

How wired are U.S. hospitals? A study of patient-oriented interactive tools.

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ABSTRACT

This study examined U.S. hospital websites to find out how they have used interactive tools to engage and serve their patients. The findings and recommendations from this study will provide guidance to the development of the U.S. hospitals and even beyond for at least the next decade. A content analysis was conducted to compare The Most Wired Hospitals with the total U.S. hospital population and compare the 2018 data and the 2011 data so as to observe the horizontal and vertical differences. The study has found that, in 2018, U.S. hospitals have adopted significantly more interactive tools and reached an average of 8.5 tools; core e-business tools have gained the biggest increase; most of such tools almost reached ubiquity among the Most Wired Hospitals. The study concludes that using interactive tools to serve patients on U.S. hospital websites and on social media is becoming a norm, that the majority of U.S. hospitals were adequately equipped to interact with their patients through their websites, and that whether to make a hospital website action-driven is more determined by the hospital administration's awareness, determination, and strategic planning than by hospital size.

Keywords: Hospitals; interactive tools; websites; patient-oriented; most-wired

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INTRODUCTION

With the growing popularity of Web 2.0 technologies, savvy Internet users have come to expect a certain level of interactivity from the websites they visit [[1]]. According to Marton's definition, 'Web 2.0 technologies offer enhanced interactivity through the creation of user-generated content on any topic of interest, information sharing, and the use of multimedia elements such as photos, audio clips, and videos' [[2]]. A hospital's website can be one of the major resources for prospective patients, families, media outlets, and other health professionals [[3]]. In a 2010 survey of more than 3,000 U.S. adults, the Pew Internet & American Life Project found that, among the 74% of adults who use the Internet, 80% have searched online for information about health topics, such as diseases or specific treatments [[3]]. According to Alpay, Overberg, and Schonk, a hospital's homepage can be the first point of contact for many people with a hospital [[4]]. Therefore, it is important for a hospital to maintain a user-friendly website to serve its clients and to help achieve its business goals [[5]]. In this study, U.S. hospital websites were examined to find out how hospitals have used interactive tools to engage and serve their users, especially patients.

Huang and Chang defined the term 'interactive tools' as devices that are 'interactive in nature, such as online form, search function, calculation function, or game, for initiating an interaction process pertaining to a patient/user's health between a patient/user and a hospital or among patients/users' [[6]]. Well-designed websites allow patients to interact with their hospital and participate in ongoing care [[7]]. The Health Information Technology for Economic and Clinical Health (HITECH) Act, which was passed in 2009, states that healthcare facilities must meet four requirements for website

design. Sites must generate and transmit permissible prescriptions electronically, maintain an up-to-date problem list of current and active diagnoses, maintain an active medication list, and provide patients with an electronic copy of their health information upon request [[8]]. Toward the end of the 2010s, it is worth investigating how many U.S. hospitals have implemented these requirements.

In the recent decade, many hospitals and health systems 'have shifted their focus from acquisition of technology to integrating tech into strategies to improve population health, capitalize on data analytics, boost patient engagement and introduce new efficiencies' [[9]]. Healthcare providers are moving towards more interactive websites and away from so called 'brochureware' websites [[7]]. Interactive tools have been widely used on hospital websites as part of e-health development in the recent decade [[6]]. According to Mea, 'E-health is a health practice that is facilitated by digital communication processes' [[10]]. E-health tools are varied and can include social media, videos, podcasts, and interactive forums [[11]]. With the increased usage of wireless devices like smartphones and tablets, more hospitals should consider using more e-health tools, such as ER wait time applications, interactive cost estimators, and mobile sites and apps [[6]]. Snyder et al. (p. 34) concurs, 'Customers and patients of hospitals are becoming increasingly demanding, web-savvy, and computer or mobile device equipped and hospitals must meet that demand' [[7]].

However, it must be noted that hospitals are not necessarily keeping pace with consumer demand [[7]]. Huang and Chang found that hospital networks have implemented more patient-oriented interactive e-health tools than independent hospitals and that those large healthcare systems tend to have more funding and more IT resources

[[6]]. As a result, the features and information on a hospital's website are more dependent on the overall size of the hospital than they are on what services the hospital can provide [[6]]. Each year, Hospitals and Health Network (H&HN) rates U.S. hospitals and releases a Most Wired Hospitals list, featuring healthcare systems that have demonstrated the advanced uses of new technologies. This study sought to explore the technological gap between the hospitals on the H&HN list and the total U.S. hospital population and determine whether U.S. hospitals have made significant improvement in online interactive tool implementation on their websites over the years and examine how hospital size and hospital location could affect a hospital's adoption of interactive tools on their websites.

