

**RESEARCH ARTICLE****The Future of Personal Health Records and Patient Portals****Author**

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Over the last two decades, the early development of standalone Personal Health Records (PHRs), and later tethered patient portals, have had a transformative effect on engaging patients by providing them with tools to manage their health and unprecedented access to their health data. However, despite anticipated benefits and continued high consumer demand for online access to personal health information, adoption and sustained use has been less than expected. Moreover, powerful forces are transforming healthcare, necessitating change and adaptation.

This aim of this paper is to examine several significant trends that are influencing the intersection of health care and technology and provide an assessment of the impact of these trends on the future of PHRs and patient portals. An aging population with an increased prevalence of chronic disease and mental health conditions, coupled with rising consumerism and more diverse care settings, has significant implications for patient-facing tools such as patient portals. Similarly, the proliferation of data generating consumer health technology and technical advances such as artificial intelligence and emerging data standards calls for the next iteration of tools to support care delivery. Moreover, the acceleration of virtual care driven by national policy changes and the COVID 19 pandemic requires better tools to realize the promising potential of the technology in an increasingly complex and interconnected world.

Taken together, these factors may provide the perfect storm that will enable a critical shift to envision a more holistic patient-centric information and resource hub that is characterized by improved architecture, optimized design and content, a robust set of well-designed tools and functions, and enhanced integration with clinical care processes and structures. This personal health portal could provide a long desired single comprehensive longitudinal personal health record with best of breed design and features to empower patients as they navigate their health journey.

**Keywords:** Personal Health Records, PHRs, patient portals, patient engagement, healthcare trends

## 1. Introduction

Several powerful forces are transforming the role of the contemporary health care consumer and creating new opportunities to improve patient care. Technological advances, coupled with a shift toward patient-centered care and unprecedented consumer access to information have created a new era of consumer engagement, empowerment, and activation. Over the last two decades, the early development of standalone Personal Health Records (PHRs), and later tethered patient portals, have had a transformative effect on engaging patients by providing them with tools to manage their health and unprecedented access to their health data.

Patient portals aim to improve the quality of care by engaging patients as active participants. The United States Office of the National Coordinator for Health IT (ONC) defines a patient portal as a secure online website that gives patients convenient, 24-hour access to personal health information from anywhere with an Internet connection.<sup>1</sup> Using a secure username and password, patients can view health information such as discharge summaries, medications, immunizations, allergies, and lab results. Many patient portals also include secure messaging, prescription refills, appointment scheduling, bill payment, and educational materials.

A PHR, in contrast, is an electronic application through which patients can maintain and manage their own health information (and that of others for whom they are authorized) in a private, secure, and confidential environment.<sup>2</sup> Systems such as the Department of Veterans Affairs's My HealtheVet represent a hybrid model which encompasses both.<sup>3</sup> Some patient portals have also added PHR functions including patient generated or device generated data

imports. Despite continued high consumer demand for online access to personal health information,<sup>4</sup> and increased availability of patient portals driven by legislative incentives such as Meaningful Use,<sup>5</sup> the adoption and sustained use of patient portals continues to be less than expected.<sup>6</sup> Moreover, several powerful forces are transforming healthcare with important implications for the future.

This aim of this paper is three-fold: to examine several significant trends that are influencing the intersection of health care and technology, to provide an assessment of the impact of these trends on the future of PHRs and patient portals, and to describe a vision for the future that characterizes the next iteration of these tools in order to realize the promising potential of the technology in an increasingly complex and interconnected world.

## 2. Significant Trends Impacting Health Care

To envision the future role of consumer-facing technology such as PHRs and patient portals, it is necessary to more broadly examine several key trends that are shaping the contours of health care and the implications for technology-enabled solutions.

### 2.1 Aging Population and Increasing Chronic Disease

The population is aging and the prevalence of chronic disease is increasing dramatically. People are living longer and with more chronic disease (i.e., obesity, diabetes, arthritis, cardiovascular disease, hypertension and stroke). In the United States overall, the over 65 population will nearly triple by 2030, and six out of ten will be managing more than one chronic condition.<sup>7,8</sup> More than one out of every three will be considered obese, and one of four will be living with diabetes.

