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Technology-Enabled Consumer Engagement: Promising Practices At Four Health Care Delivery Organizations

ABSTRACT Patients' journeys across the care continuum can be improved with patient-centered technology integrated into the care process. Misaligned financial incentives, change management challenges, and privacy concerns are some of the hurdles that have prevented health systems from deploying technology that engages patients along the care continuum. Despite these sociotechnical challenges, some health care organizations have developed innovative approaches to engaging patients. We describe promising technology-enabled consumer engagement practices at two community-based delivery organizations and two academic medical centers to demonstrate the approaches, sociotechnical challenges, and outcomes associated with their implementation. Leadership commitment and payer policies that align with the quadruple aim—enhancing patient experience, improving population health, reducing costs, and improving the work life of health care providers—would encourage further deployment and lead to greater consumer engagement along the care continuum.

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The original aims of the federal meaningful-use legislation for the development and dissemination of health information technology included patient and family engagement.[1,2] While consumers book flights and make financial transactions from mobile devices, their health care experience varies remarkably depending on the degree to which patient-centered technology is integrated into that experience.

It has been over twenty years since some patients gained secure online access to their health information, such as laboratory test results, by way of patient portals tethered to institutional electronic health records (EHRs).[3–5] These portals are intended to provide patients and their caregivers with timely electronic access to their health care information. Recent enhancements enable patients to also enjoy the convenience of scheduling appointments online, securely messaging their care teams, and reviewing clinic notes.[6] Many patients can access these tools from their mobile devices. Requirements for privacy and security pose challenges for usability,[3,4,7,8] however, and call for creative solutions that would reduce user burden without compromising security.

While most portals are optimized for outpatients, an increasing number of health care organizations are implementing these solutions in the inpatient setting, where patients have unmet information and communication needs[9,10] and also value having some control over their physical environment.[11] Patient-centered technology deployed in this setting can help meet those patient needs by identifying the care team and providing real-time access to test results, medication information, and hospitality amenities.[4,5,12] The literature is relatively silent, however, on how health care organizations can improve hospital-

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ity features of inpatient care while enhancing patient and family engagement in the care process.[13] Hospitals have been encouraged to bridge the digital divide (the differences in use of digital technology between patients of different ages, races, incomes, and education levels)[14] by providing technological solutions to all patients. However, it is relatively unknown how patients and families may use hospital-provisioned mobile devices to control their inpatient rooms and access the inpatient patient health portal.

The goal of this article is threefold: to describe consumer engagement technology projects at four institutions, including two integrated delivery networks (Ochsner Health System and Sutter Health) and two academic medical centers (Stanford Health Care and University of California [UC] San Diego Health); highlight the sociotechnical challenges and lessons learned (positive and negative) from these efforts; and synthesize the case studies in the context of patients' journeys across the continuum of care, comparing them and suggesting directions for advancing consumer engagement.

Ochsner Health System

Ochsner Health System is a not-for-profit integrated delivery system in Louisiana that serves over 700,000 patients a year. Ochsner employs over 1,200 physicians and operates over ninety clinics and twenty hospitals, assuming varying degrees of financial risk for approximately 30 percent of the patients seen.

In 2015 Ochsner focused on reengineering care between office visits for ambulatory care patients with chronic disease. Because Louisiana ranked fourth in the nation in hypertension prevalence, Ochsner first sought to develop a new model for delivering chronic disease care to patients by leveraging technology and sharing information with the goal of improving hypertension control rates.

In the initial pilot in New Orleans, Baton Rouge, and Covington, patients with uncontrolled hypertension were enrolled in the Hypertension Digital Medicine Program through orders from their providers. Patients completed online surveys through MyChart (a widely used patient portal product sold by Epic Systems) that evaluated diet, physical activity, health literacy, medication adherence, patient activation,[15] social determinants of health[16] (including medication affordability, number of people living in the home, and caregiver support), and depression. Along with clinical data from the EHR, these patient-reported data were used to create a unique patient phenotype for each patient and guide individualized interventions. Patients

were provided with an electronic blood pressure device that transmitted home blood pressure readings directly into the EHR as they were taken. To meet the needs of many patients who were unfamiliar with digital tools, Ochsner created the O Bar, modeled after service bars in computer stores, at primary care sites. The O Bar provides initial setup of the home blood pressure device plus health education, training, and technical support in the use of connected home devices and health apps.[17] Patients were asked to take no less than one blood pressure reading per week. If the care team had not received a reading for eight days, patients would receive an automated text alerting them that a blood pressure measurement was needed.