Fundamentally, the purpose of this study is to answer the question: Are U.S. hospitals adequately equipped to interact with their patients through their websites? This general research question was broken down into the following three specific research questions and two hypotheses.

- RQ1: What tools are hospitals utilizing on their websites to interact with their patients?
- RQ2: Have U.S. hospitals overall made significant improvement in terms of implementing interactive tools on their websites?
- RQ3: Are Most Wired Hospitals more aggressive than non-Most Wired Hospitals in adopting interactive tools?
- H1: Larger hospitals tend to more aggressively use interactive tools on their websites than smaller hospitals do.
- H2: Hospitals in urban areas tend to use more interactive tools than rural areas do.

The findings and recommendations from this study will provide guidance to the development of U.S. hospitals and even beyond for at least the next decade. Plus, it will provide a booster to those hospitals that have lagged behind in the technology adoption curve.

LITERATURE REVIEW

Numerous empirical studies have been found on the topic of how U.S. hospitals have used technology to run business on websites. These studies fall into three broad categories: assessment of user accessibility and participation, design/content, and features/usage.

For instance, Gallant et al. performed a study of 14 hospital websites and defined six categories of interactive tools for hospitals to use [[11]]. These categories are (1) social media (2) blogs (3) web-based broadcasting (4) web-enabled e-patient communication tools (5) mobile applications (6) online health tools. The authors discuss how these tools may be used strategically in health communication to strengthen participatory medicine.

Snyder et al. divided up website interactivity into 4 different levels [[7]]. Level 1 sites are defined as 'Informing Websites' and only have a one-way flow of information. These 'brochure style' sites give users information about what the hospital can do for the users and markets specific services. Level 2 sites are called Advanced Informing Websites and allow users to provide feedback. This feedback usually takes the form of an email address or a phone number. Level 3 sites are called Collaborative Websites, offering social media participation, though social media can be from a third-party company such as CaringBridge. Level Four, or the 'Empowered/Engaged Website', has all of the

features in the previous levels; interactive library, online billing, prescription refill, appointment scheduling, but is more advanced technologically [[7]].

Huang & Chang found, in total, 21 interactive tools in their study [[6]]. The current study, to some extent, builds on Huang & Chang's study to trace the technological development in U.S. hospitals. The findings from Huang & Chang's 2012 study, therefore, constituted as a benchmark for the findings from this study so that the findings from this study can be put in perspective.

METHODOLOGY

In this study, a content analysis was conducted in the fall of 2018. In order to make comparisons between the most technologically savvy hospitals and the rest of the hospitals in the United States, two samples were drawn. The first sample was from the 2017 Most Wired hospital list [[9]], which contains 462 hospitals. Since the total number of hospitals was manageable, a census was conducted. The other sample came from the total list of U.S. hospitals on USNews.com website (<https://health.usnews.com/best-hospitals/search?>), which contains 6347 hospitals. Since the population was huge, it was decided that a reasonable sample be drawn. According to Krejcie and Morgan, for a population of 7000, 364 items should be in the sample. As a result, one case out of every 17 was drawn to reach 364 cases to come up with a systematic probability sample [[12]]. To expedite the data extracting process, a web scraping approach using an add-on called Data Miner (<https://data-miner.io/>) in the web browser Google Chrome was used. After the two samples were completed, the website of each hospital was found through Google searches. To effectively address the two hypotheses, two independent variables were determined: hospital size based on the number of beds (small size: 1–250 beds; medium

size: 251–500 beds; large size: 501 or above) (The information was found via Google search.) and hospital geographic area based on each hospital's local population as defined by the United States Census Bureau (<https://www.census.gov/geo/reference/urban-rural.html>) (rural: 1–2,500 people; urban cluster: 2,501–50,000; urban area: 50,001 or above).

A pilot study was conducted to determine how many interactive tools were used by U.S. hospitals. Each tool was regarded as a unit of analysis and served as a dependent variable. Multiple training sessions were provided by the PI to all three coders to eventually reach the intercoder reliability coefficient of 90% using Holsti's formula [[13]]. Afterwards, each coder coded his or her own share to finish the coding process.

After the data were collected, SPSS was employed to run data analysis. Since the two data sheets were based on either census or a systematic probability sample, both descriptive and inferential statistic procedures were deployed.

FINDINGS

RQ1: What tools are hospitals utilizing on their websites to interact with their patients?

