

Patient Characteristics of VA Telehealth Users During Hurricane Harvey

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Claudia Der-Martirosian¹ , Leonie Heyworth²,
Karen Chu¹, Yvonne Mudoh¹, and Aram Dobalian^{1,3}

Abstract

Introduction: Research on patient characteristics of telehealth users is relatively new. More studies are needed to understand the characteristics of telehealth users during disasters. This study attempts to bridge this gap and examines patient characteristics of telehealth users compared with nontelehealth users at the Houston VA Medical Center (VAMC) immediately before and after Hurricane Harvey (2017). **Methods:** Since use of telehealth services reached its peak and gradually declined within 2 weeks after the landfall, the data analyses focused on 14 days before/14 days after Harvey. Two sets of analyses were conducted using chi-square, *t* test, and one-way analysis of variance: (1) Patient characteristics of telehealth users were compared with nontelehealth users. (2) Patient characteristics were compared between 3 subgroups of telehealth users. **Results:** Compared with nontelehealth users, telehealth users were older (mean age: 60.8 vs 58.5 years, $P < .001$) and had a higher mean Nosos health risk score (1.9 vs 1.4, $P < .001$). They also had a higher mean number of outpatient visits (28.0 vs 19.8, $P < .001$), higher emergency room use (37% vs 29%, $P < .001$), and higher rates of hospitalizations (21% vs 13%, $P < .001$) during the 12 months before Harvey. When compared to less frequent telehealth users, the most frequent telehealth users were the oldest and most medically complex patients. **Conclusions:** As the largest integrated health care system in the United States, the VA has many advantages favoring successful implementation of telehealth services during disasters. However, more research is needed to better understand how VA telehealth could meet the varying needs of veterans to lower risk of harm during differing types of disasters.

Keywords

Veterans Affairs (VA), telemedicine, telehealth, disasters, Hurricane Harvey, veterans

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Introduction

Use of telemedicine or telehealth as a mode of health care delivery is increasing rapidly in various medical fields and with diverse patient populations.^{1,2} Although several disease or procedure-specific studies have examined patient demographics and satisfaction with care among telehealth users,^{3–11} few studies describe the patient characteristics of the broad population of telehealth users.²

A recent study by Liu et al.² collected data from 2467 patients registered through a web-portal created to host telemedicine consultation between patients and health care providers and found that the majority (70%) of telehealth users were women, with 63% being between the ages of 35 and 64 years. The study indicated that women were more likely to use a telephone to receive telehealth services, while men were more likely to use video to connect with their health care providers.² Results from another recent study that used

data from a large nationwide telemedicine service with over 28 000 encounters between 24 040 patients and 277 physicians (January 2013 to August 2016) showed that 59% of telehealth users were women, and 55% were between ages 18 and 40 years.¹² In a recent VA study, Abel et al.¹¹ examined the demographic characteristics of VA users with one or more mental health diagnoses from 2007 to 2012. This diagnosis-specific study compared the use of the

¹Veterans Emergency Management Evaluation Center (VEMEC), U.S. Department of Veterans Affairs, North Hills, CA, USA

²University of California, San Diego San Diego, CA, USA

³University of Memphis School of Public Health, Memphis, TN, USA

Corresponding Author:

Claudia Der-Martirosian, Veterans Emergency Management Evaluation Center (VEMEC), U.S. Department of Veterans Affairs, 16111 Plummer Street MS-152, North Hills, CA 91343, USA.

Email: claudia.der-martirosian@va.gov



web-based patient portal My HealtheVet (MVT) with Clinical Video Telehealth (CVT) at the U.S. Department of Veterans Affairs (VA). The sample for this study consisted of 2 171 325 patients who received inpatient or outpatient services and had one or more mental health diagnoses before registering for MVT or initiating a CVT visit. The results showed that women, African Americans, Latinos, and low-income VA patients, were less likely to use CVT compared with men, whites, non-Hispanics, and higher-income patients, respectively.