Doctoral pharmacists and health coaches are integral members of the care team—called an integrated practice unit—that provides patient education, drug management, and lifestyle recommendations as per hypertension treatment guidelines. In addition, custom visual tools were developed within the EHR that describe the patient's social determinants,[16] trending blood pressure over time, hypertension-related comorbidities, patient activation level,[15] health literacy, and relevant lab results that assist in optimizing the effectiveness and efficiency of the care team. Care team members contact patients by phone and review screening results and treatment options for improving blood pressure control. Patients are encouraged to work with the care team to cocreate the treatment plan by choosing among various lifestyle and medication options.[18] Besides direct contacts by the care team, patients receive monthly reports by the patient portal and postal mail that describe their progress to date, along with additional tips to create better control.

Compared to propensity score–matched controls who received usual care, at six months digital medicine patients had more blood pressure measurements recorded in the EHR (93.0 versus 1.6) (exhibit 1). They had more frequent interactions with their care team, or clinical touches (130 versus 12). Furthermore, they demonstrated greater medication adherence as measured by the proportion of days covered, a leading method used to calculate medication adherence at a population level.[19,20] Medication adherence improved 14 percent among patients in the digital medicine program and declined 2 percent among patients in usual care. Digital medicine patients also achieved greater blood pressure control (79 percent versus 26 percent) and exhibited higher levels of satisfaction (84 percent versus 72 percent). Moreover, primary care physicians experienced a 29 percent reduction in the number of in-clinic visits from participat-

ing patients, thus reducing their workloads and enabling greater access for other patients (data not shown).

In 2016 the program was expanded to all Ochsner locations, and it now has over 3,000 active participants. Furthermore, it has created the infrastructure for additional programs in managing other chronic diseases, including diabetes and chronic obstructive pulmonary disease. Patients and providers alike have found the program to be life changing. The chair of primary care told coauthor Richard Milani: "This has dramatically changed how we approach chronic disease care. We forgot what help looked like until this program."

Sutter Health

Sutter Health is a not-for-profit health care delivery system that serves over three million patients annually. In response to consumer demand for care opportunities beyond the office setting, in 2001 the Palo Alto Medical Foundation, a Sutter Health affiliate, became the first health system in the nation to implement MyChart, Epic Systems' vendor-based patient portal.[7] Sutter's experience provides lessons learned about engaging patients, addressing unintended consequences as portal engagement matures, and ultimately the positive clinical benefits of such engagement.

In contrast to the national experience, where only a limited percentage of patients use patient portals,[21] as of July 2018 over 79 percent of patients seeking ambulatory care at Sutter Health had enrolled in the portal. Systemwide engagement of all stakeholders is key. Executive commitment is exemplified by inclusion of enrollment tracking on a dashboard. Clinical operations leaders track nursing staff performance on enrollment of patients during clinical encounters. Peer review reports transparently show patient portal adoption rates per clinician.

Delivering tangible patient and clinical value is critical to sustaining engagement. One of the most important functions provided by a patient portal is enabling patients to securely message their clinicians and supporting clinicians to answer them in a timely way.[7,22] Initially, patients were asked to pay a $5 monthly fee to use the messaging function, and 13 percent of patients who were enrolled in the portal paid the fee and engaged in secure messaging. A survey of portal users suggested that 65 percent of these patients had reduced one or more office visits annually, and over 70 percent were satisfied with the messaging service.[5,22]

In response to market competition, Sutter removed the monthly user fee for secure messag-