As a result of this trend, healthcare systems will need to address related challenges of controlling escalating costs in the face of increasing demand, improving quality of care and outcomes, and expanding access. With increases in longevity, an aging population will require continuous medical management in both inpatient and outpatient settings, and consume greater resources placing economic burden on already fragile health care systems. The population will require more healthcare, different types of care aligned with chronic diseases and their impact, and better coordination of care. Since chronic diseases progress slowly and often have a behavioural component, new approaches that emphasize behavioural change will be essential.<sup>9</sup> Healthcare delivery models will move from traditional models of “sick care” to new models focused on management of health provided by a diverse set of service providers, and with a greater focus on healthy behaviours, prevention, and access to real-time care.

### **2.1.1 Implications**

Addressing these challenges will require additional healthcare resources to meet growing demand, new approaches to healthcare delivery with a focus on prevention, behaviour change, and genomics, the expansion of virtual care options to increase access, and a greater focus on population wellness and prevention. The patient portal will be a foundational structure to enhance easy access to these tools and services, and will be supplemented by patient engagement platforms which use data analytics to improve population health. Online tools and resources to support chronic disease management will be increasingly important, but will need to leverage neuroscience principles that drive behaviour change. As population demographics shift, research and

evaluation will be critical to understand the needs and preferences of specific population cohorts, and to ensure user-centered design for these segments.

## **2.2 Prevalence of Mental Health Conditions**

The prevalence of mental health conditions is significant while barriers to treatment remain. Millions of Americans are affected by mental health conditions. Approximately 1 in 5 adults in the U.S. (46.6 million) experiences mental illness in a given year, and approximately 1 in 25 (11.2 million) experiences a serious mental illness that substantially interferes with or limits one or more major life activities.<sup>10</sup> In 2014, Only 41% of adults in the U.S. with a mental health condition received mental health services in the past year.<sup>11</sup> Among adults with a serious mental illness, only 62.9% received mental health services in the past year. Many who begin treatment subsequently drop out. Engaging individuals in mental health care is often challenging and met with a wide array of barriers, including the stigma associated with in person treatment.<sup>12</sup> Providing patients with multiple options for communicating with healthcare professionals and accessing mental health care services is crucial.

### **2.2.1 Implications**

Patient portals hold promising potential to enable convenient access to resources to promote mental health, to engage users with mental health conditions, to support asynchronous and synchronous communication, to encourage patients to seek treatment (e.g., online appointment scheduling and reminders), and to offer treatment options remotely (e.g., virtual chat or visit). Portals can facilitate both initial and sustained patient engagement with mental health care. Careful attention to design standards is needed to ensure

usefulness and usability especially for users with mental health conditions.<sup>13</sup> Using these design principles will also enhance the effectiveness and usefulness for all users.

Rotondi et al. expanded the Flat Explicit Design Model (FEDM) to identify critical design elements for users with mental illness.<sup>14</sup> The FEDM was formulated to reduce the cognitive effort required to effectively use an e-health application by reducing the need for users to: think abstractly, 2) rely on working memory, 3) utilize executive functions to search for information, 4) concentrate to filter out distracting contents, and 5) scan and search for information on a page or screen by providing a simplified page layout design. In addition, due to the complexity of health record information and the nature of the functionality provided, individual factors such as health literacy, numeracy ability, and graph literacy are likely to play a critical role in usability.<sup>15</sup> This can be addressed by employing user-centered design and developing implementation strategies such as end user training.<sup>16</sup>

### 2.3 Rising Consumerism

Consumerism is driving patient expectations and demands in the healthcare industry. Given the evolution of user-friendly technology-enabled services in all other industries, patient expectations for a comparable experience in health care is increasing dramatically. As consumers in an interconnected and wired world, patients are used to having information at their fingertips 24/7 and expect a broad variety of online tools and services for both basic tasks (e.g., scheduling an appointment) and more complex functions (e.g., secure messaging and virtual visits). Patients will seek out healthcare organizations and physicians who provide them with the online experiences that they're used to and expect in other aspects of their lives.

#### 2.3.1 Implications

Health care organizations will need to provide easy access to a robust suite of well-designed online tools and services. These must be aligned with the specific preferences and needs of population segments, be developed based on the principles of user-centered design, work seamlessly, and be supported by effective secondary support services. Options for personalization and customization of the patient portal experience will be required, in alignment with the consumer experience in other industries. This will also necessarily entail a more holistic approach to portal functions which focuses on the various tasks that may comprise the customer journey and anticipates desired potential actions, rather than offering multiple apps that meet single focus use cases. Customer relationship management has become a standard practice for service providers in other industries. Following this trend, portals will evolve more broadly as part of an organization's patient relationship management program with more intuitive interfaces, better patient education, tools that are well-integrated into clinical workflow and administrative processes, and improved data exchange.<sup>17</sup>

Healthcare organizations will need to strategically transform care processes to support virtual care. This comes with a new focus that the benefits may accrue in ways that indirectly affect return on investment. For example, while traditional metrics focus on traditional system utilization measures such as clinical encounters, virtual care measures also take into account cost avoidance such as using virtual chat to deliver care while reserving more expensive in-person encounters for those patients who require a higher level of care.

