of two geographically distinct urban hospital-based EDs: a large quaternary care academic hospital and a medium-sized community hospital, neither with an available PHR tethered to the ED EHR at the time of study. Together these sites provide care for nearly 140,000 encounters annually and, at the time of this study, utilized Allscripts EHR (Allscripts Healthcare Solutions, Inc.).

MyEDCare is an innovative and patient-centered discharge workflow, leveraging modern-day reliance on smartphones as a universal communication device. The primary goals of MyEDCare were to modernize patient access to high-quality discharge instructions and optimize information comprehension in the process, reducing the risk of adverse events associated with noncompliance, and lessening the likelihood of avoidable health care utilization.[30,31] Furthermore, MyEDCare was designed to reduce duplicative testing by allowing future caregivers to immediately access the test results performed during the index ED encounters.

## Objectives

This study evaluated the feasibility of utilizing MyEDCare as a discharge process. We measured the provider and patient acceptance, changes in the number of ED return visits, and patient satisfaction of receiving electronic discharge information and diagnostic test results to their smartphones as a comprehensive post-ED communication device.

## Methods

Standard ED discharge process involves providers entering discharge instructions into the EHR, which are then printed out as multiple paper documents at the time of patient discharge. ED nursing then reviews the content of these documents with the patient to complete the discharge process. MyEDCare was designed as a paperless discharge process for adult patients (21 years old and above), enabling patient-specific ED discharge instructions and ED test results to be viewed and saved on the patient's smartphone device. MyEDCare is proprietary, developed at the study site by many of the authors in the paper in collaboration with the Institution's Informatics Department.

Patients discharged from the ED who did not opt-out from MyEDCare were enrolled in the process. For patient safety, the following cohorts were also excluded from MyEDCare discharge process and received standard paper-format discharge instructions: patients discharged to locations that would require paper documentation (e.g., to law enforcement custody, skilled care facilities, shelters), patients whose employers requested discharge paperwork, patients discharged with a primary psychiatric diagnosis, and patients who were determined by providers to not have sufficient English proficiency. As MyEDCare is an ED discharge process, patients admitted to the hospital and discharged from inpatient services were also excluded.

To enroll a patient in MyEDCare, the ED physician confirms eligibility of the patient via verbal consent and verification so that he or she is in possession of a functional

 

smartphone with cellular service while in the ED. Patients could designate a proxy smartphone to a family member, provided if the phone was present with the patient at the time of ED discharge, to complete MyEDCare discharge process. The physician enters the confirmed phone number into the EHR in a designated section modified specifically for MyEDCare. The physician then places the "ED Discharge Order" in the EHR; this order finalizes MyEDCare enrollment process, triggering the cellular service contracted at our institution to generate a text message encoded with a patient-specific hyperlink that gives access to the discharge documents. The text message is then sent to the patient's smartphone via the cellular carrier affiliated with the phone number. Patients typically receive the text message within 20 seconds of the EHR discharge order being placed.

The text message includes a password-protected hyperlink to a Health Insurance Portability and Accountability Act (HIPAA)-secure website, with brief instructions on how to access the content. The HIPAA-secure platform contains a nonstandardized patient-specific information, entered by the ED providers as part of the pre-existing EHR documentation workflow prior to patient discharge and extracted automatically from the EHR into the MyEDCare online platform. Each patient's MyEDCare platform includes the following information under discrete sections: (1) results of any laboratory and radiological diagnostic testing performed in the ED, (2) information on any new medications prescribed by the ED care team, (3) instructions on when to return to ED, including ExitCare (diagnosis-specific peer-reviewed patient education and discharge instructions by Elsevier), (4) any scheduled outpatient care appointments and relevant contact information. The online layout was designed to improve patient navigation of their comprehensive post-ED care plan, compared with the multiple paper documents generated in a standard paper-format discharge, including a reduced number of "pages" on the platform. The generic MyEDCare platform display was in English only, but patient-specific discharge instruction content entered by the ED provider and automatically extracted from the EHR was not limited to a single language. ►Fig. 1 shows the interface of MyEDCare.