In total, 25 patient-oriented interactive tools in three categories based on technological novelty were found on U.S. hospitals in 2018 (See Table 1). An independent-samples T-test shows that the average number of tools used in 2018 is 8.5, significantly more than the average number 5.3 by plugging in the data from Huang and Chang's 2012 study ($T = 12$, $df = 1125$, $P < 0.01$) [[6]]. Another independent-samples T-test shows that, in 2018, the Most Wired Hospitals used an average of 13.3 interactive

tools, significantly more than that of the overall U.S. hospital population ($T = 18.8$, $df = 823$, $P < 0.01$).

RQ2: Have U.S. hospitals overall made significant improvement in terms of implementing interactive tools on their websites?

From 2011 to 2018, indeed, U.S. hospitals made significant improvement in adopting patient-oriented interactive tools on their websites. First, four new tools came into being in 2018 (See Table 1).

Communicating with a doctor via secure email (57%). A patient can talk to a doctor in a secure environment.

Video chat with a doctor (8%). Doctors can interact with their patients via online video so that symptoms could be easily and quickly identified.

Online inquiry (2%). Hospital staff members can proactively chat on their websites with the visitors to answer inquiries and provide immediate guidance.

Referring a patient to a doctor (6%). A patient can refer another patient to a doctor.

For all of these new tools, the Most Wired Hospitals outperformed other U.S. hospitals in 2018.

Table 1. Interactive tools on U.S. hospital websites.

Interactive tools	2011 U.S. hospitals	2018 U.S. hospitals (n = 364)	Most Wired Hospitals (n = 462)
Traditional functional tools			
Online search	67%	83%**	97%**
Finding a physician	57%	61%*	95%**
Presence on social media	36%	76%**	94%**
Interactive map	61%	82%**	93%**
Interactive calendar/event finder	43%	44%	65%**
Contact us	46%	59%**	58%
Interactive patient education or health risk assessment			
Online caregiver recognition	47%	12%**	51%**
Online caregiver recognition	4%	6%	34%**
E-card or email for a patient	28%	14%**	30%**
Online flower/gift shop	9%	4%*	20%**
Online nursery for viewing/purchasing baby photos	28%	5%**	19%**
Patient caring and support through CaringBridge			
Virtual tour	16%	6%**	8%
Virtual tour	9%	4%*	5%
Core e-business tools			
Paying bills online	40%	75%**	97%**
Accessing lab results	10%	70%**	97%**
Making a doctor's appointment	15%	58%**	94%**
Communicating with a doctor via secure email	N/A	57%**	86%**
Refilling prescriptions online	10%	48%**	84%**
Mobile app	2%	35%**	83%**
Pre-registration online	19%	23%*	57%**
Emerging functional tools			
Referring a patient	N/A	6%	21%**
ER wait time	6%	9%*	15%**
Video chat with a doctor	N/A	8%	13%*
Interactive cost estimator	4%	3%	12%**
Online inquiry	N/A	2%	5%*
Interface			
Interactive tools menu ^a	11%	30%**	90%**
Patient portal ^a	11%	65%**	95%**

Notes: 1. Percentage calculations are based on 462 Most Wired Hospitals in 2017 and 364 sampled U.S. hospitals. 2. ^aThese are interface designs that saliently promote at least two interactive tools on home page to make a website action-driven. 3. The Most

Wired Hospitals in 2017 and the U.S. hospital sample are compared in third and fourth columns. The comparison results based on Chi-square are presented in the fourth column, *P < 0.05, **P < 0.01. 4. The 2011 and 2018 data in the second and third columns are compared. The comparison results based on Chi-square are presented in the third column, *P < 0.05, **P < 0.01. The 2011 data are from Huang and Chang's 2012 study and used with permission.

Second, out of the 21 tools from 2011, U.S. hospitals made significant improvement in 12 of them: online search, interactive map, finding a physician, contact us, paying bills online, pre-registration, making a doctor's appointment, accessing lab results, refilling prescriptions online, mobile app, presence on social media, and ER wait time. The biggest jumps came from the tools in the category of Core e-business tools, which were massively adopted much later than many of the traditional tools. They were accessing lab results (10% to 70%), making a doctor's appointment (15% to 58%), refilling prescriptions online (10% to 48%), and paying bills online (40% to 75%). In 2011, hospital mobile apps were novelty (2%). In 2018, however, usage of mobile apps jumped to 35% and was on its way to becoming a mainstream core e-business tool. In 2011, only 26% of U.S. hospitals used at least one core e-business tool; this percentage jumped to 71% among U.S. hospitals and 98% among the Most Wired Hospitals in 2018.