## **2.4 Increasing Need for Care Coordination**

Patients are increasingly seeking care from multiple sources in addition to a traditional primary care provider, including specialists, local urgent care centers, retail clinics, and online. Within the Department of Veterans Affairs, this same trend is occurring as the MISSION Act has expanded the coverage available to Veterans from community care providers.<sup>18</sup> As a result, patients will demand technology solutions that automatically consolidate all of their information from various sources without great effort on their part, and that allow them to easily share that information based on their individual preferences.<sup>19</sup>

### **2.4.1 Implications**

While organizational health information exchange continues to mature and expand, the patient must remain at the center of the information hub. A patient-centric approach is needed to ensure the effective flow of information from multiple care settings into a centralized patient-controlled repository which provides patients with effective granular controls for information sharing. The data richness of the patient portal will be a key driver in its utility, beyond the basic transactional functions that patients will expect. The key to the future of patient portals will be this interoperability between disparate systems.

## **2.5 Proliferation of Patient Generated Health Data**

The proliferation and increased adoption of consumer health technologies is quickly increasing the frequency, amount, and types of patient generated health data (PGHD). The Office of the National Coordinator defines PGHD as health-related data created, recorded, or gathered by or for patients (or family members or other caregivers) to help address a health concern.<sup>20</sup> PGHD include, but are not

limited to, health history, treatment history, biometric data, symptoms, and lifestyle choices. Health-related PGHD are distinct from data generated in clinical settings and through encounters with clinicians, as patients are primarily responsible for capturing and recording these data and patients decide how to share or distribute these data to clinicians.

With the great proliferation and increased adoption of consumer health technologies such as online questionnaires, mobile apps, wearable devices such as fitness trackers, and at-home devices such as glucometers and blood pressure cuffs, consumers are generating significant amounts of data and expect easy mechanisms to include that data in a comprehensive personal health history, and to make that data available to their clinicians. As data becomes more readily available and personalized, it will revolutionize the way that physicians diagnose and treat patients.

### **2.5.1 Implications**

While healthcare organizations are still maturing their approaches to enable PGHD, this data will become an important source of information and insights that will need to be effectively integrated into the future patient portal. It will be critical to ensure that patient portals provide robust privacy and security controls and practices to protect the flow and storage of personal health information. The Internet of Things (IOT) will connect a wide variety of devices that can help to link a patient's wellness to their lifestyle and behavioural choices. This evolution will enable more personalized care that will lead to improved outcomes. Given the potential volume of data, smart analytic techniques will be needed to surface the most relevant signal from the noise, to detect actionable information, and predict trends.



## 2.6 Policy Convergence and COVID 19 Accelerate Virtual Care

United States national policies are converging to mandate patient data access and promote virtual care. While the HITECH Act and Meaningful Use incentivized organizational investments in technology infrastructure (e.g., certified Electronic Health Record capabilities), newer legislative initiatives have shifted focus to support interoperability and enhance consumer access to data. The 21<sup>st</sup> Century Cures Act, specifically encourages partnerships between health information exchange organizations/networks and healthcare organizations to promote patient access to their electronic health information in a single, longitudinal format that is easy to understand, secure, and updated automatically.<sup>21</sup>

In March 2019, the United States Centers for Medicare & Medicaid Services (CMS) issued the CMS Interoperability and Patient Access Proposed Rule.<sup>22</sup> Inherent in these legislative changes is the need for greater interoperability (including compliance with existing and emerging data standards), effective solutions for patient identification and patient matching across data ecosystems, effective data aggregation and harmonization, and support for consumer preferences (e.g., where and how data is shared). CMS has also enacted CPT code changes that enable reimbursement for providers to manage and coordinate patient care at home,<sup>23</sup> paving the way for asynchronous telemedicine and virtual care.<sup>24</sup>

Moreover, the COVID 19 pandemic has forced all healthcare systems, hospitals, and clinics to rapidly implement telehealth services, and delivery of patient care by the American health system has forever changed.<sup>25</sup> A new era of virtual care (e.g., video visits), telehealth, and expanded remote patient monitoring has arrived and

patients and systems rely heavily on digital care tools for the provision of both simple and increasingly complex healthcare services.

