

# **Access to the Internet and Mobile Applications in a Mixed Population Emergency Department: A Repeated Cross-Sectional Survey**

Shannon Toohey, Michelle Thao Nguyen, Soheil Saadat, Carrie Chandwani, Stephen Gassner, Alisa Wray, Ronald Rivera, Warren Wiechmann

Submitted to: Journal of Medical Internet Research  
on: February 08, 2023

**Disclaimer:** © The authors. All rights reserved. This is a privileged document currently under peer-review/community review. Authors have provided JMIR Publications with an exclusive license to publish this preprint on its website for review purposes only. While the final peer-reviewed paper may be licensed under a CC BY license on publication, at this stage authors and publisher expressly prohibit redistribution of this draft paper other than for review purposes.

Table of Contents

Original Manuscript..... 5

Supplementary Files..... 17

    Figures ..... 18

        Figure 1..... 19

        Figure 2..... 20

        Figure 3..... 21

# Access to the Internet and Mobile Applications in a Mixed Population Emergency Department: A Repeated Cross-Sectional Survey

Shannon Toohey<sup>1,2</sup> MD, MAEd; Michelle Thao Nguyen<sup>2</sup> BS; Soheil Saadat<sup>1</sup> MD, MPH, PhD; Carrie Chandwani<sup>1,2</sup> MD; Stephen Gassner<sup>1,2</sup> MD, MPH; Alisa Wray<sup>1,2</sup> MD, MAEd; Ronald Rivera<sup>1,2</sup> MD; Warren Wiechmann<sup>1,2</sup> MD, MBA

<sup>1</sup>Department of Emergency Medicine, University of California, Irvine Orange US

<sup>2</sup>School of Medicine, University of California, Irvine Irvine US

## Corresponding Author:

Shannon Toohey MD, MAEd

Department of Emergency Medicine, University of California, Irvine

101 The City Dr S

Orange

US

## Abstract

**Background:** Electronic media can be used to help address the communication gaps that exist between doctors and patients. Prior to utilizing these tools within an emergency department with patients of various socioeconomic statuses, it was important to collect data regarding patient accessibility to the internet, email, and other health management applications.

**Objective:** The survey was conducted in 2014 and repeated in 2019 to identify trends in patients' access to and use of the internet. We sought to assess the degree of interest in education content delivered through electronic modalities.

**Methods:** This anonymous, prospective, cross-sectional survey included 50 questions and was completed by 241 English and Spanish-speaking patients in 2014. 253 additional surveys were collected in 2019. Participants were surveyed at the University of California, Irvine Medical Center's Emergency Department (UCIMCED) while patients were waiting for treatment and diagnostic tests. The primary outcome was to compare internet access and communication technology use between 2014 and 2019. Secondary goal was to compare the pattern of internet use and search for health information between 2014 and 2019 among patients who presented to the UC Irvine Emergency Department.

**Results:** The vast majority of patients have access to the internet, with 83.8% (N=241, 95%, CI: 78.5% - 88.2%) having access in 2014, and this number increasing to 88.1% (N= 253, 95%, CI: 83.5% - 91.9%) in 2019 (P=.160). Most internet-using patients owned a smartphone in 2014 (N= 161; 80.1%), increasing almost 10% by 2019 (N=200; 89.7%). When searching for health-related information, 32.5% of patients could always find pertinent health information and 20.6% found this information always reliable. In addition, patients reported using electronic devices to obtain more information on their health, including Fitbits, activity trackers, and blood pressure cuffs. Among a range of electronic modalities patients can use to communicate with their healthcare provider, patients felt most comfortable receiving discharge instructions via email in 2014 and 2019.

**Conclusions:** The implications of this study can be used to develop electronic resources tailored to educate emergency department patients about their healthcare beyond the confines of a hospital. Given that as of 2019 88.1% of patients in our emergency department have access to the internet or email, electronic media is a reasonable venue for patient education. Given that we have a predominantly low-income patient population, with 61% of respondents reporting an income of less than \$25,000, these results are valuable and provide new ways to reach patients of all socioeconomic statuses.

(JMIR Preprints 08/02/2023:46168)

DOI: <https://doi.org/10.2196/preprints.46168>

## Preprint Settings

1) Would you like to publish your submitted manuscript as preprint?

✓ **Please make my preprint PDF available to anyone at any time (recommended).**

Please make my preprint PDF available only to logged-in users; I understand that my title and abstract will remain visible to all users.

Only make the preprint title and abstract visible.

No, I do not wish to publish my submitted manuscript as a preprint.

2) If accepted for publication in a JMIR journal, would you like the PDF to be visible to the public?

✓ **Yes, please make my accepted manuscript PDF available to anyone at any time (Recommended).**

Yes, but please make my accepted manuscript PDF available only to logged-in users; I understand that the title and abstract will remain visible.

Yes, but only make the title and abstract visible (see Important note, above). I understand that if I later pay to participate in <http://www.jmir.org/preprint/46168>



## Original Manuscript

## Access to the Internet and Mobile Applications in a Mixed Population Emergency Department: A Repeated Cross-Sectional Survey

Shannon Toohey, MD, MAEd<sup>1,2</sup>; Michelle T. Nguyen, BS<sup>2</sup>; Soheil Saadat, MD, MPH, PhD<sup>1</sup>; Carrie E. Chandwani, MD<sup>1,2</sup>; Stephen F. Gassner, MD, MPH<sup>1,2</sup>; Alisa Wray MD, MAEd<sup>1,2</sup>; Ronald Rivera, MD<sup>1,2</sup>; Warren Wiechmann, MD, MBA<sup>1,2</sup>

<sup>1</sup>Department of Emergency Medicine, University of California, Irvine, CA, USA

<sup>2</sup>School of Medicine, University of California, Irvine, Irvine, CA, USA

### Abstract

**Background:** Electronic media can be used to help address the communication gaps that exist between doctors and patients. Prior to utilizing these tools within an emergency department with patients of various socioeconomic statuses, it was important to collect data regarding patient accessibility to the internet, email, and other health management applications.