Despite a rapid increase in the use of telehealth services at the VA,^{10-11,13-15} little is known about the characteristics of VA telehealth users in general, especially during major disasters. Approximately 9 million U.S. Military Veterans are enrolled at the VA nationwide, and about one-third live in rural or highly rural areas, where face-to-face access to a VA provider might be limited,¹⁶ especially during major disasters. Furthermore, compared with the general population and veterans who are not VA patients, veterans who rely on the VA for health care services are more likely to be unemployed, poor, single, have poorer health status, and use more services.¹⁷⁻¹⁹ Consequently, veterans receiving care from the VA are more likely to be at a higher risk for medical complications and need for care during disasters.

When access to face-to-face/usual care is interrupted because of road closures or other environmental conditions that makes it unsafe to leave home, telehealth might be a viable option. Telehealth can help connect VA patients to their health care providers when in need of care. However, research on the use of telehealth services during disasters is relatively new, and little work has been done examining the patient characteristics of VA telehealth users during major disasters.²⁰

During Hurricane Harvey, which made landfall near Houston, Texas, at peak intensity on August 25, 2017, many areas in the state received more than 50 inches of rain, causing catastrophic flooding. By focusing on encounter-level data, our previous study²¹ examined the use of telehealth services at the Houston VAMC, which remained open during the hurricane. That study identified three major types of telehealth services that were used immediately after Harvey: primary care, home health, and mental health services. According to the study, health care providers used telehealth to provide virtual care to patients when routine, face-to-face care was disrupted during Harvey. The study findings illustrated that the use of telehealth services increased substantially, from a daily average of 18%, to the peak of 55%, during the 14-day post-Harvey period.²¹ This article expands on our previous research and uses patient-level data to compare the characteristics of telehealth users and nontelehealth users at the Houston VAMC immediately before and after Harvey.

Methods

In order to examine the patient characteristics of telehealth users immediately before and after Harvey, the

study period included 14 days pre/post Harvey, because during the 14 days post Harvey, the use of telehealth services at Houston VAMC both reached its peak and then gradually declined back to pre-Harvey levels.²¹ Using outpatient workload data from the VA Corporate Data Warehouse, a national repository of clinical and administrative data from all VA medical facilities, we extracted detailed information about each clinical visit for 29 829 Houston VAMC patients, who had accessed outpatient services 14 days prior to Hurricane Harvey. Among this initial study cohort, 14 191 patients used telehealth services 14 days before or 14 days after Harvey, while the remaining 15 638 Houston VAMC patients did not use any telehealth services during the 28-day study period. We further subdivided the telehealth study cohort into 3 mutually exclusive telehealth subcohorts: Houston VAMC patients who used telehealth services only before ($n = 6536$), only after ($n = 5210$), or both before and after ($n = 2445$) Harvey (see Figure 1).

We ran additional analyses to examine the use of non-telehealth services among both telehealth and nontelehealth study groups during the 28-day study period. Among the 15 638 nontelehealth users, 12 909 accessed nontelehealth outpatient services during the 14-day pre-Harvey study period, whereas only 6824 patients used nontelehealth outpatient services during the 14-day post-Harvey study period (data not shown). Similarly, among the 14 191 telehealth users, 4131 accessed nontelehealth outpatient services during the 14-day pre-Harvey study period, and only 2092 patients used nontelehealth outpatient services during the 14-day post-Harvey study period (data not shown).

To examine the patient characteristics of telehealth users, 2 sets of analyses were conducted. For both sets of analyses, 8 patient characteristics (4 demographic and 4 patient health characteristics) were assessed. The 4 demographic characteristics included mean age during Harvey, percent men, percent Hispanic, and percent African American. The 4 patient health characteristics included mean number of outpatient visits, mean Nosos score, percent emergency room (ER) visits, and percent hospitalizations. For patient health characteristics, the timeframe included 12 months before Harvey made landfall, whereas for the demographic characteristics, the time frame included the day of Harvey landfall. The Nosos measure is a tailored, VA-risk score that uses diagnostic and demographic information from the entire year to generate both hierarchical condition categories (HCCs) and risk scores.²² Therefore, higher Nosos scores indicate higher health risks.