### 2.6.1 Implications

Given these shifts, virtual medical care has gained significant momentum. Patient portals will need to continue to expand to enable easy access to a range of virtual tools and services (e.g., virtual visits, virtual chat, etc.) and mature to be truly interoperable. This will require compliance with existing and emerging data standards, effective solutions for patient identification and patient matching across data ecosystems, effective data aggregation and harmonization, and support for consumer preferences (e.g., where and how data is shared). It will also require improved synchronization of care across multiple care delivery modalities.

## 2.7. Technology Advances

Technology advances such as Application Programming Interfaces (APIs) have moved from innovation to mainstream. As the technology continues to advance, there will be more of a need for API lifecycle governance, data stewardship, and new approaches that move away from point-to-point single focus solutions to leverage APIs as reusable assets. While initially APIs were focused on narrow use cases, the vision for the future is to develop APIs as reusable building blocks that can be hooked together within Application Networks to address a wide variety of use cases. Application Networks enable APIs to be available in a repository as functional reusable assets that can be combined in web or mobile apps to support clinical workflow and business process automation, as opposed to point to point integrations.

### **2.7.1 Implications**

APIs will be developed as reusable building blocks within Application Networks, allowing them to be connected in efficient ways to support a more robust set of use cases. This will enable the development of more fully featured solutions that anticipate the types of functions that are needed, based on the various pathways in the customer journey. To accomplish this, organizations must fully understand the customer journey along the continuum of a patient trajectory and successfully translate these insights into the optimization of the patient portal and patient engagement platform.

### **2.8 Artificial Intelligence**

Emerging technologies with demonstrated value include Artificial Intelligence (AI), Machine Learning (ML), and Real Time Clinical Decision Support. AI in healthcare refers to the use of complex algorithms designed to perform certain tasks in an automated fashion to review and interpret data, and even suggest solutions to complex medical problems. AI and machine learning tools are helping physicians make more informed decisions, hospitals achieve better outcomes, and patients receive more timely and personalized care.<sup>26</sup> AI tools will help to close the significant gaps in healthcare by supporting virtual care through Telemedicine and harnessing big data to drive personalized medicine.

Although the encounter-based paradigm is still prominent, with the COVID-19 pandemic, organizations are turning to virtual care or telemedicine to maximize use of finite resources and provide patients with access to services. Using AI-enabled tools, Telemedicine is connecting rural patients to urban health centers, dramatically shortening specialist wait times, and reducing high readmission rates.<sup>27</sup> AI-enabled tools help providers monitor their patients remotely using predictive analytics

and real-time medical device data, triage cases that require more intensive care interventions, and improve the accuracy of virtual decision-making. Using highly sensitive and specific algorithms, AI can not only target individuals in a patient population with specific conditions that require an intervention, it can also identify those who may be at risk well in advance of detection using traditional methods.

Clinical support can be enhanced by using connected technologies and systems, as opposed to less mature point to point systems that are data silos. AI can combine data from disparate sources, like a patient's genetic test, personal health record, and an electronic health record (EHR), to provide more timely alerts and suggestions to a care team. Algorithms can be designed to input data from a variety of sources to create deeply personalized and timely outputs, such as disease risk profiles or suggested diagnoses. With the renewed emphasis on the social determinants of health and the impact these factors have on health and wellness, AI-enabled tools can combine and analyze data from multiple sources to generate a more holistic view of the patient, their predicted risk, and behavior changes that have significant potential to improve health.

### **2.8.1 Implications**

In addition to the transformative benefits to overall patient care, AI-enabled tools can enhance patient engagement by anticipating patient needs, enabling personalized medicine, improving the patient experience, and boosting the potential for virtual care to increase patient access and satisfaction. With the patient portal, AI can also provide patients with intelligent guidance and support when needed and personalized to them. Virtual assistants ("chat-bots") are changing the way that patients can access information and services, enabling 24/7,

always-on advice and support in a conversational user-friendly self-service model that leverages natural language processing.

## 2.9 Increasing Privacy and Security Risks

As technology and policy advances foster the potential of personal health data in a more data-driven future, privacy and security risks increase concurrently. As information increasing flows between data ecosystems, privacy and security controls become paramount. While interoperability increases the flow of data between ecosystems to potentially transform conveniences and benefits for patients and providers, data in the wrong hands can expose patients to unnecessary risk and discrimination.