Third, in 2018, over half of the U.S. hospitals (65%) had a secure patient portal for patients to interact with their hospitals online. Thanks to the continuous development and improvement of such patient portal systems by external vendors like MyChart, CernerHealth, FollowMyHealth, and Evident, many hospitals are able to adopt such a system to execute those features listed in the Core e-business tools category. In contrast,

only 11% of the hospitals had this function in 2011. In addition, significantly more U.S. hospitals (11% to 30%) had an independent menu that featured at least two interactive tools to call to action, such as 'Pay bills online' and 'Make an appointment.' In other words, the hospital websites were found to be much more action-driven in 2018 than they were in 2011.

On the other hand, the following six tools took a significant dip over the years: interactive patient education or health risk assessment (47% to 12%), online nursery for viewing/purchasing baby photos (28% to 5%), e-card or email for a patient (28% to 14%), patient caring and support through CaringBridge (16% to 6%), online flower/gift shop (9% to 4%), and virtual tour (9% to 4%).

RQ3: Are Most Wired Hospitals more aggressive than non-Most Wired Hospitals in adopting interactive tools?

The Most Wired Hospitals significantly outperformed the rest of the U.S. hospitals in 22 of the 25 interactive tools (See Table 1). The only three tools that had no significant difference in terms of adoption were patient caring and support through CaringBridge, virtual tour, and contact us. The top-five differences came from mobile app (35% to 83%), interactive patient education (12% to 51%), refilling prescriptions (48% to 84%), making a doctor's appointment (58% to 94%), and pre-registration online (23% to 57%) – almost all were core e-business tools.

Among all the tools used by the Most Wired Hospitals, the adoption rate of eight tools, including accessing lab results, paying bills online, online search, finding a physician, making a doctor's appointment, presence on social media, and interactive

map, ranged from 94% to 98%, almost reaching ubiquity, while no tool on other U.S. hospitals exceeded 85% adoption rate in 2018.

The Most Wired Hospitals overwhelmingly used an interactive tools menu (90%) and a patient portal (95%), while the adoption rates of their counterparts in other U.S. hospitals were significantly lower – only 30% and 65%.

By the way, 41% of the Most Wired Hospitals were large hospitals; 23% were medium-size hospitals, and 36% were small hospitals. On the other hand, only 3% of the Most Wired Hospitals came from rural areas, as most were located in urban areas (57%) or urban clusters (40%).

H1: Larger hospitals tend to more aggressively use interactive tools on their websites than smaller hospitals do.

Hospital size made a significant difference in nine out of 25 interactive tools both for The Most Wired Hospitals and for other U.S. hospitals. Larger hospitals tended to use online search, finding a physician, pre-registration, making a doctor's appointment, communicating with a doctor via secure email, refilling prescriptions online, presence on social media, mobile app, online chat, plus a patient portal, while smaller hospitals did not (See Table 2). This hypothesis is partially supported.

H2: Hospitals in urban areas tend to use more interactive tools than rural areas do.

Table 2. Impact of hospital size and location on the implementation of interactive tools on U.S. hospital websites.

Association between an interactive feature (or category) and an independent variable	Hospital size (small vs. medium vs. large)		Hospital location (rural, urban-cluster, urban)	
	Most Wired Hospitals (n = 462)	U.S. hospitals	Most Wired Hospitals	U.S. hospitals (n = 364)
Traditional functional tools				
Online search	5	7.7*	9.7**	57.7**
Finding a physician	15.8**	16.8**	7.9*	34.2**
Presence on social media	7.9*	23.0**	7.8*	18.6**
Interactive map	2.2	4.9	1.7	5.4
Interactive calendar or event finder	14.0**	0.2	8.8*	1.1
Contact us	0.2	1.5	0.2	1.4
Interactive patient education or health risk assessment				
Online caregiver recognition	22.5**	5.3	2.8	2.1
E-card or email for a patient	1.2	2.7	1.6	6.4*
Online flower/gift shop	5.0	0.2	1.9	3.5
Online nursery for viewing/purchasing baby photos	4.4	2.6	0.9	1.8
Patient caring and support through CaringBridge	2.4	1.9	0.3	8.5*
Virtual tour	0.9	3.1	1.4	1.9
Core e-business tools				
Paying bills online	1.2	0.8	2.6	0.7
Accessing lab results	4.5	2.3	0.1	1.8
Making a doctor's appointment	15.8**	0.3	1.2	1.5
Communicating with a doctor via secure email	12.5**	10.2*	1.2	16.6**
Refilling prescriptions online	9.5**	11.7*	1.1	11.1*
Mobile app	6.8*	10.0*	1.0	4.8
Pre-registration online	8.7*	35.1**	1.2	18.1**
Emerging functional tools				
Referring a patient or doctor	7.6*	32.3**	3.7	23.6**
ER wait time	1.0	1.6	3.9	5.2
Video Chat with Doctor	0.9	5.8	3.5	0.7
Interactive cost estimator	2.6	21.7**	1.4	6.4*
Online inquiry	1.0	7.1*	3.6	3.0
Interface				
Interactive tools menu	22**	8.8*	1.6	3.6
Patient portal	0.9	13.7*	1.2	12.1*
	10.2*	10.5*	0.8	10.8*