Upon receiving the text message, the ED nurse guides the patient in their first access of MyEDCare online content, using their date of birth as the patient-specific password for HIPPA compliance. The ED nurse member then reviews the electronic discharge documents on the phone in real-time, confirming content accuracy and patient comprehension, using teach-back method to optimize retention.[32] Patients formally confirm receipt and comprehension of the discharge instructions using electronic signature pads connected to the EHR. This completion of the paperless MyEDCare ED discharge process takes approximately the same time a nurse would spend reviewing standard paper discharge instructions: 2 to 5 minutes per patient, depending on case details. Some patients were enrolled in MyEDCare but either did not receive the text message while in ED or could not access the online platform from the text hyperlink. These patients experiencing an incomplete MyEDCare discharge process subsequently received standard paper-format discharge instructions. Scenarios leading to an incomplete MyEDCare discharge process included: lack of smartphone PDF viewing software required to view content, smartphone malfunction or loss of power, data plans prohibiting access to MyEDCare online content, limitations to cellular carrier service, or nonfunctional hyperlinks.

The documents are capable of being downloaded to the patient's smartphones in a PDF format to facilitate the

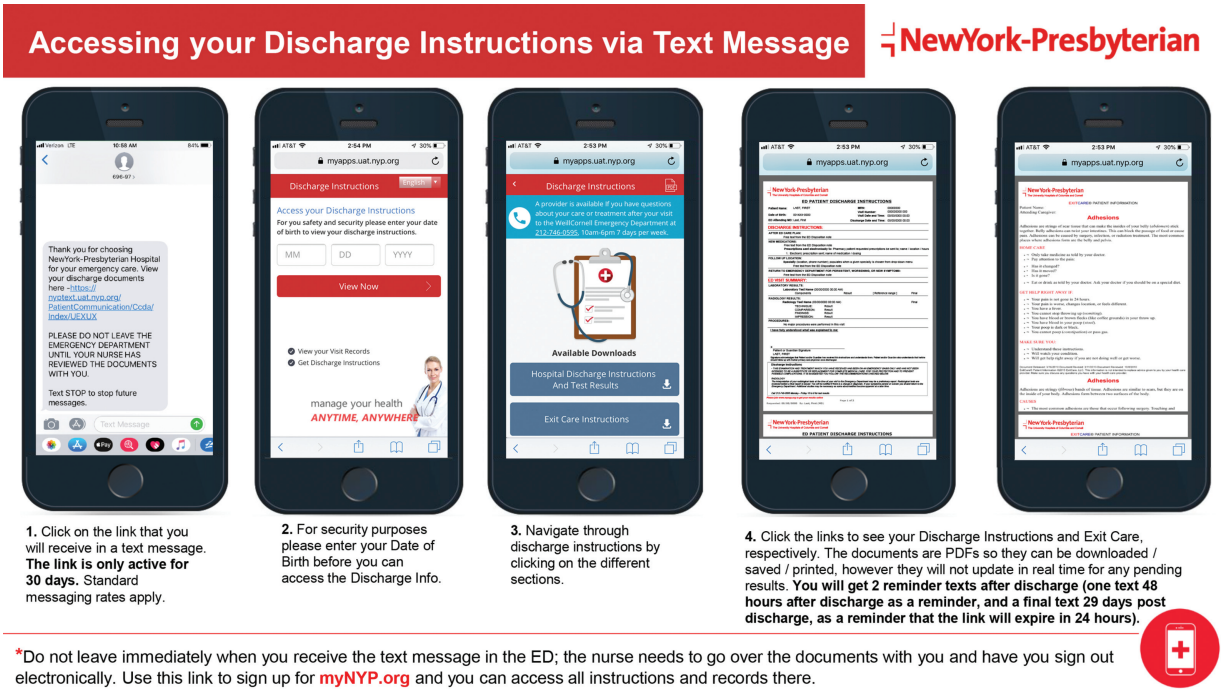


**Fig. 1** MyEDCare smartphone interface.

 

