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**Categorization of Usage Patterns of an Emergency Department Telehealth Follow-up Program during the COVID-19 Pandemic**

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## **Abstract**

### **a) Research questions**

Our overarching questions are: In patients discharged from Texas Health emergency departments, how is the Hospital2Home app-based follow-up program utilized? How has this utilization changed when comparing years immediately pre- and post-the start of the COVID-19 pandemic?

### **b) Background, significance, and rationale for the question**

The education that is provided at the time of discharge from the ED is a pivotal moment in a patient's care. Multiple studies have shown that a large percentage of patients do not understand their discharge instructions. Additionally, many patients don't keep their follow-up appointments after discharge. Lack of understanding of the discharge instructions and lack of follow-up can lead to unscheduled return visits to the ED and increased hospital costs.

A potential solution to help patients better understand their discharge instructions, and mitigate the lack of primary care follow-up and unscheduled return ED visits, is through the use of telehealth for ED follow-up. In 2019, Texas Health Harris Methodist Fort Worth Hospital, a level 2 trauma center with approximately 90,000 visits per year implemented an application-based telehealth follow-up service for ED patients called Hospital to Home (H2H). The program provides all patients who are discharged from the ED with a unique code that can be used with an online or phone application to allow patients to remotely ask a physician questions for 7 days after discharge.

### **c) Materials and methods**

A retrospective chart review was conducted to look at characteristics of the utilization of the H2H platform for patients that were seen in the Emergency Department at multiple Texas Health facilities between the period at the beginning of the COVID-19 pandemic, defined as March 2020-March 2021, and the year directly preceding the pandemic, defined as January 2019-January 2020. Characteristics include age, gender, the reason for usage, and secondary outcomes of usage.

### **d) Results**

Data collection shows a significant increase in usage of the H2H program for the first year of COVID compared to the year immediately prior. There was a significant increase in patients sent for inpatient follow-up by their H2H provider.

### **e) Conclusions**

This project hopes to shift some of the past approaches that responsibility stops once a patient leaves the ED. Our data shows an increasing number of patients are willing to utilize H2H after discharge. Telehealth can serve as a resource for patients who still may have questions after their discharge and can't get in to see their primary care physicians. It also can let patients know when they should return to the ED for emergent complications. That way, programs like this can save lives and have benefits for hospital systems nationwide.

## Research Questions

Our overarching questions are: In patients discharged from Texas Health emergency departments, how is the Hospital2Home app-based follow-up program utilized? How has this utilization changed when comparing years immediately pre- and post-the start of the COVID-19 pandemic?

The goals of this project are twofold:

1. Categorize usage patterns of an application-based telehealth follow-up program in emergency department patients during the COVID-19 pandemic.
2. Compare usage patterns during the COVID-19 pandemic with the usage patterns before the pandemic.

## Introduction, Significance, and Rationale

In 2018, there were approximately 143 million Emergency Department (ED) visits in the United States, with 123 million leading to the patient being discharged from the ED <sup>1</sup>. The education that is provided at the time of discharge from the ED is a pivotal moment in a patient's care. This education should include information about aftercare and patient follow-up, in addition to instructions about when to return to the ED. Multiple studies have shown that a large percentage of patients do not understand their discharge instructions<sup>2</sup>. Additionally, when instructed to follow up with their primary care physician, in some settings only about 20% of patients keep their follow-up appointments<sup>3</sup>. Lack of understanding of the discharge instructions and lack of follow-up can lead to unscheduled return visits to the ED<sup>4</sup>. It has been shown that between 8% and up to 20% of discharged patients present again for an unscheduled ED return visit<sup>5,6</sup>. The cause for these visits is multifactorial including not understanding discharge instructions, fear, and lack of follow-up<sup>4</sup>.

A potential solution to help patients better understand their discharge instructions, and mitigate the lack of primary care follow-up and unscheduled return ED visits, is through the use of telehealth for ED follow-up. There are many potential benefits to using this technology including being able to provide patients with further education about their diagnosis and aftercare plan, addressing continued symptoms, answering questions, and identifying patients that need to immediately return to the ED. In 2019, Texas Health Harris Methodist Fort Worth Hospital, a level 2 trauma center with approximately 90,000 visits per year implemented an application-based telehealth follow-up service for ED patients called Hospital to Home (H2H). The program provides all patients who are discharged from the ED with a unique code that can be used with an online or phone application to allow patients to remotely ask a physician questions for 7 days after discharge.