For the first set of analyses, the patient demographic and health characteristics were compared between telehealth ($n = 14 191$) and nontelehealth ($n = 15 638$) users. For the second set of analyses, the patient demographic and health characteristics of 3 telehealth subgroups: before ($n = 6536$), after ($n = 5210$), and both before and after ($n = 2445$) Hurricane Harvey, were compared. For both sets of

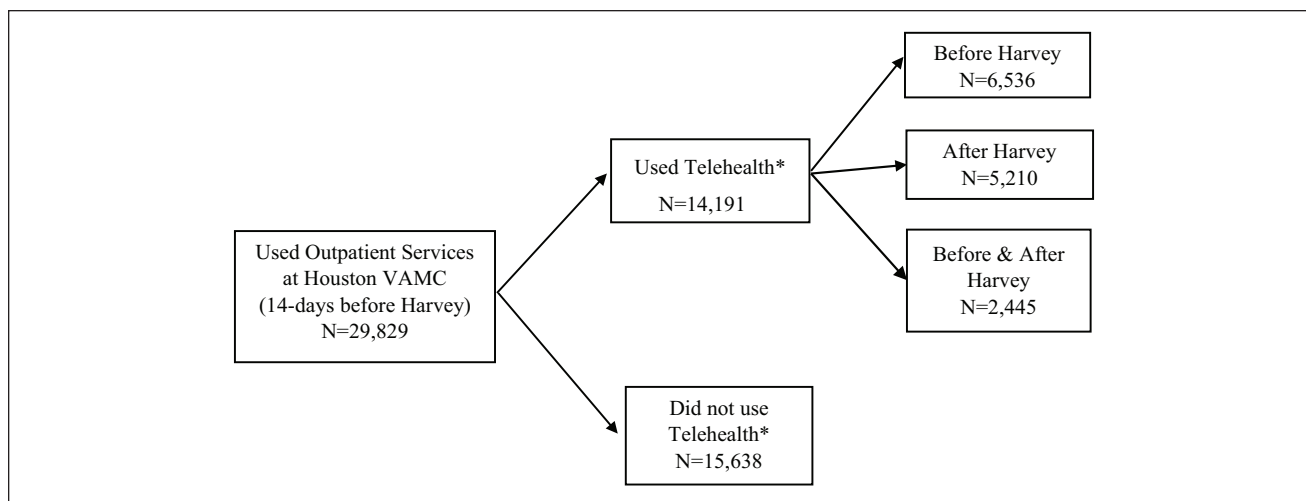


Figure 1. Study cohorts for telehealth use during Hurricane Harvey.

*Used health care services at the Houston VA Medical Center (VAMC) 14 days before and/or 14 days after Harvey.

Table 1. Patient Characteristics of Telehealth Versus Nontelehealth Users 14 Days Before and 14 Days After Hurricane Harvey.

Used telehealth	Mean age	% Male	% African American	% Hispanic
Yes (n = 14 191)	60.8*	88	37	10
No (n = 15 638)	58.5	89	37	11

Used telehealth	Mean no. of outpatient visits	Mean Nosos ^a	% Emergency room visits	% Hospitalized
Yes (n = 14 191)	28.0*	1.9*	37*	21*
No (n = 15 638)	19.8	1.4	29	13

^aNosos is a tailored risk score to the VA that uses diagnostic and demographic information from the entire year to generate both hierarchical condition categories (HCCs) and risk scores. Source: <https://www.herc.research.va.gov/include/page.asp?id=risk-adjustment>.

*P < .001.

analyses, chi-square, *t* test, and one-way analysis of variance were conducted using Stata 15 (StataCorp).

This study was approved by the VA Greater Los Angeles Healthcare System’s Institutional Review Board.