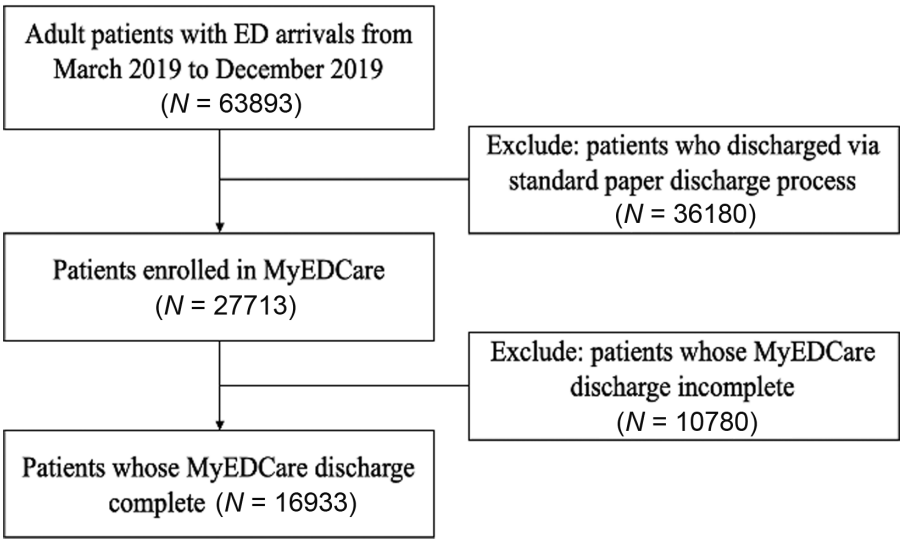


**Fig. 2** Inclusion and exclusion criteria of MyEDCare.

electronic transfer to family and health care providers at the patient's discretion. With the goal of optimizing engagement in post-ED care, similar text messages encoded with the same hyperlink and protected information are automatically generated and sent to patients 48 hours after ED discharge and again at 29 days. Patients can continue to access their online content for 30 days after ED discharge. Patients receiving electronic discharge could also receive paper documents if specifically requested.

This process was piloted for 9 months starting on March 20th, 2019 at the two EDs, respectively. Data collection for evaluation was performed throughout the pilot on a weekly basis. Upon completion of the program, we measured the percentage of ED patients who were enrolled in MyEDCare, including their demographics, subsequent completion or incompletion of MyEDCare discharge process, and the number of times patients accessed the platform post-discharge. We neither measured the access times or dates to relate them to the three text messages sent over 30 days, nor determined how frequently patients downloaded the content in the PDF format. The MyEDCare discharge performance, including both complete and incomplete MyEDCare, was compared against the standard paper discharge process for patients who presented to the ED during the 9-month pilot. We also measured return visits to the ED within 72 hours, 9 days, and 30 days of discharge, subdivided into scheduled and unscheduled (e.g., suture removals, wound checks) return visits. For statistical analysis, Chi-square or Fisher's exact test was used to compare categorical variables, and Wilcoxon rank sum test was used for continuous variables after checking normality. Q–Q plot was used to check the normality for continuous variables. Moreover, a logistic regression was used to analyze MyEDCare access as the dependent variable. Variables listed in ►Table 1 were used as the independent variables.

We solicited feedback via unstructured interviews from a convenience sample of ED staff, including five providers, five nurses, and five patient navigators.[33] In the interviews, we asked for their feedback on (1) the usability of MyEDCare; (2) patient safety of MyEDCare; (3) their subjective opinion of patient's responses to MyEDCare; (4) the impact of MyEDCare on transition of care processes. We conducted data collection and analysis in an iterative fashion. Additionally, we measured patient comprehension of the ED encounter and discharge-related information using our performance on six individual ED Consumer Assessment of Healthcare Providers and Systems (ED-CAHPS) metrics.[34] Linear mean scoring was used in the calculation without case-mix adjustment.