**Objective:** The survey was conducted in 2014 and repeated in 2019 to identify trends in patients' access to and use of the internet. We sought to assess the degree of interest in education content delivered through electronic modalities.

**Methods:** This anonymous, prospective, cross-sectional survey included 50 questions and was completed by 241 English and Spanish-speaking patients in 2014. 253 additional surveys were collected in 2019. Participants were surveyed at the University of California, Irvine Medical Center's Emergency Department (UCIMCED) while patients were waiting for treatment and diagnostic tests. The primary outcome was to compare internet access and communication technology use between 2014 and 2019. Secondary goal was to compare the pattern of internet use and search for health information between 2014 and 2019 among patients who presented to the UC Irvine Emergency Department.

**Results:** The vast majority of patients have access to the internet, with 83.8% (N=241, 95%, CI: 78.5% - 88.2%) having access in 2014, and this number increasing to 88.1% (N= 253, 95%, CI: 83.5% - 91.9%) in 2019 ( $P=.160$ ). Most internet-using patients owned a smartphone in 2014 (N= 161; 80.1%), increasing almost 10% by 2019 (N=200; 89.7%). When searching for health-related information, 32.5% of patients could always find pertinent health information and 20.6% found this information always reliable. In addition, patients reported using electronic devices to obtain more information on their health, including Fitbits, activity trackers, and blood pressure cuffs. Among a range of electronic modalities patients can use to communicate with their healthcare provider, patients felt most comfortable receiving discharge instructions via email in 2014 and 2019.

**Conclusions:** The implications of this study can be used to develop electronic resources tailored to educate emergency department patients about their healthcare beyond the confines of a hospital. Given that as of 2019 88.1% of patients in our emergency department have access to the internet or email, electronic media is a reasonable venue for patient education. Given that we have a predominantly low-income patient population, with 61% of respondents reporting an income of less than \$25,000, these results are valuable and provide new ways to reach patients of all socioeconomic statuses.

**Key words:** internet access, electronic media, doctor-patient communication, smartphones, patient education, activity trackers

### Introduction

It can be difficult for physicians to effectively educate patients during visits to the emergency room[1-3]. In the face of a complex delivery environment, high patient volumes and medical documentation requirements, physician-patient interactions can be rushed and brief [4]. Limited communication time can have a significant effect on those that we serve as well as our health care system as a whole. At the time of discharge, many

patients have a poor understanding of their diagnosis, prescribed medications, and requirements for follow-up care [1]. These knowledge gaps create an abundance of short and long-term consequences. Patient health outcomes are negatively impacted, return visits to the emergency department increase, and the frequency of hospital readmissions rise[1].

Electronic media is a poorly utilized but powerful tool that can be used to help address these communication and knowledge gaps. The recent proliferation of internet blogs, social networking sites, mobile health apps, and podcasts represents an important educational opportunity for physicians and other medical professionals. Emergency room doctors are uniquely positioned to take advantage of electronic media. As a first-line provider and a proverbial “jack-of-all trades,” the emergency physician is trained to advise a wide spectrum of patients on health care issues that arise within every major organ system. Although previous studies have measured internet availability to emergency department patients [5-10], most data was collected prior to 2009—it is highly likely that accessibility has increased in the subsequent years.

### *Objectives*

Within our emergency department, we collected survey responses from patients regarding current accessibility to the internet, email, and mobile devices. We aimed to quantify the percentage of patients at our emergency department in 2014 and 2019 that have access to these resources, as well as the percentage of patients that would be interested in educational content delivered through these means.

### *Methodology*

#### *Recruitment*

An anonymous, survey was conducted at the University of California, Irvine Medical Center’s Emergency Department, a Level 1 trauma center located in Orange, California between March 2014 and June 2014, and then repeated five years later between May 2019 and August 2019. The survey included a total of 50 multiple choice, yes-or-no, and free-response questions. All English and Spanish speaking emergency department patients over the age of 18 were eligible for the study, except for those that were too ill, incarcerated, or pregnant. The UC Irvine Institutional Review Board assessed and approved the study prior to survey administration.

#### *Statistical Analysis*

The primary outcome was to compare the internet access and communication technology use between 2014 and 2019. Given an estimation of 90% based on prior studies [5,9], we used a two-sample t-test with 95% confidence intervals less than or equal to  $\pm 5\%$ . This power calculation resulted in an estimated minimum sample size of 201 participants. The secondary goal was to compare the pattern of internet use and health information searches between 2014 and 2019 among patients presented to the UC Irvine Emergency Department.

### *Results*

#### *Demographics*

During the 2014 study period, a total of 241 patients were surveyed at the UC Irvine Emergency Department; 253 patients were surveyed in 2019. Demographics of the study populations are in Table 1 below. In 2014, 83.8% (N= 201, 95% CI: 78.5% - 88.2%) reported using the internet or accessing email at least occasionally. This proportion increased to 88.1% (N= 223, 95% CI: 83.5% - 91.9%) in 2019 ( $P=.160$ ). In 2014, 55.2% (N= 111, 95% CI: 48.1% - 62.2%) of internet users indicated that they access the internet or email multiple times per day. This proportion rose to 64.7% (N=141, 95% CI: 57.9% - 71.0%) in 2019 ( $P=.048$ ).