The H2H program is a national quality improvement program that has been implemented in various hospitals and cardiovascular settings across the nation. It is an electronic follow-up initiative that has previously emphasized a goal to reduce 30-day return rates for patients

discharged with cardiovascular issues. The three main areas of improvement targeted by the program on its website are: early follow-up, post-discharge medication management, and identifying signs and symptoms of disease progression.<sup>8</sup>

The H2H program was introduced to Texas Health Harris Methodist Fort Worth Emergency Room in 2019 after being tested out at smaller emergency rooms throughout north Texas in the years prior. It is now being used at over 15 Texas Health facilities. The program provides all patients who are discharged from the ED with a unique code that can be used with an application where patients can remotely ask a physician questions for a set period after discharge. This program is automatically included in the cost of their ED visit and is intended to provide an additional mechanism for follow-up.

Previous research has looked at the effects of the H2H program in relation to cardiac follow-up in Veteran Affairs (VA) hospitals.<sup>9</sup> This research found that enrollment in the H2H program led to a slightly higher number of follow-up appointments in a cardiology clinic. They did not find any significant difference in 30-day readmission rates for those with cardiovascular disease enrolled in the H2H program compared with those in hospitals that weren't enrolled in H2H. We believe that following an ED visit, people will be more acutely aware of their health concerns and will be more likely to use the H2H program to address their questions where in the past they may have had to return to the ED or wait for a follow-up appointment with their PCP.

There is direct evidence to show that return visits to the ED are costly to both patients and hospitals. Studies show that patients who returned to the ED after hospital discharge and were readmitted had higher rates of in-hospital mortality and ICU admission, longer lengths of stay, and higher costs during repeat hospital admission compared with those admitted to the hospital during the index ED visit without a return ED visit.<sup>10</sup> The increased stay uses hospital resources in the forms of healthcare works, medicine, lab testing, and imaging availability to name a few. Patients also pay a hefty price to return to the ED as "Emergency department episodes of care accounted for \$328.1 billion in payments in 2010. This represented 12.5% of NHE; ED admissions were 8.3% and outpatient ED care was 4.2%. Nonemergent outpatient visits were the most common, comprising 30.4% of ED episodes."<sup>11</sup> Patients and hospitals alike would benefit from avoiding returns to the hospital when it comes to cost but also disease exposure as well.

The first step we took to analyze the effectiveness of the H2H program in improving patient understanding as well as reducing hospital return rates and overall costs at Texas Health facilities was to characterize the ways patients are using the program. That was the easiest way we thought to start since that was data that could easily be collected, broken down, and analyzed for a large number of patients.

However, as we started the project, another factor affecting emergency department visits emerged: the COVID-19 pandemic. The COVID-19 impact on ED care is something that is still

being studied. It has been shown that overall, ED volumes decreased, but it also showed that patients increased utilization of telehealth services for their healthcare needs overall<sup>7</sup>.

Considering all of this, our study serves to characterize the use of the H2H program during the COVID-19 pandemic while comparing the differences in the use of the program in the period during the pandemic with the time directly preceding the pandemic.

## **Research Materials and Methods**

### **Setting**

This study is a retrospective chart review of patient encounters utilizing the H2H program. All data was gathered directly from the H2H platform.

### **Subject Identification**

Individual study subjects were identified using an index of patients discharged from multiple Texas Health emergency departments to determine who utilized the H2H program. The desired patient population consists of those above the age of 18 who may or may not have a primary care physician on file (PCP).

### **Specific Methods**

A retrospective chart review was conducted to look at characteristics of the utilization of the H2H platform for patients that were seen in the Emergency Department at up to 18 different Texas Health emergency departments from January 2019-March 2021. Specific characteristics that were collected and analyzed are detailed in Table 1. Data were compared between the period at the beginning of the COVID-19 pandemic, defined as March 2020-March 2021, and the year directly preceding the pandemic, defined as January 2019-January 2020.

### **Analysis of Subject Data**

Using descriptive and statistical analysis, we described and compared the characteristics listed above of the defined population of H2H users between the first year before and the year during the prevalence of COVID-19. We collected generalized data for all Texas Health H2H patient users, and specific data from at least 1000 different patients from each date range to obtain statistically significant results. Data are reported as percentages, means, and standard deviations for each group.