Results

Table 1 illustrates the findings from the first set of analyses, comparing the demographic and health characteristics of telehealth (n = 14 191) and nontelehealth (n = 15 638) users during the study time period (14 days before and 14 days after Harvey). The results indicate no demographic differences between telehealth and nontelehealth users except age; telehealth users were older (mean age: 60.8 vs 58.5 years, *P* < .001) compared with nontelehealth users. In terms of patient health characteristics, when compared with nontelehealth users, telehealth users had a higher mean number of outpatient visits (28.0 vs 19.8, *P* < .001), higher mean Nosos scores (1.9 vs 1.4, *P* < .001), higher ER use (37% vs

29%, *P* < .001), and higher rates of hospitalizations (21% vs 13%, *P* < .001) during the 12 months before Harvey.

Table 2 illustrates findings from the second set of analyses comparing the patient demographics and health characteristics of 3 telehealth subgroups: used telehealth services before (n = 6536), after (n = 5210), and both before and after (n = 2445) Harvey. The first panel in Table 2 displays the demographic characteristics. We found that the before and after telehealth subgroup was older compared with the other 2 telehealth subgroups (mean age: 63.9 vs 60.4 vs 59.9 years, *P* < .001). For the other demographic variables, there were no statistically significant differences between the 3 telehealth subgroups.

The second panel in Table 2 displays patient health characteristics for the 3 telehealth subgroups and shows statistically significant differences between the before and after telehealth subgroup and the other 2 subgroups for all 4 health indicators. The before and after telehealth subgroup had the highest mean number of outpatient visits (42.3 vs

Table 2. Patient Characteristics of Telehealth Users 14 Days Before and 14 Days After Hurricane Harvey.

Used telehealth	Sample size	Mean age, y	% Male	% African American	% Hispanic
Only before Harvey	6536	60.4	88	36	9
Only after Harvey	5210	59.9	88	37	11
Before and after Harvey	2445	63.9*	90	40	8

Used telehealth	Sample size	Mean no. of outpatient visits	Mean Nosos ^a	% Emergency room visits	% Hospitalized
Only before Harvey	6536	24.3	1.7	35	19
Only after Harvey	5210	25.9	1.8	34	17
Before and after Harvey	2445	42.3*	2.9*	49%*	31%*

^aNosos is a tailored risk score to the VA that uses diagnostic and demographic information from the entire year to generate both hierarchical condition categories (HCCs) and risk scores during the 12 months pre-Harvey. Source: <https://www.herc.research.va.gov/include/page.asp?id=risk-adjustment>.

* $P < .001$.

24.3 vs 25.9, $P < .001$), the highest mean Nosos scores (2.9 vs 1.7 vs 1.8, $P < .001$), the highest ER use (49% vs 35% vs 34%, $P < .001$), and the highest hospitalization rate (31% vs 19% vs 17%, $P < .001$).

Discussion

Research about the patient characteristics of telehealth users is relatively new, and more studies are especially needed regarding those who use it during disasters. This study attempts to bridge this gap by examining the patient characteristics of telehealth users compared with nontelehealth users at the Houston VAMC 14 days before and 14 days after Hurricane Harvey. Our findings indicate that telehealth users tended to be older and had a higher number of outpatient visits, higher health risk factors, higher ER use, and higher rates of hospitalization during the 12 months before Harvey. In other words, telehealth users tended to be medically more vulnerable. The study findings further illustrate that among Houston VAMC telehealth users, those who used VA telehealth services both immediately before and immediately after Harvey, were the oldest and medically most vulnerable (ie, highest Nosos score, highest number of outpatient visits, highest rate of ER visits, and highest rate of hospitalizations during the 12 months prior to Harvey). In other words, the most frequent telehealth users during Harvey were the oldest and most medically complex patients.