### **Table 1: Demographic Data**

	2014 N (%)	2019 N (%)	P value
<b>Gender</b>			
Female	128 (53.1)	114 (49.1)	.387
Male	113 (46.9)	118 (50.9)	
<b>Age</b>			
18-25	36 (14.9)	36 (15.5)	.076
26-35	48 (19.9)	43 (18.5)	
36-50	71 (29.5)	60 (25.9)	
51-69	70 (29.1)	59 (25.4)	
70+	16 (6.6)	34 (14.7)	
<b>Questionnaire Language</b>			
English	192 (79.7)	227 (89.7)	.002
Spanish	49 (20.3)	26 (10.3)	
<b>Approximate Annual Income</b>			
\$0-\$24,999	147 (61.0)	81 (44.3)	.017
\$25,000-\$49,000	36 (14.9)	46 (25.1)	
\$50,000-\$74,999	23 (9.5)	20 (10.9)	
\$75,000-\$99,000	17 (7.1)	17 (9.3)	
\$100,000-\$199,000	12 (5.0)	15 (8.2)	
\$200,000+	6 (2.5)	4 (2.2)	

### Internet Access and Utilization

Patients most frequently access the internet or email using their home internet connection in both 2014 and 2019, (N=107, 53.2% and N=106, 48.6%, respectively) or the data plan on their cell phone (N=83, 41.3% and N=98, 45%). Most internet-using patients owned a smartphone in 2014 (N= 161; 80.1%), increasing almost 10% by 2019 (N=200; 89.7%). Furthermore, most have monthly contract plans 346 (N= 346; 82.8% overall).

Table 2 also describes patients' use of various devices to connect to the internet and email, including smartphones, computers, and tablet devices. We also broke down how internet-using patients used their devices in 2014 and 2019. When patients were asked whether they find the health information that they are looking for online, 84.8% (N=350) believed they could always or most times find it. There was not a statistically significant difference patients who stated that they always or most times find internet-sourced health information reliable between 2014 and 2019 ( $P=.549$ ).

**Table 2: Internet Access and Use**

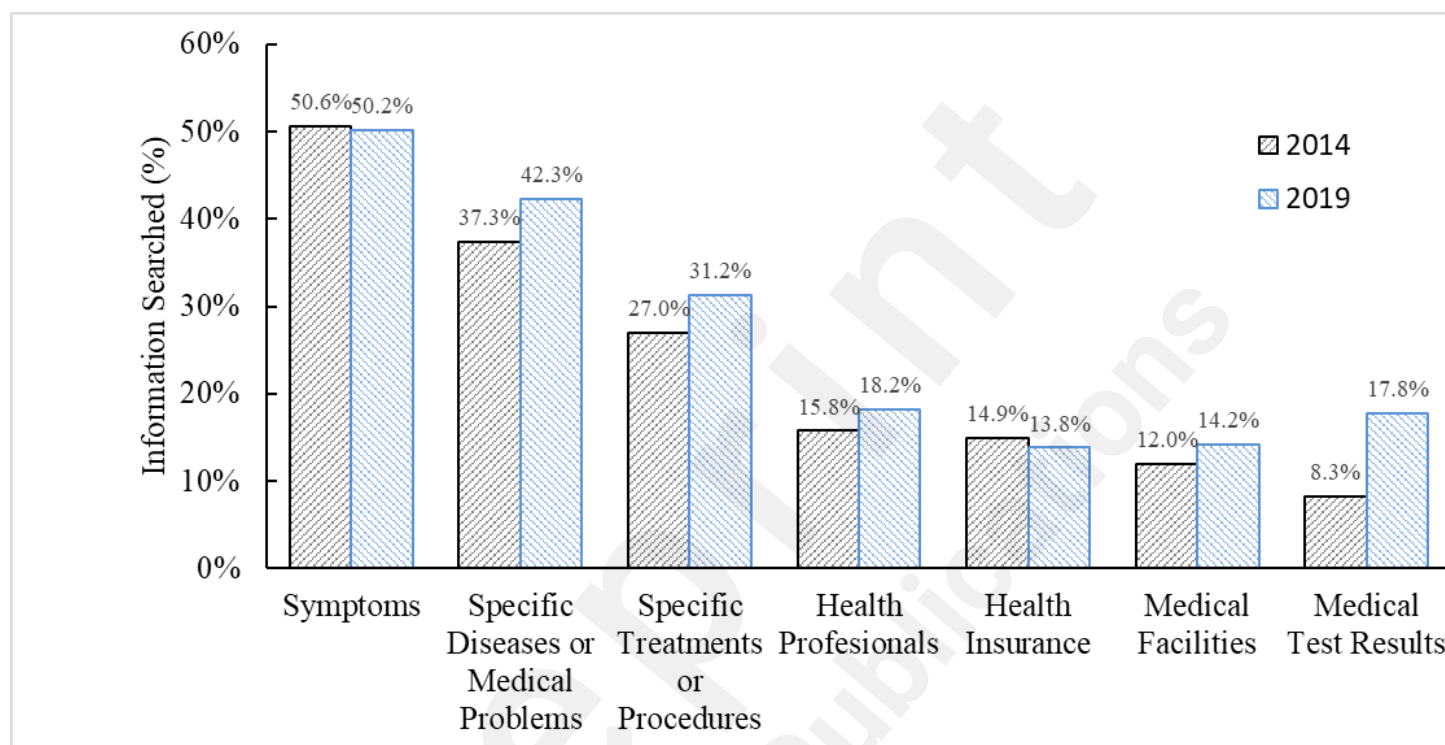
Most frequent service to access the internet	2014 N (%)	2019 N (%)	P value
Home internet Connection	107 (53.2)	106 (48.6)	.631
Data plan on Cell Phone	83 (41.3)	98(45.0)	
Free Services at Public Locations	11 (5.5)	14 (6.4)	
<b>Own a Smartphone</b>			
Yes	161 (80.1)	200 (89.7)	.953
No	40 (19.9)	23 (10.3)	
<b>Smartphone Plans</b>			
Have a Monthly Contract Plan	162 (85.3)	184 (90.6)	.256