## Results

During the 9-month pilot, 27,713 patients were enrolled in the personal smartphone-based MyEDCare discharge process, accounting for 43% of all treat-and-release patients discharged from the ED. A total of 27% of treat-and-release patients completed MyEDCare ED discharge process, accessing the online content (61% of all enrolled patients). ►Fig. 2 displays the inclusion and exclusion criteria. On average, MyEDCare platform was accessed twice per patient (SD = 1.63). ►Table 1 shows the patient demographics and clinical profile of patients enrolled in MyEDCare; discharged via MyEDCare; did not complete the MyEDCare process (so were converted to discharge via standard paper discharge instructions) and were excluded for MyEDCare prior to enrollment so received a planned discharge with standard paper discharge instructions. As reported in ►Table 1, no clinically meaningful differences in ESI levels or diagnosis types were observed between patients who completed MyEDCare ED discharge process compared with those discharged with standard paper discharge instructions. Conversely, we observed significant differences in marital statuses, age, preferred language, insurance status and race as shown in ►Tables 1 and 2 (results from the regression model). Diagnoses that were most common among patients who completed MyEDCare ED discharge process were chest

 

**Table 1** Characteristics of patients enrolled in MyEDCare

| *N* (%)/Mean (SD) | Enrolled in MyEDCare (*N* = 27,713) | Completed MyEDCare discharge (*N* = 16,933) | Incomplete MyEDCare discharge[b] (*N* = 10,780) | Paper-discharge[c] (*N* = 36,180) |
|---|---|---|---|---|
| ED site | | | | |
| Cornell ED | 16,992 (61.3%) | 10,447 (61.7%) | 6,545 (60.7%) | 20,370 (56.3%) |
| LMH ED | 10,721 (38.7%) | 6,486 (38.3%) | 4,235 (39.3%) | 15,810 (43.7%) |
| Marital status[a] | | | | |
| Married | 8,660 (31.2%) | 5,501 (32.5%) | 3,159 (29.3%) | 9,859 (27.7%) |
| Nonmarried | 19,053 (68.8%) | 11,432 (67.5%) | 7,621 (70.7%) | 25,749 (72.3%) |
| Female | 16068 (58.0%) | 9,873 (58.3%) | 6,195 (57.5%) | 18,465 (51.4%) |
| English as primary langauge[a] | 24,249 (87.5%) | 14,969 (88.4%) | 9,280 (86.1%) | 30,582 (85.2%) |
| Race[a] | | | | |
| Asian | 1,815 (6.5%) | 1,172 (6.9%) | 643 (6.0%) | 3,215 (9.5%) |
| Black or African American | 6,162 (22.2%) | 3,291 (19.4%) | 2,871 (26.6%) | 8,118 (24.1%) |
| Other | 8,689 (31.4%) | 5,344 (31.6%) | 3,345 (31.0%) | 7,835 (23.3%) |
| White | 11,047 (39.9%) | 7,126 (42.1%) | 3,921 (36.4%) | 14,501 (43.1%) |
| Payor[a] | | | | |
| Commercial | 15,129 (54.6%) | 10,363 (61.2%) | 4,766 (44.2%) | 12,299 (34.1%) |
| Medicaid | 6,825 (24.6%) | 3,644 (21.5%) | 3,181 (29.5%) | 10,430 (28.9%) |
| Medicare | 3,889 (14.0%) | 1,861 (11.0%) | 2,028 (18.8%) | 9,776 (27.1%) |
| Self-pay (NA) | 1,870 (6.7%) | 1,065 (6.3%) | 805 (7.5%) | 3,565 (9.9%) |
| ESI[a] | 3.29 (0.61) | 3.30 (0.61) | 3.27 (0.61) | 3.24 (0.64) |
| Age[a] | 43.8 (16.4) | 42.1 (15.7) | 46.3 (17.2) | 50.5 (19.61) |