EXHIBIT 1

Six-month outcomes for patients of Ochsner Health System enrolled in the Hypertension Digital Medicine Program, compared to those for propensity score–matched patients in usual care
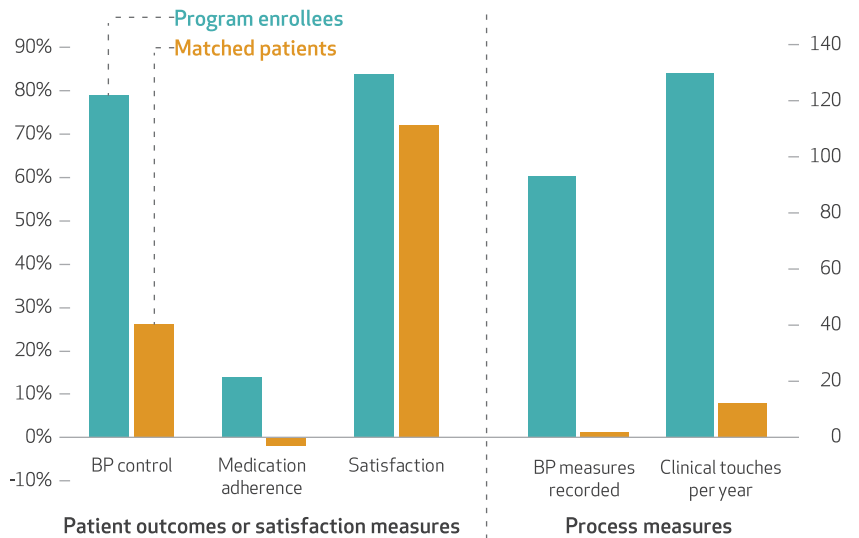
SOURCE Authors' analysis of outcome data for patients of Ochsner Health System enrolled in the Hypertension Digital Medicine Program over three years. **NOTES** The program is explained in the text. Clinical touches include outpatient visits; patient portal communications between provider and patient; letters, calls, and texts; and patient-generated health data transmitted to the health team. All differences in outcomes between the two groups were significant ($p < 0.05$ for percentage of days of medication adherence, explained in the text, and satisfaction; $p < 0.01$ for all other differences). BP is blood pressure.

ing for Palo Alto Medical Foundation patients, increasing the messaging-eligible population from 13 percent to 100 percent of enrolled patients. Sutter used a three-pronged approach to enable clinicians to respond in a timely fashion to the anticipated increased volume of messages. First, to support change management, multiple town hall meetings were held to engage clinicians in developing solutions. Second, medical assistants or nurses were tasked with addressing patient messages first when appropriate, and clinical guides for addressing common patient message themes were provided to clinicians. Third, to recognize the value of the work provided by the clinicians, an incentive program was established to reward the answering of messages within one business day. In 2011 the average response time dropped to about four hours, despite a sixfold increase in messaging volume. Patients used the portal to exchange almost sixteen million secure messages with clinicians in 2017, and over 90 percent of patient-initiated messages were answered within one business day.

Other components of Sutter's patient portal include online appointment scheduling, automated wait-listing of appointments, and booking of same-day video visits for low-acuity

conditions seven days a week. The wait-listing function enabled wait-listed patients to see primary care clinicians fifteen days earlier and to see specialists twenty-six days earlier than initially scheduled. The number of video visits for low-acuity conditions has grown eightfold since launch in March 2018.

To help patients engage in self-management of their health, patient-centric decision support tools concurrently alert clinicians in the EHR and patients in the portal to address screening and disease monitoring concordant with evidence-based recommendations. Guideline-concordant reminders of hemoglobin A1c monitoring among patients with diabetes improved the rate of A1c test completion by 33.9 percent ($p < 0.01$).[23] In a clinical trial of online disease management delivered via the patient portal, patients with previously uncontrolled diabetes had a significant reduction in HbA1c at six months, compared to usual care (a reduction of 1.32 percent versus one of 0.66 percent; $p < 0.001$).[24]

Sustainment of patient engagement is facilitated by a dedicated service center that provides support twelve hours a day, five days a week. In 2017 there were over 400,000 customer service support encounters with patients via phone, chat, and email to facilitate continuous access to the portal. An average of approximately 450,000 unique users log into the portal 2,500,000 times per month.