Pay as you go prepaid plan	28 (14.7)	19 (9.4)	
<b>Access the Internet via a Smartphone</b>			
Yes	164 (82.4)	195 (90.3)	.015
No	35 (18.6)	21(9.7)	
<b>Access the Internet via a Computer</b>			
Yes	157 (78.9)	161 (74.9)	.348
No	42 (21.1)	54 (25.1%)	
<b>Access the Internet via a Tablet</b>			
Yes	105 (52.5)	106 (49.8)	.582
No	95 (47.5)	107 (50.2)	
<b>Send/receive text messages on any device</b>			
Yes	184 (92.0)	204 (96.7)	.039
No	16 (8.0)	7 (3.3)	
<b>Watch films on any device</b>			
Yes	139 (69.8)	170 (80.6)	.009
No	60 (30.2)	41 (19.4)	
<b>Download software application on any device</b>			
Yes	153 (78.1)	181 (86.2)	.016
No	43 (21.9)	29 (13.8)	
<b>Manage health or activity on any device</b>			
Yes	54 (28.4)	98 (48.8)	<.001
No	136 (71.6)	103 (51.2)	
<b>Search for health information via computer/netbook</b>			
Yes	141 (71.9)	143 (69.1)	.705
No	55 (28.1)	64 (30.9)	
<b>Search for health information via phone or tablet</b>			
Yes	130 (66.3)	176 (84.6)	<.001
No	66 (33.7)	32 (15.4)	
<b>Success in finding health Information</b>			
Always	51 (27.9)	68 (37.2)	.002
Most times	95 (51.9)	83 (45.4)	
About half the time	15 (8.2)	19 (10.4)	
Few Times	4 (2.2)	10 (5.5)	
Never	18 (9.8)	3 (1.6)	
<b>Reliability of health information</b>			
Always	29 (15.8)	43 (20.7)	.004
Most times	84 (45.9)	90 (43.3)	
About half the time	24 (13.1)	48 (23.1)	
Few Times	13 (7.1)	13 (6.3)	
Never	5 (2.7)	3 (1.4)	

I am unsure	28 (15.3)	11 (5.3)	
<a href="#">[1]Sample size my vary because some patients did not answer all the questions</a>			

Survey participants indicated that they access information on a variety of health-related issues using the internet (figure 1). There was not a statistically significant difference in distribution of information searched on internet between 2014 and 2019 ( $P=.212$ )



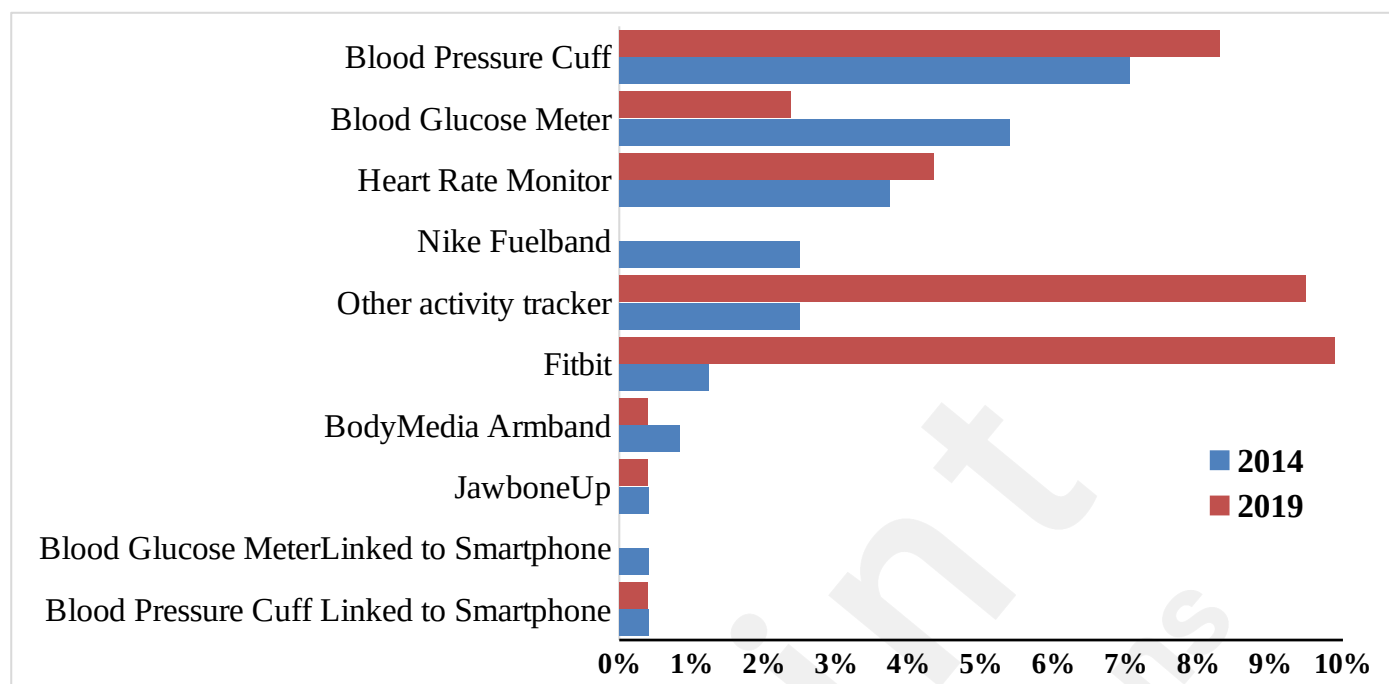
**Figure 1: Patient access to internet-based health information by topic.**

Overall, 49.3% ( $N=201$ ) of internet-using patients stated that online health information has convinced them to seek advice from a medical professional; the proportion was not statistically different between 2014 and 2019 ( $P=.575$ ). Additionally, 40.9% ( $N=167$ ) of internet users report that they have discussed health information accessed they online with a care provider. Of this subset, 77.1% ( $N=128$ ) stated that this medical professional had a “positive” or “somewhat positive” reaction to the information that was shared. In both cases, there was not a statistically significance between 2014 and 2019 ( $P=.169$  and  $P=.590$  respectively).