Abbreviations: ED, emergency department; ESI, emergency severity index; LMH, Lower Manhattan Hospital.
[a]$p < 0.05$, comparing patients who completed MyEDCare and those who did not.
[b]Incomplete MyEDCare discharge (defaulted to standard paper-discharge process).
[c]Paper discharge process (excluded from MyEDCare prior to enrollment).

pain, abdominal pain, headache, cough, back pain, dizziness, fall, palpitations, syncope, and knee pain. Similarly, diagnoses that were most common among patients discharged with standard paper discharge instructions were chest pain, abdominal pain, headache, cough, fall, dizziness, back pain, shortness of breath, unspecified abdominal pain, and syncope.

►**Table 3** compares the ED return visit rate in patients who completed MyEDCare ED discharge process versus those who were enrolled in MyEDCare but were ultimately discharged via standard paper-based discharge instructions due to an incomplete MyEDCare ED discharge process. Patients discharged via MyEDCare had less frequent unscheduled ED returns at 72 hours (3.1 vs. 3.8%) and 30 days (9.4 vs. 12.8%) compared with patients with incomplete (failed) MyEDCare enrollment ($p$-value = 0.003 and $p$-value < 0.001). For completion, ►**Table 4** shows the ED return visit rate comparing all patients enrolled in MyEDCare to those discharged with standard paper-based discharge instructions. Patients enrolled in MyEDCare also had less frequent unscheduled ED returns in 72 hours (3.4 vs. 5.6%) and 30 days (10.7 vs. 16.9%) compared with patients discharged via conventional paper workflows ($p$-value <0.001). Of the patient who completed MyEDCare discharge process, 9,051 (32.7%) patients accessed just once. There are 1,009 patients who accessed the online content at least five times. The average number of access does not include patients with incomplete (failed) MyEDCare enrollment.

►**Table 2** shows the results from the regression model. Age had a significant impact on the odds of completing the MyEDCare discharge process. One year increase in age was associated with the odds decrease by 0.986 times ($p < 0.001$). Race played a role for Black or African American and Other but not for Asian patients compared with White patients. Black or African American patients (OR = 0.668, $p < 0.001$) and Other race patients (OR = 0.910, $p = 0.003$) were less likely to complete MyEDCare discharge process. Male patients had lower odds compared with female (OR = 0.925, $p = 0.002$). Non-English and nonmarried had a negative impact on access (OR = 0.885, $p = 0.002$ and OR = 0.870, $p = 0.002$). Patients who visited the community ED had decreased odds by 0.937 times compared with tertiary hospital ED ($p = 0.015$). Compared with patients who had commercial insurance, patients with Medicaid (OR = 0.561,

 

**Table 2** Regression results in assessing the factors associated with MyEDCare access

| Variable | OR | *p*-Value |
|---|---|---|
| Gender (reference: female) | | |
| Male | 0.925 | 0.002[b] |
| Race (reference: white) | | |
| Black or African American | 0.668 | < 0.001[c] |
| Asian | 1.057 | 0.32 |
| Other | 0.910 | 0.003[b] |
| Language | | |
| Non-English | 0.885 | 0.002[b] |
| Marital status | | |
| Nonmarried | 0.870 | 0.002[b] |
| ED site | | |
| LMH | 0.937 | 0.015[a] |
| Payor (reference: commercial) | | |
| Medicaid | 0.561 | < 0.001[c] |
| Medicare | 0.625 | < 0.001[c] |
| Self-pay | 0.622 | < 0.001[c] |
| Age | 0.986 | < 0.001[c] |
| ESI | 1.084 | < 0.001[c] |

Abbreviations: ED, emergency department; ESI, emergency severity index; LMH, Lower Manhattan Hospital; OR, odds ratio.
[a]$p < 0.05$.
[b]$p < 0.01$.
[c]$p < 0.001$.

$p < 0.001$), Medicare (OR = 0.625, $p < 0.001$), and self-pay (OR = 0.622, $p < 0.001$) had lower odds of access.