Stanford Health Care

Stanford Health Care is a not-for-profit multihospital health system that includes more than 100 affiliated faculty and community-based clinics. As Stanford Health Care grew from a single tertiary medical center to a regional health system with community primary and specialty care, digital engagement with patients became increasingly important to provide efficient access to administrative services, connect with patients between visits, satisfy a growing demand for access to health data, and enable remote monitoring of high-risk patients.[9,25] Stanford's priorities were to increase patient portal enrollment and usage, enable patients to access their own medical data and records, and monitor and respond to patients' symptoms between visits.

While patient portals have grown in functionality, sign-up rates are often low owing to rigorous but onerous identity verification processes. To facilitate enrollment, Stanford automatically verifies patient identity during portal enrollment using a process similar to credit verification, in which the patient answers a series of questions based on publicly available data such as the most recent home addresses instead of standard in-person verification. Stanford also developed a novel method to issue a text-based instant invitation to sign up for the patient portal directly from the EHR to the patient's mobile phone. In combination with effort by front-office staff, these automatic processes have led to 72 percent enrollment overall and 87 percent within primary care—among the highest in the nation.

Stanford customized its EHR-based patient portal, the Stanford MyHealth application, to provide novel features such as technology that automates patient check-ins upon arrival at a clinic and provides an indoor navigational tool to enable patients to find their way around the hospital. The custom platform also allows patients to access their health data via mobile and web-based apps, including laboratory, radiology, and pathology information that was previously difficult for patients to obtain despite a legal right to these data.

In an effort to expand patients' access to their own health information,[6] Stanford shares doctors' notes with patients across virtually all providers, with the exception of mental health care providers. This functional enhancement has led to high readership rates, with nearly 35 percent of all doctors' notes viewed by patients overall and 42 percent within cancer and primary care. This patient-facing feature required intensive change management to overcome physician anxiety. The doctor's note has historically been a provider-centric document, and though patients have legal access to their record, enabling online access for patients is a relatively new concept. To generate support, Stanford engaged providers on multiple fronts, including physician leaders (for example, the chief medical officer and department chairs), front-line physicians, and their full multidisciplinary care teams. Upon implementation, providers voiced virtually no negative feedback, and there was no noticeable increase in patients' concerns.

Recognizing that emotional distress is commonly unidentified among patients receiving treatment for cancer, Stanford implemented a process to systematically survey such patients for unaddressed symptoms, distress, and needs through the patient portal as a standard element of visit preparation. Positive responses triggered clinical decision support to remind clinicians to offer supportive services, addressing unmet symptom-driven needs. A spectrum of examples was uncovered—from minor transportation issues to major financial hardship, and from anxiety to suicidality. In a survey of 54,000 patients with cancer, about 40 percent of the roughly 13,000 patients who responded re-

ported experiencing distress. These responses precipitated more than 6,000 referrals for psychotherapy, case management, nutrition, and other services. In all, this process engages the patient in preparing ahead of the visit, informs the care team of unmet needs, and helps patients connect with their care teams.

UC San Diego Health

UC San Diego Health maintains two geographically separate hospitals with a combined capacity of 808 beds. It employs almost 9,000 staff and physicians, with over 30,000 discharges and 750,000 outpatient visits annually. In 1996 it implemented a home-grown patient portal called PCASSO,[3,4] and in 2008 it rolled out an EHR-integrated patient portal.

In its newly constructed 364-bed Jacobs Medical Center, in 2016 UC San Diego Health hardwired inpatient rooms to embed digital technology for engaging patients during their inpatient stays. Tablet computers in each patient room give patients access to room controls (lights, shades, thermostat, and entertainment system), educational content, and an inpatient patient portal (MyChart Bedside, from Epic Systems). From their beds, patients can access test results, photographs of their health care team, a schedule of medications and upcoming procedures, and prescribed educational materials.

To understand the take-up of room control features and the inpatient portal on tablets, UC San Diego Health studied 3,411 inpatient stays (excluding 789 newborn stays) between September 1 and November 30, 2017. In two-thirds of the stays, patients used the room control feature, and in one-third, patients accessed the inpatient patient portal (exhibit 2). After multiple factors were controlled for, logistic regression analysis suggests that the odds of using the inpatient patient portal among room control users were 1.65 times greater than the odds for patients who didn't use the tablet for room control. This suggests that the tablet has served as a conduit that nudged more patients to use the patient portal.