This study is a chart review using data from Texas Health systems. Subjects were selected from those who are at least 18 years old and were discharged from H2H-participating Texas Health Emergency Rooms between the years of 2019-2020. Our study focused on the year 2019, the year before the COVID-19 pandemic in the United States, and 2020, the next full year including COVID-19. The Texas Health hospitals in our study include both level 1 and level 2 trauma centers that see thousands of patients a year. They use EPIC for electronic medical records, and we used some EPIC data as well as data provided by Texas Health Resources (THR) from their H2H program database to identify patient demographic data such as age, gender, etc. We used authorized

versions of EPIC from personal and hospital computers as needed after being cleared by the THR administrators in charge of EPIC credentialing. All final presented patient data is de-identified.

<b>DATA COLLECTION</b>
Age
Gender (coded as male/female/other)
Is this repeated usage of H2H for the same visit? Coded as “yes” or “no”
Reason for Usage-coded as the physician documented reason for visit
Duration of active interaction in seconds
Initial response time in seconds
Number of images uploaded
Number of messages sent by patients
Number of messages sent by provider
Secondary Outcomes of Usage-coded as none, medication prescribed or instructions to immediately return to ED

**Table 1. Specific H2H Characteristics Analyzed**

## Results

From January 2019 to December 2019, there were 242,233 total discharges across 17 participating Texas Health facility emergency departments. This led to 6,441 new H2H registrations and 2,760 completed H2H encounters. While we are still analyzing the medical reasons for H2H encounters, the primary non-medical reasons for use include questions about other redirect/admin (179 encounters) and medical records/results inquiries (100 encounters). Of those completed, 22.17% led to recommended in-person follow-up (n=612). 3.80% lead to recommended virtual follow-up (n=105). About 15.1% of encounters included an additional prescription being written with the primary type being a non-antibiotic prescription. 78.1% of encounters occurred on a mobile device via the internet, 19.1% of encounters occurred from a desktop via the internet, and 2.80% of encounters occurred directly via the H2H app.

For the dates March 2020 to March 2021, there were 456,165 total discharges across 18 Texas Health facility emergency departments. This led to 25,220 new H2H registrations and 10,719 completed encounters. The most common non-medical reasons for use include questions about medical records/results (514 encounters) and other redirect/admin inquiries (317 encounters). Of those completed, 26.9% led to recommended in-person follow-up (n=2,886). 2.67% lead to recommended virtual follow-up (n=286). About 15.2% of encounters included an additional prescription being written with the primary type again being a non-antibiotic prescription. 70.4% of encounters occurred on a mobile device via the internet, 16.2% of encounters occurred from a desktop via the internet, and 13.4% of encounters occurred directly via the H2H app.

When we looked closer at individualized patient information for the H2H data from January 2019 to December 2019, we had 3,342 patients across 17 total Texas Health Facilities. 70.4% were females (n= 2353) and 29.6% were males (n=989). The average duration of active interactions was 4504.12 seconds, or 75.07 minutes, with the average initial response time by physicians of 1238.35 seconds, or 20.64 minutes. The average number of images uploaded was .223 per patient. The patients sent an average of 5.94 messages per encounter, while the providers sent an average of 7.28 messages per encounter. About 24.33% of users (n=813) were repeat users, while 75.67% of patients (n=2529) were first-time users.

For the individualized H2H information from March 2020 to December 2020, we had data for 12,280 patients across 18 total Texas Health Facilities. 68.4% were females (n= 8402) and 31.6% were males (n=3878). The average duration of active interactions was 3906.56 seconds, or 65.11 minutes, with the average initial response time by physicians of 446.87 seconds, or 7.448 minutes. The average number of images uploaded was .263 per patient. The patients sent on average 7.05 messages per encounter while the providers sent an average of 7.96 messages per encounter. About 33.21% of users were repeat users (n=4078) and 66.79% of patients (n=8202) were first-time users.