Based on our unstructured interviews answered via emails and in person, ED providers reported increased efficiency applying the new discharge process, particularly for not having to locate a complete set of discharge papers and then physically deliver the documents to the right nurse caring for the patient at the time of discharge. Providers and nurses both cited MyEDCare's benefit in improving patient safety, noting the verification process with date of birth password mitigated against the possibility of patients receiving the wrong discharge documents, a HIPAA violation, and recognized risk of standard paper discharge instructions. During this pilot no patients received the wrong discharge instructions via MyEDCare. Nursing staff also reported that the new discharge workflow has improved both the ED discharge process and the coordination of outpatient care. For example, MyEDCare allowed patients with primary care outside of the study site network to email their results and follow-up instructions directly to their providers. Patients who need orthopaedic follow-up appointments noted an increased benefit for the availability of X-ray reports directly to share with their orthopaedists. For patient navigators, who typically need access to discharge paperwork with test results as well as patients' picture IDs and insurance cards, misplaced discharge paperwork often caused interruptions in this care transition. MyEDCare helped circumvent this hindrance by eliminating the need for paper discharge paperwork. As shown in ►Table 5, ED-CAHPS scores for MyEDCare patients demonstrated higher than average scores in the following questions related to nursing care: nurses explain in a way you understand; Nurses listen carefully; Nurses treat you with respect. No other differences in ED-CAHPS questions were determined significant.

## Discussion

Our results demonstrate that patients who were discharged via MyEDCare ED discharge process had less frequent 72-hour, 9-day, and 30-day unscheduled return ED visits. On average, patients accessed the online platform twice, demonstrating engagement with MyEDCare content beyond the ED nurse lead discharge process. Unstructured interviews with ED staff all reported positive feedback on the new process, including an absence of patients receiving the wrong discharge instructions, both HIPPA and patient safety issue occurring in the standard paper-based ED discharge process. Given these findings, we believe EDs, urgent care facilities, and potentially inpatient hospital services may consider developing an optional, HIPAA-compliant, smartphone, text-based ED discharge process, including the transmission of test results. Given recent survey data suggesting patients

**Table 3** Comparing ED utilization between patients who completed and did not complete MyEDCare ED discharge process

| | Completed MyEDCare discharge (*N*,%) | Incomplete MyEDCare discharge (defaulted to paper-discharge) (*N*,%) | *p*-Value |
|---|---|---|---|
| Scheduled 72-h return | 39 (0.2) | 26 (0.2) | 0.956 |
| Unscheduled 72-h return[a] | 526 (3.1) | 406 (3.8) | 0.003[b] |
| Scheduled 9-d return | 103 (0.6) | 60 (0.6) | 0.640 |
| Unscheduled 9-d return[a] | 1,005 (5.9) | 821 (7.6) | <0.001[c] |
| Scheduled 30-d return | 152 (0.9) | 86 (0.8) | 0.417 |
| Unscheduled 30-d return[a] | 1,586 (9.4) | 1,383 (12.8) | <0.001[c] |

[a]*p*-Value <0.05.
[b]*p*-Value <0.01.
[c]*p*-Value <0.001.

 

**Table 4** Comparing ED Utilization between MyEDCare Enrollment and Paper Discharge

| | Enrolled MyEDCare (*N*, %) | Paper-discharge (*N*, %) | *p*-Value |
|---|---|---|---|
| Scheduled 72-h return | 65 (0.2) | 83 (0.2) | 0.959 |
| Unscheduled 72-h return[a] | 932 (3.%) | 2,035 (5.6) | <0.001[c] |
| Scheduled 9-d return | 163 (0.%) | 202 (0.6) | 0.658 |
| Unscheduled 9-d return[a] | 1,826 (6.%) | 3,743 (10.3) | <0.001[c] |
| Scheduled 30-d return | 238 (0.9) | 279 (0.8) | 0.238 |
| Unscheduled 30-d return[a] | 2,969 (10.7) | 6,106 (16.9) | <0.001[c] |

[a]*p*-Value <0.05.
[b]*p*-Value <0.01.
[c]*p*-Value <0.001.