Prior to presenting to the emergency department, 25.3% ( $N=103$ ) of internet users reported going online to look up health information related to their visit. Of this subset, 70.2% ( $N=66$ ) stated that the information that they found influenced their decision to come. There was not a statistically significant difference in any of those variables between 2014 and 2019 ( $P=.475$  and  $P=.870$  respectively).

#### Cumulative Data on Health Management Products

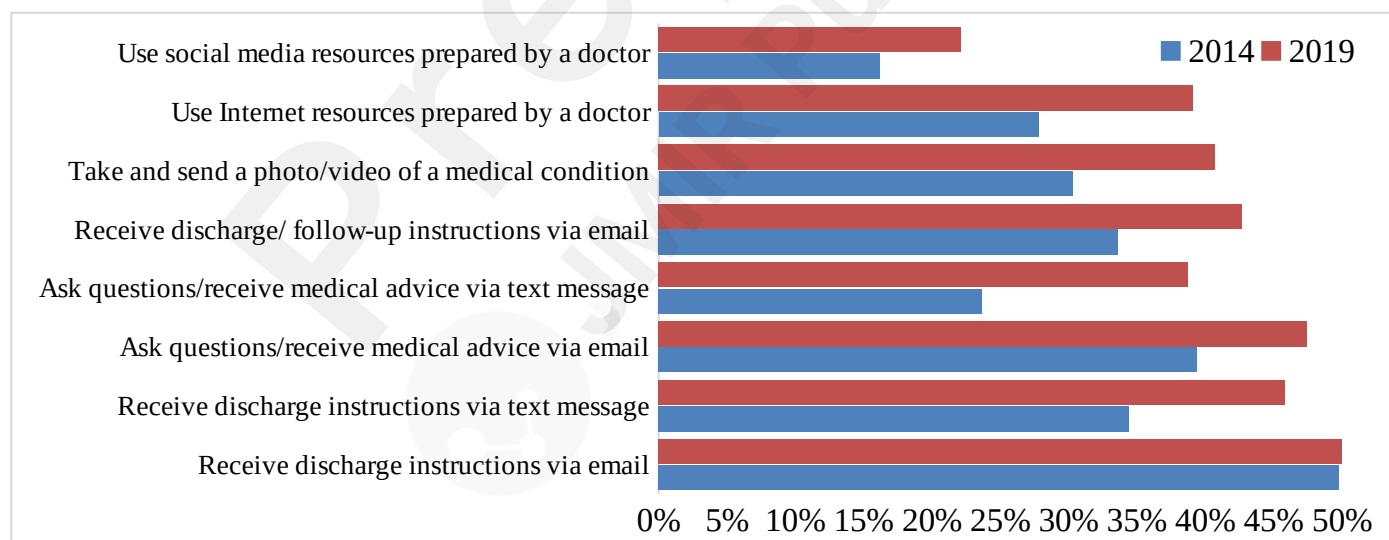
Every patient surveyed was asked about the use of non-application products to help manage their health and activity levels. A given patient may had been using more than one device. In that case, the responder has appeared in several categories. In 2014, a blood pressure cuff and blood glucose meter were most frequently used by patients. The use of Fitbits and other activity trackers rose in 2019.



**Figure 2: Percentage of patients that use various products to manage health and activity.**

#### Physician-Patient Electronic Communication

This same group of patients was asked whether they would feel comfortable interacting with physicians in a variety of scenarios using different electronic tools. These tools included social media resources, internet resources, text messages, and emails. In 2014 and 2019, 49.8% and 54.5% of patients respectively felt most comfortable receiving discharge instructions via email.



**Figure 3: Percentage of patients that felt comfortable communicating with a health care provider on electronic media in 2014 and 2019.**

#### Discussion

The outcomes of this study suggest that emergency department patients have reliable access to the internet and mobile devices. Several studies have found a similar reliance on internet access and smartphones to complement their healthcare in a variety of healthcare settings, supporting that internet access is widely available across diverse socioeconomic patient populations [9,11,12]. This opens a wide avenue of

opportunities to use online resources and electronic communication for patient education and follow-up [13].

The Pew Research Center has collected data on American internet and mobile device usage since the early 2000s. This database shows that 84% and 90% of Americans used the internet in 2014 and 2019, respectively [14]. These findings are consistent with our data, which found that 83.8% of patients in 2014 and 88.1% of patients in 2019 had internet access. However, our study found that a higher percentage of patients owned smartphones (80.1% in 2014, 89.7% in 2019) compared to the average American (59% in 2014, 81% in 2019) during this period [15]. One potential reason for this difference is that our study took place in a largely suburban emergency department, while the Pew Research data includes individuals from both urban and rural communities. Overall, these results indicate internet and smartphone usage has become increasingly common among American adults and our patient population.

Our data indicates that patients are more comfortable searching for and accessing health information on mobile devices, prompting a greater need for technology proficiency and implementation in patient care. Patients are engaging more with tools to access and gauge their health, showing trends towards tracking their activity, exercise, and food intake. These devices include activity trackers and Fitbits, which enable patients receive biofeedback and modulate their lifestyle [16]. Thus, patients are searching for opportunities to measure health outcomes regularly and are amenable to adopting new health-based technology.

Previous literature has reported that with the innovation of technology and growth of the internet, patients are challenged with filtering through the information found online [17, 18, 19]. Our study is consistent with these findings as only 32.5% of patients could always find pertinent health information and less than 21% of these individuals found that information always reliable. A potential solution to this uncertainty is integration of web-based programs that are sent directly from providers to their patients, which can be used to compliment discharge instructions. This could provide patients with medically verified information simplified into digestible facts to optimize patient understanding. This eliminates distrust and confusion around medical information found online. Delivering this information directly to patients can equip them with the knowledge and skills to address their healthcare concerns before leaving the hospital.