## Discussion and Innovation

Initial data analysis shows significantly higher H2H registrations (25,220 vs 6,441 patients) and total completed encounters (10,719 vs 2760 encounters) in the time post-Covid compared to the time before COVID. I believe this can be attributed to the increasing push for Texas Health emergency departments to emphasize the H2H program on discharge. Instructions on how to use H2H are even printed out and provided on discharge paperwork at participating facilities. This continued emphasis by ED staff will lead to a further increase in the utilization of H2H by discharged patients. There is also a wider distribution of ages of users in the year post-Covid highlighting the willingness amongst all patient populations to utilize telehealth solutions, particularly at times when it is difficult or ill-advised to go to medical facilities.

A greater percentage of patients were an in-person follow-up in 2020 over 2019 (26.9% in 2020 vs 22.2% in 2019 ). One of the goals of programs like H2H is to provide patients with short-term follow-up after discharge, especially for those who may not have a PCP or cannot get access to one quickly. The number of patients that were advised to get in-person follow-up shows the benefit of telehealth in letting people know when it is appropriate to return to the ED. It also prevents patients from unnecessarily returning to the ED for an issue that can be addressed via telehealth or at a later date on an outpatient basis. This saves money for the patients and the hospital.

Although the percentage of encounters that included an additional prescription being written remained the same between the years studied at around 15%, that is still a significant number. This shows that there is perhaps room for improvement in the prescriptions given at initial discharge or the discharge conversations around over-the-counter solutions. More analysis needs to be done on exactly what prescriptions are being prescribed and how that gap can be further closed. We are still analyzing the individualized medical reasons for H2H usage. That data may also highlight communication gaps that need to be addressed in discharge conversations.

There was a significant increase in the percentage of encounters using the H2H app (13.4% in 2020 compared to 2.8% in 2019). Apps are an increasingly easy way to engage with patients from all populations. They do not directly require an internet connection like desktop access and are often more intuitive to use, especially for the younger generation. I think more emphasis needs to be placed on promoting the H2H app as an easy way to engage more patients. The numbers show that more and more patients are willing to utilize this modality.

When looking at more individualized patient data, there were significantly more total patients (12,280 patients in 2020 vs 3,342 in 2019) who interacted with H2H. More images and messages were sent overall by patients as well. This data makes sense because patients are looking for ways to get health care and information without having to go to hospitals or clinics, especially after a pandemic. Of note, the percentage of repeat users was significantly higher in the year post-COVID (up to 33.2% in 2020 from 24.3% in 2019). Patients are seeing the benefit



of telehealth programs like H2H and are willing to use them again as a quality adjunct to follow-up care following discharge.

We anticipate the number of H2H utilizers will continue to grow as people realize the benefits of telehealth applications. It provides quick and easy access to physicians for patients that may forgo follow-up otherwise. One of the strengths of programs and research like this is that there will always be patients coming in and out of the ED, so we will be able to continue to track trends as they evolve. Improvements and changes can be made as patients' needs change. One of the weaknesses of the study is that to get the data, discharged patients need to register with the H2H program, which is still a relatively small percentage of the total number of people discharged from Texas Health hospitals. This can be improved with a better emphasis on the program by ED staff during patient discharge as well as an overall stronger advertising effort from the hospital system, which is already being discussed.

H2H can be an innovative new approach to post-discharge communications. It allows patients to have their questions answered without having to return to the hospital or wait days to weeks for an appointment with their primary care physicians. We believe this will have a strong effect on reducing unnecessary hospital return rates and costs associated with these visits. As we look at the individualized patient data, we will better be able to determine what types of questions are being asked. Once we determine common themes of questions, we can even go back to hospital administration and ED physician groups to discuss how to better integrate these themes into discharge conversations and materials.

### **Future Directions**

More research still needs to be done to further clarify the exact role that H2H plays in patient satisfaction. Patient satisfaction is coming under new emphasis from hospital programs nationwide and undoubtedly leads to better patient care. This can be done through collaborative arrangements between the H2H administrators and hospital quality improvement and surveying departments. There is also some benefit in looking further into the demographics that utilize the program. For the program to have the greatest impact, it needs to be accessible to patients from all socioeconomic backgrounds. The infrastructure exists to look at H2H utilization by location along with things like gender and race. Further examining these trends is necessary to achieve widespread utilization moving forward. As discussed earlier, discharge medicine prescription trends can also be tracked using H2H data. We can further analyze where there are opportunities for ED physicians to discuss more over-the-counter pain options or even scenarios where it is appropriate to be more aggressive with prescribing pain medicines or antibiotics.