Note: 1. The numbers in the Table are chi-square values (df = 2), *P <.05, **P <.01. 2.

Number of beds: small hospital: (58.1%); medium hospital: (23.7%); large hospital: (18.2%). Hospital location: rural area: (13.3%); urban cluster: (47.5%); urban area: (39.2%).

This study found that Most Wired Hospitals in urban areas tended to use more interactive tools than rural areas with 12 out of 25 interactive tools having statistically significant difference. For other U.S. hospitals, only four tools were affected by hospital size (See Table 2). This hypothesis is partially supported.

DISCUSSION AND CONCLUSIONS

From 2011 to 2018, U.S. hospitals made tremendous improvements in making their websites interactive. The average number of adopted interactive tools increased from 5.6 to 8.5 and even to 13.3 among the Most Wired Hospitals. In other words, using interactive tools to serve patients on U.S. hospital websites and on social media is becoming a norm. All four more patient-oriented interactive tools – communicating with a doctor via secure email, video chat with a doctor, online inquiry, and referring a patient to a doctor have brought great convenience to patients seeking medical help from their hospitals. Communicating with a doctor via secure email had the biggest jump among these four new tools, developing from almost no presence in 2011 to 57% among U.S. hospitals and 86% among the Most Wired Hospitals in 2018. Most patients in the United States today have easier access to their doctors to ask for medical advice, prescription or prescription refills without stepping out of their houses and without incurring extra costs. This is a very positive trend that will greatly benefit U.S. patients in the years to come.

Caution needs to be noted about the online inquiry tool. Among these four new tools, no U.S. hospitals adopted the online inquiry tool in 2011, but over half of Chinese hospitals (52%) had adopted it in 2013 [[14]]. In 2018, only 2% of U.S. hospitals (5.2% for Most Wired Hospitals) were using it. In China, many hospitals, especially private hospitals, use this tool on their websites to aggressively grab market share; the inquiry

window pops up without a user's request, blocks the view of the rest of the content, and resurfaces quickly after a user has suppressed it or switched to another page [[14]] (ibid.). According to Huang and Liu, 61% of Chinese patients who participated in the study disliked or strongly disliked the online inquiry design, while 29% of the respondents did not care [[15]]. The authors caution that 'any hospital that uses the Online Inquiry tool needs to use it responsibly and show respect to its users so as to win their trust' (p. 153) [[15]]. This caution can be of use to those U.S. hospitals that have adopted this tool.

Ten years after the HITECH Act was passed, U.S. hospitals have made significant inroads to meet the four requirements for website design stated in the Act. Huang and Chang found that, in 2011, only the tool paying bills online reached an adoption rate over 40% and that none of the other core e-business tools exceeded a 20% adoption rate [[6]]. They called on hospitals to more aggressively adopt other core e-business tools. The authors should be delighted to see that, in 2018, the adoption rates of all core e-business tools, from accessing lab results, making a doctor's appointment, refilling prescriptions online, paying bills online, to pre-registration, all dramatically exceeded their counterparts in 2011. This development was even more prevalent in the Most Wired Hospitals; the tools accessing lab results (97%), paying bills online (97%), and making a doctor's appointment (94%) became almost universal. Three other tools – communicating with a doctor via secure email, refilling prescriptions online, and mobile app – exceeded 80% adoption rate and closely followed behind. Pre-registration online, or sometimes called online check-in, allows a patient, especially a new patient, to provide personal information, medical history, allergy and insurance information, and much more information before he or she visits a doctor. This tool can save a patient time at the

hospital and increase a hospital's turnaround, especially in larger hospitals in urban areas. Chinese hospitals reached 31% adoption rate in 2013 [[14]], while U.S. hospitals reached only 23% adoption rate in 2018 and need to pick up adoption speed.