Since October 2009, the Department of Health and Human Services' Office for Civil Rights (OCR) has been publishing summaries of U.S. healthcare data breaches. In that time frame, 2,545 healthcare data breaches have been reported. Those breaches have resulted in the theft, exposure, or impermissible disclosure of 194,853,404 healthcare records. That equates to the records of 59.8% of the population of the United States.<sup>28</sup>

Federal security and privacy regulations, principally the Health Insurance Portability and Accountability Act of 1996 (HIPAA) and the accompanying Health Information Technology for Economic and Clinical Health (HITECH) Act provide clear guidance on securing personal health information including National Institute of Standards and Technology (NIST) encryption standards, information disclosure rules, and patients right of access to their data. As PHRs and patient portals evolve, organizations also need to pay close attention to HIPAA compliant approaches for electronic messaging, cloud storage,

data exchange, and risk assessments.<sup>29</sup> In this new era of data democratization, new solutions are needed to provide privacy and security protection of personal health information. Emerging technologies with demonstrated value include FHIR (Fast Healthcare Interoperability Resources) and Blockchain; different solutions which have both have merit for different subsets of the requirements of healthcare.

FHIR has emerged as a nimble, lower cost integration standard built on modern technologies. FHIR is a collection of transient messages useful for moving data between persistent data stores or for on demand consumption. Blockchain, in contrast, is a persistent data store of information. It is an immutable ledger of, not only the data, but the messages which change the data. While FHIR is a messaging solution, Blockchain is a component in an interoperability architecture which automatically refreshes itself across multiple sites. Blockchain is an alternative to distributed databases and message sets which assist them to remain whole and accurate. Blockchain solutions have the potential to help in a portion of interoperability use cases, however FHIR will still be an invaluable part of the technical toolkit.<sup>30</sup>

### 2.9.1 Implications

As digital health technology grows and medical devices become more connected, PHI and access to it may be scattered among devices and more vulnerable than ever. Health data is much more complex than many other data sets and areas of health care have disparate standards for recording data. The advent and continuous maturation of technologies like FHIR Resources and Private Blockchain Networks can provide the infrastructural tools required to liberate Personal Health Information from closed



exchanged networks, while maintaining security and protecting individual privacy. Instead of multiple patient portals, there is a dire need for a patient-centric digital longitudinal patient record: a centralized patient platform with the ability to aggregate and share information with the patient as the key stakeholder.

## **2.10 Mobile Integrated Consumer Technology**

Consumer technology is increasingly portable, mobile, automated and integrated. According to the latest research conducted by the Pew Research Center, 97% of Americans now own a cell phone, with 85% of those being a smartphone.<sup>31</sup> Nearly 77% of US adults now own a desktop or laptop computer, and 53% own tablet computers. Use of wearable technology such as smart watches, fitness trackers, wearable health monitors, smart clothing, and implantables is growing significantly, fuelled by advances in processing power and storage capability, demonstrating technology's tendency to get faster and smaller at the same time.

Increasingly combined with AI-powered tools, consumer technology devices enable more than just tracking and monitoring; by enabling automation and integration, consumer technology is offering new functions and features that are increasing their value and usefulness. Intelligent agents such as Siri, Alexa, and Cortana use conversational platforms to enable consumers to easily interact with AI. Google Lens is an AI-powered technology that uses a smartphone camera and deep machine learning to not only detect an object, but understand what it detects and offer actions based on what it sees. Apple Maps predicts the places you're most likely to go based on your behaviour patterns and recommends the fastest way to get there based on traffic, time of day, your location,

and your schedule. In each of these examples, device integration provides useful and convenient functions that are portable, mobile, automated and integrated.

### **2.10.1 Implications**

PHRs and Patient portals must have access options that are portable and mobile, and deliver features that can be automated, and integrated. While desktop computer usage will continue to be an important way for many users to interact with their PHR/patient portal, increasingly users will want the same level of access and features in their mobile devices for portability. Patients will expect these to provide a consistent experience, offer the same functionality, and be seamlessly connected. Integration of AI-enabled tools will enable new utilities, contextualization of data to provide personalized insights, intelligent guidance, and pattern recognition that can offer convenience and support desired behaviour change.

Other types of consumer technology will need to be integrated to enable a more complete view of the various data streams that impact health and wellness. Within the patient portal, embedded AI-powered virtual digital assistants have great potential to provide intelligent guidance, trend analysis and insights, predictive guidance, and health coaching. Healthcare organizations will need to provide integration of consumer access across various patient engagement and access platforms, rather than multiple single use case mobile apps and disconnected consumer-facing technology offerings.