Our results demonstrate that patients are comfortable with interacting with physicians using a variety of electronic media. Similar studies also indicate that patients request electronic or video discharge instructions because these resources promote patient and caregiver knowledge of their diagnoses and treatments [20-22]. In addition to discharge instructions, patients express a growing interest in sending and receiving text message or emails to their providers, allowing for rapid response times and reassuring answers. This mode of communication has improved medicine adherence and quality of life without incurring an additional cost [23].

After discharge, there is opportunity for electronic follow-up interventions through telephone calls or telehealth visits. Previous literature has explored the effect of follow-up telephone calls hours to days after their ED visits, rendering mixed results. There is no significant evidence to support that these ED interventions improve compliance or decrease ED return rates and mortality in the elderly population [24-28]. These results contrast the largest call program published study to date, which found that patients who were not included in telephone interventions are 1.3 times more likely to be readmitted [29]. Additionally, a meta-analysis found patients who received  $\geq 2$  follow-up phone calls have the lowest likelihood of readmission [30]. Prior studies evaluate the strengths and limitations of this communication modality, setting the foundation for future routes for improvement. Further research is needed to identify the impact of electronic follow-up systems on other factors of patient care including patient satisfaction, patient education, support for caregivers, psychological support, and other social determinants of health.

In summary, further development of internet-based communication in the hospital and after discharge is both desired and warranted.

### *Limitations*

Many emergency department patients were too ill or otherwise unable to complete the survey. This includes

—but is not necessarily limited to—those who are extremely ill, those exhibiting alcohol intoxication, substance intoxication, violent behavior, active psychosis, suicidal ideations, and homicidal ideations. Additionally, patients that presented as trauma activations and those in police custody were excluded from the survey.

There was a gap in data collection, as the research associates do not work between midnight and 8am. Thus, any patients that presented overnight were not included in the survey. This could cause unknown skews in the data results. Considering these factors, we feel the result still provides an interesting view into the ways our patients use technology and the internet with respect to their healthcare. These results may not be generalizable to very rural communities with limited access to the internet or other electronic devices.

It is also important to note that the survey contained only yes/no, multiple-choice, and free response questions. Furthermore, every patient did not answer all the questions. A better understanding of patients' interest in electronic multimedia could potentially be gained through open-ended interviews on all patients.

### *Conclusions*

This data will help us guide future plans to take advantage of electronic resources for various patient education means including implementation of electronic discharge instructions and patient education. Future research should evaluate if access to physician prescribed electronic resources and/or utilization of electronic follow-up improves patient satisfaction, understanding, compliance and healthcare outcomes. Integrating internet resources in the emergency department is a promising route for enhancing patient satisfaction, education, and health outcomes.

*Acknowledgements:* We would like to acknowledge the contributions of the Emergency Medicine Research Associates Program and UC Irvine Emergency Department Staff for assistance with recruitment and data collection.

*Conflict of interest:* There are no conflicts of interest or sources of funding to disclose. No author received financial, professional, or other compensation that would bias the results.

### *Multimedia Appendix*

#### **Appendix: Access to Technology Survey**

### *References*

1. XEngel KG, Buckley BA, Forth VE, McCarthy DM, Ellison EP, Schmidt MJ, Adams JG. Patient understanding of emergency department discharge instructions: where are knowledge deficits greatest? Acad Emerg Med. 2012 Sep;19(9):E1035-44. doi: 10.1111/j.1553-2712.2012.01425.x. PMID: 22978730.
2. Zavala S, Shaffer C. Do patients understand discharge instructions? J Emerg Nurs. 2011 Mar;37(2):138-40. doi: 10.1016/j.jen.2009.11.008. Epub 2009 Dec 9. PMID: 21397126.
3. Lawrence LM, Jenkins CA, Zhou C, Givens TG. The effect of diagnosis-specific computerized discharge instructions on 72-hour return visits to the pediatric emergency department. Pediatr Emerg Care. 2009 Nov;25(11):733-8. doi: 10.1097/PEC.0b013e3181bec817. PMID: 19864969.
4. Hill RG Jr, Sears LM, Melanson SW. 4000 clicks: a productivity analysis of electronic medical records in a community hospital ED. Am J Emerg Med. 2013 Nov;31(11):1591-4. doi: 10.1016/j.ajem.2013.06.028. Epub 2013 Sep 21. PMID: 24060331.
5. Bond MC, Klemm R, Merlis J, Kopinski JE, Hirshon JM. Computer Access and Internet Use by Urban and Suburban Emergency Department Customers. J Emerg Med. 2012 Jul;43(1):159-65. doi: 10.1016/