With regard to the literature about the use of telehealth services among older adults, previous studies have shown that the increasing rates of adults living independently and “aging in place” has led to increased use of telehealth among older adults.²³ Similarly, use of telehealth services is more prevalent among the elderly receiving home care services, because this group tends to be more medically vulnerable and have greater health challenges that require frequent follow-ups.²⁴ Even though technology and other aspects of telehealth is less familiar to older adults, a systematic review

of the literature on the use of telehealth by older adults with depression showed that use of telehealth increased access to care and positive health outcomes.¹⁴ That study showed that telehealth increased access to treatment by reducing barriers such as living arrangements, social isolation, impaired functional status, and stigma, all of which contribute to low treatment rates for depression.²⁵ Moreover, some studies have shown that older adults with caregivers were more likely to engage in technology-enhanced health care,^{13,24,26} and that even those without caregivers were able to adopt telehealth technology after being coached.⁵

With regard to use of telehealth services among medically complex VA patients, such as those with cardiovascular disease, diabetes, muscular sclerosis, or mental health diagnoses, there are numerous chronic, disease, or diagnosis-specific studies that have examined the benefits of telehealth technology.^{3,4,7,9,24,25,27-29} Many of these studies have shown increased patient satisfaction, reduced cost, and increased access to care among telehealth users.^{6,12,30-32}

As technology continues to become more widespread, the utilization of telehealth by all types of patients is likely to increase. Moreover, given the recent increase in the number, intensity, and different types of major disasters,³³ more studies are needed to better understand how VA telehealth and similar technology among non-VA telehealth users can effectively meet the needs of both VA and non-VA patients, including those who are medically vulnerable. By having a better understanding of the patient characteristics of telehealth users during disasters, the VA can better prepare for the implementation of telehealth technology for future disasters. In addition, it may be possible to expand the use of telehealth to better meet not just the needs of those who are currently using telehealth during disasters but to also better meet the needs of those who may need care less urgently than typical disaster telehealth users, but who perceive themselves to be at lower risk for harm and are therefore less likely to seek out telehealth.

The VA telehealth technology for routine care includes clinical video telehealth, home telehealth, and transmission of diagnostic images, vital signs, and other patient data.³⁴ These technologies use electronic communications and video-teleconferencing to exchange medical information between different types of health care providers and between health care providers and patients.³⁴ To date, it is not clear how these technologies can be best implemented during major disasters. More research studies are needed to better understand how telehealth at the VA can be adapted so virtual care can become integrated into VA emergency management protocols and procedures during major disasters nationwide.

This study has several limitations. First, this study focuses on 1 type of disaster (hurricane) and only 1 event (Harvey). It should be noted, however, that disasters may illustrate different, unique circumstances and that different types of such events present varying challenges. Therefore, we can learn new lessons about the use of telehealth from each disaster. Second, the study does not examine the impact of telehealth use on health outcomes. Instead, all patient health characteristics in this study were based on information collected during the 12 months before Harvey made landfall. Future studies should examine health outcomes and patient satisfaction of telehealth users compared with a study cohort of nontelehealth users during disasters.

As the largest integrated health care system in the United States, the VA has many advantages favoring the successful implementation of telehealth services during disasters. In particular, the passage of the Anywhere to Anywhere VA initiative (in June 2018) allows any VA provider to provide health care services to any VA patient, even across state lines. Thus, it may be more feasible to accommodate continuity of care as well as any increased demand or need for telehealth in a region that is affected by a disaster.

Conclusions

The VA telehealth programs vary by region and facility, as do the types of disasters that can potentially affect VA facilities across the nation. Each VA facility has the potential to expand and adapt its routine daily telehealth services to accommodate access to care during major crises. Additionally, as a part of an integrated health care network, VA facilities have the potential to collaborate and incorporate telehealth technologies during disasters. Lessons learned from how VA implements telehealth technologies can be applied to other non-VA health care systems. Future studies should examine whether and how other non-VA systems can adapt to increased or different demands for telehealth after disasters. Given the outbreak of the novel coronavirus, telehealth will continue to grow and become even more integrated into mainstream medical practice, both at the VA and at other non-VA systems. With this increasing adoption of telemedicine, there is a need for additional research to better

understand how to overcome challenges to most effectively adapt to emerging telehealth technologies.

Declaration of Conflicting Interests

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ORCID iD

Claudia Der-Martirosian  <https://orcid.org/0000-0001-6841-198X>

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