**Table 5** Comparing ED-CAHPS score between MyEDCare and paper discharge

| Question | Completed MyEDCare discharge (*N* response = 338) | Paper-discharge (*N* response = 928) | *p*-Value |
|---|---|---|---|
| Before you left, someone ask for follow-up care | 85.2 | 81.8 | 0.155 |
| Left ER understanding health problem | 82.0 | 85.8 | 0.098 |
| Left ED understanding symptoms | 81.8 | 87.2 | 0.276 |
| MD explain in way you understand | 84.6 | 85.8 | 0.588 |
| MD listen carefully to you | 86.9 | 84.5 | 0.061 |
| MD spend enough time with you | 71.9 | 74.1 | 0.210 |
| MD treat you with respect | 89.2 | 87.9 | 0.435 |
| Nurses explain in way you understand | 86.5 | 81.9 | 0.033[a] |
| Nurses listen carefully | 85.4 | 81.9 | 0.022[a] |
| Nurses spend enough time with you | 70.2 | 71.6 | 0.423 |
| Nurses treat you with respect | 89.0 | 86.1 | 0.032[a] |
| Rate ER | 82.8 | 81.9 | 0.937 |
| Recommend ER | 83.2 | 82.5 | 0.669 |

Abbreviations: ED, emergency department; ER, emergency room; MD, Doctor of Medicine.
[a]*p*-Value < 0.05.

may prefer receiving health care information via secure text messages compared with patient portals, even health care systems with PHR should consider this process.[35]

Multiple variables affect patients' individual discharge processes in a large urban ED serving a diverse patient population. This study demonstrated that a smartphone, text-based ED discharge is not feasible for all ED patients: 43% of treat and release ED patients received the online content, and 27% successfully accessed the online content, respectively. The 57% of discharged patients who were not enrolled in MyEDCare reflect the complex community our two urban EDs serve. As part of the gap analysis, we discovered multiple patient groups for which MyEDCare was not appropriate. They include chronically ill patients from long-term care facilities without smartphones (and a formal need for paper discharge documents), and patients from vulnerable sociodemographic groups such as patient who are illiterate, non-English speaking or cannot afford a smartphone or the associated carrier data charges. Additional functions of the MyEDCare platform, such as a chat feature (with providers, care managers, and patient navigators in the ED), may further enhance post-ED transitions of care in some patient groups who are excluded from PHR use.

Alternatives to text communication post ED discharge include PHR mobile applications associated with an EHR. During the time this study was conducted our health system did not use ED EHR with an interfacing patient portal, but this authorship argues that text messaging can be an alternative to or complement PHRs. Text messaging enjoys high consumer interface familiarity and, despite the exponential rise of message apps, continues to be the most widely adopted and least expensive technological function on mobile phones; the cost of the average commercial health app is around US $425,000.[36,37] "Push" technology delivered without any effort from the individual, text messages exhibit up to a 98% open rate and a response rate double that of email, phone, or social media.[38,39] While text messages and push notifications from mobile applications are similar in functionality, in practice texts offer platform independence and

 

lower data plan requirement. In contrast, PHR account creation and activation barriers may be accentuated during the ED visit, such as the time and attention required for enrollment, downloading, and initial navigation.[40] Furthermore, mobile applications require new downloads and push notifications enabled when devices are changed, whereas changes in phone numbers are not frequent, thus allowing potential long-term communication.

Several additional opportunities for program refinement were identified during this pilot study based on findings from the patients who were sent the text message but could not access the online content. Limitations were predominantly technological, including incompatibility of some smartphone software required to view PDF documents, prohibitive cellular carrier data contracts, cellular carrier service dead zones in the ED, and cell carrier text delays. Optimizing suboptimal cell carrier service in our EDs increased the number of patients able to receive MyEDCare text messages during the pilot program.