- j.jemermed.2011.03.034. Epub 2011 Dec 3. PMID: 22142670.
6. Dudas RA, Pumilia JN, Crocetti M. Pediatric Caregiver Attitudes and Technologic Readiness Toward Electronic Follow-Up Communication in an Urban Community Emergency Department. *Telemed J E Health*. 2013 Jun;19(6):493-6. doi: 10.1089/tmj.2012.0166. Epub 2013 Apr 9. PMID: 23570276.
  7. Kind T, Huang ZJ, Farr D, Pomerantz KL. Internet and computer access and use for health information in an underserved community. *Ambul Pediatr*. 2005 Mar-Apr;5(2):117-21. doi: 10.1367/A04-107R.1. PMID: 15780014.
  8. Salo D, Perez C, Lavery R, Malankar A, Borenstein M, Bernstein S. Patient education and the internet: do patients want us to provide them with medical web sites to learn more about their medical problems? *J Emerg Med*. 2004 Apr;26(3):293-300. doi: 10.1016/j.jemermed.2003.09.008. PMID: 15028326.
  9. Saidinejad M, Teach SJ, Chamberlain JM. Internet access and electronic communication among families in an urban pediatric emergency department. *Pediatr Emerg Care*. 2012 Jun;28(6):553-7. doi: 10.1097/PEC.0b013e318258ad76. PMID: 22653452.
  10. Post LA, Vaca FE, Doran KM, et al. New Media Use by Patients Who Are Homeless: The Potential of mHealth to Build Connectivity. *J Med Internet Res*. 2013 Sep 3;15(9):e195. doi: 10.2196/jmir.2724. PMID: 24001876.
  11. Kim E, Torous J, Horng S, Grossestreuer AV, Rodriguez J, Lee T, Nathanson LA. Mobile device ownership among emergency department patients. *Int J Med Inform*. 2019 Jun;126:114-117. doi: 10.1016/j.ijmedinf.2019.03.020. Epub 2019 Apr 1. PMID: 31029252.
  12. Shields WC, Omaki E, McDonald EM, Rosenberg R, Aitken M, Stevens MW, Gielen AC. Cell Phone and Computer Use Among Parents Visiting an Urban Pediatric Emergency Department. *Pediatr Emerg Care*. 2018 Dec;34(12):878-882. doi: 10.1097/PEC.0000000000001679. PMID: 30507752.
  13. Wray A, Goubert R, Gadepally R, Boysen-Osborn M, Wiechmann W, Toohey S. Utilization of Educational Videos to Improve Communication and Discharge Instructions. *West J Emerg Med*. 2021 Apr 27;22(3):644-647. doi: 10.5811/westjem.2021.1.48968. PMID: 34125040.
  14. "Internet/Broadband Fact Sheet." Pew Research Center, Washington, D.C. (7 Apr. 2021) <https://www.pewresearch.org/internet/fact-sheet/internet-broadband/>
  15. "Mobile Fact Sheet." Pew Research Center, Washington, D.C. (7 Apr. 2021) <https://www.pewresearch.org/internet/fact-sheet/mobile/>
  16. Germini F, Noronha N, Borg Debono V, Abraham Philip B, Pete D, Navarro T, Keepanasseril A, Parpia S, de Wit K, Iorio A. Accuracy and Acceptability of Wrist-Wearable Activity-Tracking Devices: Systematic Review of the Literature. *J Med Internet Res*. 2022 Jan 21;24(1):e30791. doi: 10.2196/30791. PMID: 35060915.
  17. van Deursen AJ. Internet skill-related problems in accessing online health information. *Int J Med Inform*. 2012 Jan;81(1):61-72. doi: 10.1016/j.ijmedinf.2011.10.005. Epub 2011 Nov 11. PMID: 22079240.
  18. Sayakhov P, Carolan-Olah M. Internet use by pregnant women seeking pregnancy-related information: a systematic review. *BMC Pregnancy Childbirth*. 2016 Mar 28;16:65. doi: 10.1186/s12884-016-0856-5. PMID: 27021727.

19. Hautala GS, Comadoll SM, Raffetto ML, Ducas GW, Jacobs CA, Aneja A, Matuszewski PE. Most orthopaedic trauma patients are using the internet, but do you know where they're going? *Injury*. 2021 Nov;52(11):3299-3303. doi: 10.1016/j.injury.2021.02.029. Epub 2021 Feb 24. PMID: 33653619.
20. Saidinejad M, Zorc J. Mobile and web-based education: delivering emergency department discharge and aftercare instructions. *Pediatr Emerg Care*. 2014 Mar;30(3):211-6. doi: 10.1097/PEC.000000000000097. PMID: 24589814.
21. Ismail S, McIntosh M, Kalynych C, Joseph M, Wylie T, Butterfield R, Smotherman C, Kraemer DF, Osian SR. Impact of Video Discharge Instructions for Pediatric Fever and Closed Head Injury from the Emergency Department. *J Emerg Med*. 2016 Mar;50(3):e177-83. doi: 10.1016/j.jemermed.2015.10.006. Epub 2016 Jan 21. PMID: 26806318.
22. Bloch SA, Bloch AJ. Using video discharge instructions as an adjunct to standard written instructions improved caregivers' understanding of their child's emergency department visit, plan, and follow-up: a randomized controlled trial. *Pediatr Emerg Care*. 2013 Jun;29(6):699-704. doi: 10.1097/PEC.0b013e3182955480. PMID: 23714763.
23. Arora S, Peters AL, Burner E, Lam CN, Menchine M. Trial to examine text message-based mHealth in emergency department patients with diabetes (TExT-MED): a randomized controlled trial. *Ann Emerg Med*. 2014 Jun;63(6):745-54.e6. doi: 10.1016/j.annemergmed.2013.10.012. Epub 2013 Nov 11. Erratum in: *Ann Emerg Med*. 2017 Jun;69(6):802. PMID: 24225332.
24. Biese K, Lamantia M, Shofer F, McCall B, Roberts E, Stearns SC, Principe S, Kizer JS, Cairns CB, Busby-Whitehead J. A randomized trial exploring the effect of a telephone call follow-up on care plan compliance among older adults discharged home from the emergency department. *Acad Emerg Med*. 2014 Feb;21(2):188-95. doi: 10.1111/acem.12308. PMID: 24673675.
25. Biese KJ, Busby-Whitehead J, Cai J, Stearns SC, Roberts E, Mihas P, Emmett D, Zhou Q, Farmer F, Kizer JS. Telephone Follow-Up for Older Adults Discharged to Home from the Emergency Department: A Pragmatic Randomized Controlled Trial. *J Am Geriatr Soc*. 2018 Mar;66(3):452-458. doi: 10.1111/jgs.15142. Epub 2017 Dec 22. PMID: 29272029.
26. Nasser L, Stratton T. BET 1: Follow-up phone calls and compliance with discharge instructions in elderly patients discharged from the emergency department. *Emerg Med J*. 2019 Feb;36(2):126-127. doi: 10.1136/emermed-2019-208441.1. PMID: 30696779.
27. van Loon-van Gaalen M, van der Linden MC, Gussekloo J, van der Mast RC. Telephone follow-up to reduce unplanned hospital returns for older emergency department patients: A randomized trial. *J Am Geriatr Soc*. 2021 Nov;69(11):3157-3166. doi: 10.1111/jgs.17336. Epub 2021 Jun 25. PMID: 34173229.
28. Yiadom MYAB, Domenico HJ, Byrne DW, Hasselblad M, Kripalani S, Choma N, Tucker-Marlow S, Gatto CL, Wang L, Bhatia MC, Morrison J, Harrell FE, Hartert TV, Lindsell CJ, Bernard GR. Impact of a Follow-up Telephone Call Program on 30-Day Readmissions (FUTR-30): A Pragmatic Randomized Controlled Real-world Effectiveness Trial. *Med Care*. 2020 Sep;58(9):785-792. doi: 10.1097/MLR.0000000000001353. PMID: 32732787.
29. Harrison PL, Hara PA, Pope JE, Young MC, Rula EY. The impact of postdischarge telephonic follow-up on hospital readmissions. *Popul Health Manag*. 2011 Feb;14(1):27-32. doi: 10.1089/pop.2009.0076. Epub 2010 Nov 19. PMID: 21090991.
30. Branowicki PM, Vessey JA, Graham DA, McCabe MA, Clapp AL, Blaine K, O'Neill MR, Gouthro