It is worth noting, however, that patients used the inpatient patient portal differently by age and race, even after service areas were controlled for. The odds of using the portal among non-white patients were 0.84 times the odds among white patients. Compared to younger patients, older patients also had lower odds of using the portal (odds ratio: 0.64).

While the costs of tablets were relatively low in the context of building a new state-of-the-art hospital, scaling up the use of tablets was not

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EXHIBIT 2

Patient characteristics associated with use of bedside digital room control and inpatient patient portal on tablet computers in inpatient settings at UC San Diego Health

	Sample size (N = 3,411)	Used bedside room control		Used inpatient patient portal		Odds ratios of using inpatient patient portal
		No.	%	No.	%	
Used bedside room control	2,242	2,242	100	815	36	1.65***
Sex						
Male	920	700	76	316	34	1.06
Female	2,491	1,542	62	781	31	Ref
Age (years)						
Younger patients (2–64)	2,694	1,713	64	898	33	Ref
Older patients (≥65)	717	529	74	199	28	0.64***
Race						
White	2,009	1,286	64	652	32	Ref
Nonwhite	1,402	956	68	445	32	0.84**
Hospital service area						
Obstetrics and gynecology	1,599	860	54	488	31	Ref
General medicine	475	378	80	192	40	1.56***
Bone marrow transplant	241	228	95	165	68	4.65***
Critical care	78	27	35	27	35	1.51
General surgery	456	419	92	118	26	0.72**
Medical specialty	79	14	18	17	22	0.86
Neurology	113	70	62	16	14	0.42***
Surgical subspecialty	370	246	66	74	20	0.60***

SOURCE Authors' analysis of data for 2017 from UC San Diego Health on inpatient stays. **p < 0.05 ***p < 0.01

as simple as flipping a switch. Integrating patients' tablet use into clinical staff work flow can be challenging.[26] Keeping information on the care team up-to-date and reflected in the tablets can also be difficult. This can be particularly difficult for academic medical centers where residents provide significant patient care. Including residents' information and pictures in the care team profile will require nontrivial efforts. Continued engagement by clinical staff with patients and the allocation of resources to provide technical support to clinicians is necessary to transform the inpatient care setting from a traditional clinician-centric culture to a patient-centric culture.

In early 2018 UC San Diego Health, along with Ochsner, became one of the first organizations to adopt a new digital tool produced by Apple[27] that makes it possible for patients to integrate data from multiple sources—for example, their personal devices and multiple health care delivery organizations from which they receive services, in addition to the data from their primary health care organization. A UC San Diego Health survey of the first 425 users of the tool suggested that 90 percent of these early adopters reported improvements in understanding their own health; sharing health information with caregivers, family, or friends; and facilitation of conversations with clinicians.[28]

Patient portals are being leveraged to further improve transparency of patient priorities to clinicians at UC San Diego Health, and also at Sutter. In a study funded by the Patient-Centered Outcomes Research Institute, patients are invited to contribute to setting ambulatory care visit agendas, using the patient portal to inform their primary care physicians of their top priorities before their visits.[29]

Discussion

As patients enjoy more user-friendly technology in nonhealth areas of their lives, they expect the same type of consumer-friendly technology in health care. The innovations from the academic and community-based delivery organizations described in this article mirror some of the modern conveniences available in the consumer marketplace. The online appendix exhibit describes and summarizes the technology-enabled consumer engagement approaches at the four organizations as patients encounter health care providers at home, in outpatient clinics, and in hospitals.[30] While each institution stands out in particular areas, no institution has adopted these tools and processes in all areas.

At home, consumers expect to be able to schedule appointments online, securely message their care teams, and review clinical results. All four organizations have implemented these features in the patient portal, with 45–79 percent of their patients using them. User interface redesign has enabled some of the organizations to authenticate users in real time, thereby greatly removing friction in patient portal enrollment. Notably, all four organizations have adopted OpenNotes—which, while engaging patients,[6] brings unique physician change management challenges.[31] Two of the organizations (UC San Diego Health and Sutter) are going further, with funding from the Patient-Centered Outcomes Research Institute, to examine the potential impact of improving transparency of patient priorities to clinicians using the patient portal.[29]

Several organizations have home monitoring using patient portal technology. The provision of transmittable blood pressure and weight monitoring along with a physical service bar or digital service center enables access to these valuable technologies for patients with chronic conditions. All four organizations are also offering virtual care[32] that is accessible through mobile patient portal applications or online.