### **Conclusions**

This project hopes to shift some of the past approaches that responsibility stops once a patient leaves the ED. Programs like the H2H program can serve as a resource for patients who still may have questions after their discharge and can't get in to see their primary care physicians. It also

can let patients know when they should return to the ED for emergent complications. Overall, H2H can save large sums of hospital money that was previously used on unnecessary visits that can be funneled into other areas of need. In that way, programs like this can save lives and have benefits for hospital systems nationwide. Our data collection has shown a significant increase in H2H utilization in just one year when comparing 2020 to 2019. Continued emphasis by the hospital system on telehealth programs can further serve to improve the healthcare experience for patients and hospitals alike.

## **Compliance**

This project received approval from the TCU IRB. It was considered within the IRB-exempt category. This is because our project presented a minimal risk of harm to patients. We used patient charts and discharge data for analysis. All research data collected were deidentified and reported in aggregate with no personal identifiers utilized. Research data was stored and managed securely. The data collected was stored in the HIPAA-compliant, Qualtrics-secure database and the only access was by the research team. Any hard copies of research documents including electronic documents were securely stored in locked containers (file cabinets, lockers, drawers, etc.) in the office of the PI. All electronic records were maintained on password protected computers. At all times, only members of the research team had access to any research-related documents. All such personnel were properly trained and supervised regarding the management and handling of confidential materials.

## References

1. Trends in the Utilization of Emergency Department Services, 2009-2018. ASPE. Published March 1, 2021. <https://aspe.hhs.gov/reports/trends-utilization-emergency-department-services-2009-2018>
2. Sheikh H, Brezar A, Dzwonek A, et al. Patient understanding of discharge instructions in the emergency department: do different patients need different approaches? *International Journal of Emergency Medicine*. 2018;11(1). doi:<https://doi.org/10.1186/s12245-018-0164-0>
3. Ruben K, Mortensen K, Eldridge B. Emergency Department Referral Process and Subsequent Use of Safety-Net Clinics. *Journal of Immigrant and Minority Health*. 2014;17(5):1298-1304. doi:<https://doi.org/10.1007/s10903-014-0111-y>
4. Rising KL, Padrez KA, O'Brien M, et al. Return Visits to the Emergency Department: The Patient Perspective. *Annals of Emergency Medicine*. 2015;65(4):377-386.e3. doi:<https://doi.org/10.1016/j.annemergmed.2014.07.015>
5. Duseja R, Bardach NS, Lin GA, et al. Revisit Rates and Associated Costs After an Emergency Department Encounter. *Annals of Internal Medicine*. 2015;162(11):750. doi:<https://doi.org/10.7326/m14-1616>
6. Hiti EA, Tamim H, Makki M, et al. Characteristics and determinants of high-risk unscheduled return visits to the emergency department. *Emergency Medicine Journal*. 2019;37(2):79-84. doi:<https://doi.org/10.1136/emered-2018-208343>
7. Koonin LM. Trends in the use of telehealth during the emergence of the COVID-19 pandemic — united states, january–march 2020. *MMWR Morbidity and Mortality Weekly Report*. 2020;69(43). doi:<https://doi.org/10.15585/mmwr.mm6943a3>
8. About H2H. [cvquality.acc.org](https://cvquality.acc.org). Accessed February 22, 2023. <https://cvquality.acc.org/initiatives/hospital-to-home/about-h2h>
9. Heidenreich PA, Sahay A, Oliva N, et al. Impact of the Hospital to Home Initiative on Readmissions in the VA Health Care System. *Quality Management in Health Care*. 2016;25(3):129-133. doi:<https://doi.org/10.1097/qmh.000000000000105>

10. Sabbatini AK, Kocher KE, Basu A, et al. In-Hospital Outcomes and Costs Among Patients Hospitalized During a Return Visit to the Emergency Department. *JAMA*. 2016;315(7):663-671. doi:<https://doi.org/10.1001/jama.2016.0649>
  
11. Galarraga JE, Pines JM. Costs of ED episodes of care in the United States. *The American Journal of Emergency Medicine*. 2016;34(3):357-365. doi:<https://doi.org/10.1016/j.ajem.2015.06.001>