## **3.0 Future Vision**

PHRs and patient portals have had a transformative effect on engaging patients by providing them with tools to manage their health and unprecedented access to

their health data. While much progress has been made, the vision for the future must boldly identify the next iteration of these tools in order to realize the promising potential of the technology in an increasingly complex and interconnected world. Analysis of the significant trends impacting the intersection of technology and healthcare points to the need for a hybrid solution that represents all of the functionality of a traditional patient portal combined with a single comprehensive longitudinal personal health record that enables the aggregation, harmonization, and curation of data from multiple sources and devices, with granular controls for information sharing. For simplicity, this new hybrid 'Personal Health Portal' should be imagined as a patient-centric repository that provides a robust set of tools and features that harnesses the best of breed design and technology advances. In addition to the implications provided earlier, the four lenses below more broadly summarize this vision.

### **3.1 Architecture**

The Personal Health Portal will represent a patient-centric information hub, with the ability to automatically aggregate, store, harmonize, and curate data from a wide variety of sources (including multiple organizational EHRs, discrete data from other care settings, genomics, biometric data, and PGHD) to create a rich and comprehensive longitudinal personal health history. Smart analytics and AI-enabled tools will transform and contextualize data into predictive insights that will enable personalized care and precision medicine. Sophisticated privacy and security controls will provide robust information protection and enable granular preferences for enabling proxy access and patient-driven information sharing, based on individual preferences. The Personal Health Portal will be portable, mobile, automated and

integrated, offering an optimal consistent experience across multiple methods of access (e.g., smartphone, tablet, desktop computer). Application Networks will enable APIs to function as reusable assets that can be combined to support multiple patient use case scenarios, clinical workflow and business process automation.

### **3.2 Design and Content**

A strategic approach to user-centered design will optimize the Personal Health Portal for various population segments and cohorts to address their specific needs with best of breed design, easy to use navigation, intuitive interfaces, engaging content, and complementary supporting tools. Instead of 'one size fits all,' the Personal Health Portal will support personalization, customization, and tailoring to align with a patient's specific needs and preferences. Novel methods for visualization and information display will support trend analysis and predictive insights, enhancing patient activation and health literacy. Content will be carefully designed and curated to maximize value to the patient user and enable content tailoring, for example providing a set of pre-operative and post-operative instructions that takes into account patient variables such as demographics, health literacy, comorbidities, and social determinants of health.

### **3.3 Functionality**

The Personal Health Portal will provide a robust set of well-designed online tools and functions that offer convenience, enhance access, promote physical and mental wellness, and enable effective chronic disease management. Beyond the ability to view, download, and transmit personal health data, this new breed of portal will also leverage AI and machine learning to contextualize data to provide intelligent personalized guidance and health coaching

to support behaviour change. The portal will support remote patient monitoring and offer asynchronous and synchronous communication tools to encourage patients to more effectively manage their conditions and seek appropriate treatment as needed, and will seamlessly connect them to multiple treatment options (e.g., virtual chat and telemedicine).

### **3.4 Integration**

Organizations will take a more holistic approach to patient relationship management and align and integrate the Personal Health Portal with administrative and clinical care management processes and structures. This will create a foundation for improved efficiency and enhance both the quality of care and the patient experience. The portal will offer a variety of integrated tools that comprise the patient journey along the trajectory of care, from medication reconciliation to concordance with a personalized treatment plan; from arranging a virtual care appointment to enabling preappointment activities that maximize the clinical encounter, supporting hospital discharge and avoiding readmission; providing tailored education resources and tools to connecting patients with support groups or communities focused on their specific health conditions or wellness concerns. The Personal Health Portal will support a variety of notification and reminder options that can also be integrated

within other apps and tools that consumers already use to manage their time, tasks, and information.

### **4.0 Conclusion**

While much progress has been made, a fundamental shift is needed to realize the potential benefits that PHRs and patient portals can bring to patients, their families, and caregivers. The convergence of several key trends may provide the perfect storm that will enable this critical shift. A 'Personal Health Portal' could provide a long desired single comprehensive longitudinal personal health record that enables the automated aggregation, harmonization, and curation of data from multiple sources and devices, with granular controls for information sharing. Coupled with a robust set of tools and features, this model can harness the best of breed design and technology advances emerging throughout the consumer technology industry to empower patients as they navigate their health journey. The future is promising; realizing that promise will require a steadfast focus on the patient as the very center of a multifaceted information and resource hub.

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