Patients who completed the MyEDCare discharge demonstrated significantly reduced unscheduled ED return visits at 72-hour, 9-day, and 30-day time periods, compared with patients enrolled in MyEDCare but ultimately discharged via standard paper-based discharge instructions due to an incomplete (failed) MyEDCare ED discharge process. Furthermore, scheduled return visits (e.g., for suture removal and wound checks) remained unchanged between the two groups. This suggests that MyEDCare may improve comprehension and potentially compliance with the post ED care plan, preventing ED return visits.[7] However, similar differences in unscheduled return visits were also observed when comparing all patients enrolled in MyEDCare (including those with incomplete MyEDCare, defaulting to standard paper-based discharge) to those with planned standard paper-based discharge. Given the demographic divergence between these subgroups, these findings suggests that bias between subgroups may limit conclusions on the impact of MyEDCare on unplanned ED revisits. Similarly, demographic differences between the subgroups also limit conclusions regarding the impact of MyEDCare on patient satisfaction. Our hypothesis is that the higher scores in the nursing domains may be explained by the nursing-lead "confirmation of completion" process required for MyEDCare discharge. An additional limitation to the study is that some patients discharged via MyEDCare requested additional paper copies of relevant information on their ED care (e.g., test results). These requests were accommodated by the ED team by also printing out documents directly from the EHR. Unfortunately, these cases were not captured in our analysis, such cases were only identified as successfully completing MyEDCare discharge process.

Patients who accessed MyEDCare were more likely to be married, have commercial insurance, and be racially White. These findings suggest that MyEDCare was more accessible to patients from historically privileged and wealthier groups. Similar innovation inequities in these groups have been identified within the context of growing telehealth and PHR use.[41,42] Future work on MyEDCare should examine barriers related to patient characteristics and demographics and further iterations of MyEDCare should be multilingual, especially given the diverse ethnic and linguistic differences amongst ED patients in our catchment area. It is also important to better understand operational factors associated with utilization, including the time of day patients interacted with the content, whether recurrent text messages increased patient engagement. The MyEDCare development team will also explore video content on the platform, shown to enhance patient engagement and comprehension and address literacy barriers.[43–49] Robust conclusions about clinical outcomes related to MyEDCare, such as its impact on subsequent ED visits and health care trajectories will require further research.

## Conclusion

This study reports our pilot program enrolling patients from diverse communities of an urban city who we attempted to discharge from two EDs via a personal smartphone, text-based ED discharge process. MyEDCare was found to reduce 72-hour, 9-day, and 30-day unscheduled return ED visits and have a positive impact on patients' perceptions of ED nursing. As populations become increasingly reliant on smartphones, developing processes to complement this technological evolution will facilitate the design of future health care models. Further research would be required to demonstrate the impact of smartphone, text-based ED discharge on clinical outcomes, patient and staff satisfaction, as well as on how such technological solutions can be inclusive of vulnerable populations.

## Clinical Relevance Statement

Poor comprehension regarding emergency department (ED) care and low compliance with post-ED care instructions contribute to high ED return rates and potential adverse events. Exploring the use of a text-based, smartphone ED discharge process is an important step in technology innovation to improve post-ED transitions of care and patient-centered outcomes.

## Multiple Choice Questions

1. When implementing a smartphone-based ED discharge process, which of the following must have close attention to ensure sufficient patient uptake?
   a. EHR vendor
   b. ED size
   c. Cell phone carrier service
   d. Availability of a mobile application.

   **Correct Answer:** The correct answer is option c.

2. After implementing a smartphone-based ED discharge process, which of the following can be measured to evaluate patient satisfaction?

 

a. ED-CAHPS score
b. 72-hour ED return
c. 30-day ED return
d. All of the above.

**Correct Answer:** The correct answer is option d.

### Protection of Human and Animal Subjects

This case report summarizes a quality-improvement evaluation.

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### Conflict of Interest

Y.Z. has equity ownership of Iris OB Health.

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