The findings from Huang, Chang and Kharana's 2012 study show that all of these core e-business tools, if available, were all in the top 10 of the users' list of the most desired interactive tools, except for the mobile app tool, which was still nascent [[16]]. Logically, it is reasonable to measure a hospital's adequacy in technological readiness on its website by the adoption rate of such core e-business tools. As of 2018, the majority of U.S. hospitals (71%), let alone the Most Wired Hospitals (98%), were adequately equipped to interact with their patients through their websites. On the other hand, more U.S. hospitals should follow the model of the Most Wired Hospitals to make their hospital websites action-driven so that the big disparity between the technological haves and have-nots can be abridged. The diffusion of interactive tools on U.S. hospital websites still has much room to expand.

The massive adoptions of these core e-business tools could not have been possible without external vendors, such as MyChart, CernerHealth, FollowMyHealth, and Evident's industrious software and mobile app development to come up with a secure patient portal to incorporate most of these core e-business tools. Likewise, such adoptions are impossible without numerous U.S. hospitals' determination to go paperless by using increasingly mature patient-portal platforms. It is, therefore, logical to see significantly more U.S. hospitals (11% to 30%), especially the Most Wired Hospitals (90%), have aggressively promoted such core e-business tools and the patient portal by creating a conspicuous menu on their hospital websites' home page. It is understandable

that larger hospitals and hospitals in urban areas have more funding to build a patient portal, create a mobile app, and purchase interactive patient education materials from external vendors and have a bigger need for patients to make doctors' appointments, pre-register, find a suitable physician out of an extensive pool, search for needed information from a big website, and market themselves via social media. Smaller hospitals and hospitals in rural areas and urban clusters, however, can learn from the former to create an interactive tools menu to make their website action-driven, especially because such a move is not cost-prohibitive. As Huang and Chang concluded that 'more advanced e-health implementation does require significant investment in information communication technology ... The ultimate driver of these hospitals' e-health development is their vision and strategic planning' (p. 58) [[17]].

While core e-business tools have won over many hospitals' favor, it probably should not be a surprise to see that some other tools have lost numerous hospitals' endorsement. In 2011, hospitals' online nursery for viewing/purchasing baby photos (28%), e-card or email for a patient (28%), patient caring and support through CaringBridge (16%) tools still attracted some hospitals. It is very likely that, with the increasing concerns over privacy, Most Wired or not, the few hospitals that had adopted this tool dropped the feature of allowing the public to view baby photos on their websites. Since personal communication can be carried out very easily today through platforms like email, texting, FaceTime, Skype, social media, and so on, either creating an email system on a hospital website or using CaringBridge, an external vendor that aims to allow people 'to easily get updates and offer support and encouragement' [[18]], is probably unnecessary. The fact that CarePages, a site that carried out almost identical functions

to CaringBridge's, had to close its business in 2009, could testify, to some extent, how useful such a tool is to most hospital website users. In 2011, these three tools were already among users' least favored tools [[16]]. In 2011, online flower/gift shop (9%), virtual tour (9%), and interactive cost estimator (4%) had not taken off. In 2018, the adoptions of these tools either were stagnant or declined. It is very likely that users' sporadic uses of these tools have inspired many hospitals to drop them. A big surprise from this study is that the interactive patient education or health risk assessment tool steeply dropped from 47% to 12% over the years among U.S. hospitals, though the Most Wired Hospitals maintained relatively the same adoption rate (51%). Since numerous websites, especially Google Search, provide extensive and specific healthcare and medical information, generic information about a symptom or disease provided almost exclusively by external vendors may be hard to compete. It is not known whether hospitals' removal of this tool is associated with users' sparse use of such content or that the hospitals have to purchase the tool from an external vendor. All surmises in this paragraph need to be confirmed by further studies. The lesson the U.S. hospitals can learn from the decreased adoption of these non-core e-business tools is that it is justifiable to drop those tools that patients hardly need, yet it is crucial to at least implement those core e-business tools, which are now becoming standard.

Finally, the Most Wired Hospitals have adopted significantly more interactive tools than the rest of the U.S. hospitals. However, the fact that 36% of the Most Wired Hospitals were small hospitals and 23% were medium-size hospitals is very telling: whether to make

a hospital website more action-driven is more determined by the hospital administration's awareness, determination, and strategic planning than by hospital size.

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