JA, Snyderman CK, Kline NE, Chiang VW, Cannon C, Berry JG. Meta-Analysis of Clinical Trials That Evaluate the Effectiveness of Hospital-Initiated Postdischarge Interventions on Hospital Readmission. *J Healthc Qual.* 2017 Nov/Dec;39(6):354-366. doi: 10.1097/JHQ.0000000000000057. PMID: 27631713.

#### *Abbreviations*

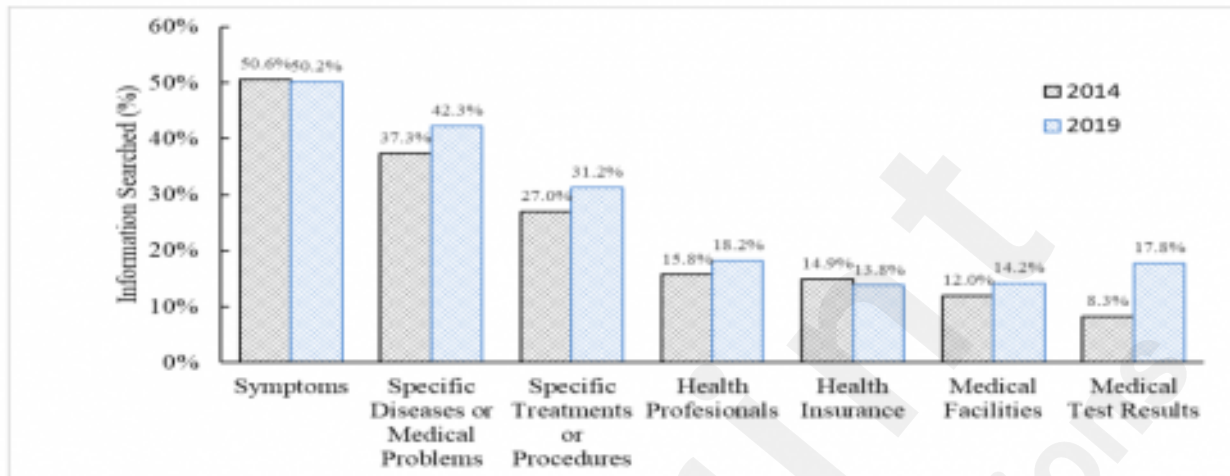
UCIMCED – University of California, Irvine Medical Center’s Emergency Department



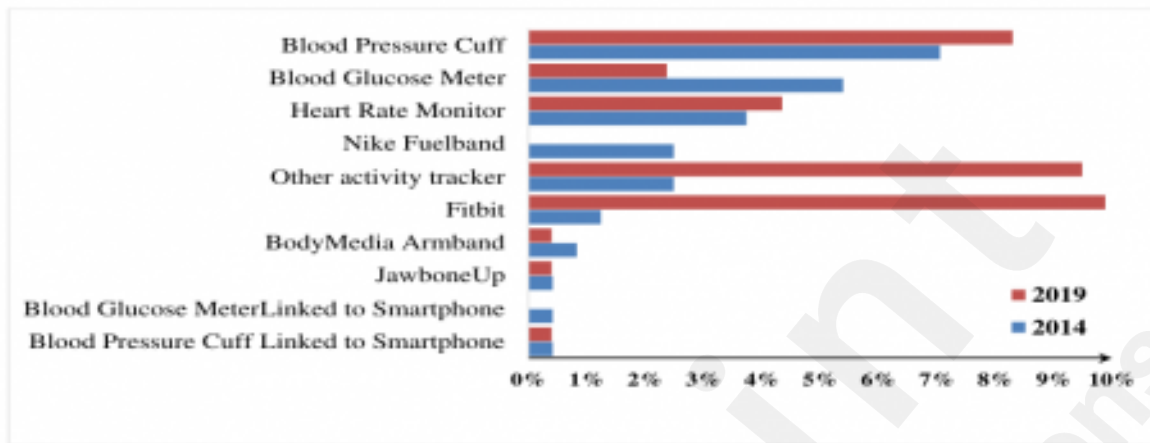
## Supplementary Files

## Figures

Patient access to internet-based health information by topic.



Percentage of patients that use various products to manage health and activity.



Percentage of patients that felt comfortable communicating with a health care provider on electronic media in 2014 and 2019.