In the clinic, consumers are being offered way-finding technology on their mobile devices. Mobile check-in offers the convenience of "saving your spot in line" and the ability to privately complete previsit questionnaires, as well as directly paying for services without needing to interact with any clinic staff.

For hospitalized patients, institutions are increasingly looking to empower patients by providing access to inpatient patient portals that can facilitate communication; provide easy access to hospitality amenities; and deliver education to advance safe, coordinated, and dignified patient-centered care.[12,26] Further patient engagement enhancements can be built upon the early successes in uptake of room control features to transform the culture of inpatient care setting from clinician-centric to patient-centric. While hospital-provisioned devices are an equalizing enablement for many patients, patients with unmet needs because of older age, nonwhite race, and serious illnesses should receive additional individualized support—not only for physical comfort, but also for meaningful engagement in their care at levels consistent with their preferences and needs. It is important to prevent overdependence on technology that could exacerbate perceived isolation and patients' unmet needs for human connection and interaction.[9] Additional research is needed to assess the impact of room control features and inpatient patient portals provided on tablets on outcomes that matter to patients and families during their inpatient stays and beyond.

Policy Implications

Federal resources have facilitated consumer engagement by health care delivery organizations. For example, Sutter leveraged funding from meaningful use on some of its digital consumer engagement tools. Other organizations used grants to purchase initial equipment for televisits. In 2018 the four organizations implemented interoperable personal health records capabilities using the open Apple Health Record application programming interface.[28] In addition to empowering patients to aggregate their records from multiple health systems, this will enable all four organizations to attest to meeting 2018 stage 3 standards for meaningful use in the Centers for Medicare and Medicaid Services' Merit-based Incentive Payment System.

The long-term sustainability and scalability of these initiatives depend on payers' commitment to the quadruple aim—enhancing patient experience, improving population health, reducing costs, and improving the work life of health care providers.[33] Organizations may lack incentives to scale virtual visits, for example, in a fee-for-service environment—despite recognized benefits of virtual visits in preventing avoidable emergency department visits and hospital admissions, increasing the capacity of mental health care providers, and allowing for telemonitoring after hospital discharge.[34] Private payers require documentation unique to video visits. The field is evolving, however, as Medicare will begin to reimburse providers for conducting video visits, reviewing brief communication technology–based services such as virtual check-ins, and remotely evaluating recorded video or images submitted by the patient.[35]

Although Medicare has created a new mechanism to pay for team-based care, it charges patients a 20 percent monthly copayment for remote monitoring and chronic care management services. Ochsner decided to not bill the Centers for Medicare and Medicaid Services for its Hypertension Digital Medicine Program, although it included chronic care management and remote monitoring, because Ochsner did not want to increase its patients' financial burden. Its success in significantly increasing the rate of blood pressure control, medication adherence, and satisfaction with care among patients, however, has resulted in payment from commercial insurance in recognition of its performance. When payers benefit from providers' use of technology to engage patients and its subsequent savings, payers should share the savings with the health care delivery organizations.

A direct business case for patient engagement cannot always be made, however. Indeed, most of the strategies described here do not directly contribute to revenue and are often costly. It is difficult to quantify the value of patient satisfaction in a competitive health care market and hard to gauge patient engagement—let alone its monetary value. However, in many metropolitan areas there is increasing competition among health care systems, and consumer engagement is an important differentiator and may even be a basic requirement. Despite lack of direct financial benefit, these four health systems have invested in consumer-facing technologies to better connect with their patients, reduce the friction of obtaining care, and serve the needs of patients. The technology-enhanced journey to a patient-centered world is achievable with organizational commitment to implementing patient-centered care. Use of digital tools to enhance consumer engagement and transparency could not only improve patient health outcomes and experience with care, but could also grow health care organizations' market share. ∎

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30 To access the appendix, click on the Details tab of the article online.

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