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Original article

Online patient portal-based management of medication renewal and refill pickup in ambulatory care settings: A retrospective utilization study at tertiary care hospital in Saudi Arabia

Shabeer Ali Thorakkattil *, Sainul Abideen Parakkal, Fatimah Abushoumi, Habib S. Nemr, Hoor Alhazza, Rita Jabbour, Fuad Al-Ghamdi

Pharmacy Services Department, Johns Hopkins Aramco Healthcare (JHAH), Saudi Arabia

ABSTRACT

Background: The prescription pickup and renewal process in ambulatory care settings requires numerous steps, such as making an appointment with a physician to renew prescriptions and direct pharmacy visits to pick up medications. This process can be difficult or cumbersome for some patients; however, digital health-associated patient portals can reduce the burden on both patients and healthcare professionals.
Methods: A retrospective study was conducted in an ambulatory care setting of Johns Hopkins Aramco Healthcare. We analyzed the utilization pattern of MyChart for medication renewal and refill pickup services for ambulatory care patients of all specialties from October 1, 2018, to September 30, 2020. The data were extracted electronically from the Epic-Hyperspace EHR system, and the effects of factors such as year of access and COVID-19 on MyChart utilization were analyzed.
Results: A total of 125,538 patients were registered using MyChart. In the first and second year of this study, MyChart was utilized by 44,063 (8.7%) and 59,622 (13.6%) patients, respectively, for medication pickup. Additionally, in these two years, 92,997 (21.6%) and 156,020 (38.9%) medication refills were requested through MyChart (with no direct pharmacy visit) and collected from different pickup locations, respectively. In two years, there were 363,159 medications sent to physicians for renewal through Epic-MyChart, of which 347,244 (95.6%) were approved and 15,915 (4.4%) were denied. A significant increasing ($p < 0.05$) trend in utilization, medication requests, and renewal requests using the MyChart were observed over a period of 24 months and during quarantine due to COVID-19. Although there was a decrease in physicians denying renewal request, these were not significantly affected by time or COVID-19.
Conclusion: The high and consistent utilization of the patient portal MyChart indicates its broad acceptance, significantly minimizing the barriers to medication pickup and renewal processes in ambulatory care settings. The year of access and COVID-19 were significantly associated with an increasing trend in MyChart utilization. With increased utilization and higher acceptability, the internet-based patient portal MyChart continues to hold great potential for providing quality healthcare services by increasing access and making patients decision-makers in their healthcare.

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1. Introduction

Effective communication between patients and healthcare providers is conducive to the delivery of high-quality healthcare (Zhou et al., 2020). In-person, telephone, and paper-based encounters are the most common ways patients and healthcare workers communicate (Quinn et al., 2019) (Abd-alrazaq et al., 2021). However, transformations in information and communications technologies

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have occurred in all sectors, including healthcare. Numerous mobile-based health applications and web platforms have been developed as a part of digital healthcare (Gopal et al., 2019). (Alami et al., 2017). Health information technology (HIT) and interactive patient portals have given patients greater decision-making power and kept them more informed than was previously possible (Ammenwerth et al., 2012). Incorporating the patient as partners in their care through HIT is the recommended solution for resolving challenges in chronic disease prevalence and minimizing treatment costs (Sheikh et al., 2015).

Handwritten communications are being upgraded to patient portal-based electronic prescriptions, which positively reflects their quality and safety (Hassol et al., 2004). The evolution of online patient portals, such as Epic-MyChart and Cerner-Healthelife, began in the 1990 s, primarily in the United States. These have grown in popularity in recent decades, paralleling the rise of social media and mobile technology (Irizarry et al., 2015).

Epic applications expanded their role in serving significant patient populations in Canada, Brazil, Ireland, the UK, the Netherlands, Denmark, and, recently, in the United Arab Emirates and Saudi Arabia ("Epic | . . .with the patient at the heart," n.d.). Patients can now access secure online healthcare information portals through their smartphones or other devices. These patient portals are integrated with patients' electronic health records (EHRs), thus lessening the amount of work for healthcare workers and patients (Sellberg and Eltes, 2017).

It has been reported that these patient portals are associated with improved medication adherence, improved chronic disease management, better patient-provider communication, adequate office visit time, and greater satisfaction with the provided care (Kruse et al., 2015a). (Kruse et al., 2015b). Patient portals allow for meaningful interactions between patients and healthcare providers and deliver healthier outcomes (Lockhart et al., 2019). Other significant advantages of patient portals include increased efficiency, improved health information tracking, records of provider communications, better collaboration, enhanced trust in providers, and heightened engagement (Elers et al., 2018). Healthcare systems put significant resources into tools such as patient portals to help patients become more actively involved in their care and, eventually, experience improved clinical or health outcomes (Sieck et al., 2018).

In particular, the medication renewal and refill phases in ambulatory care involve several barriers. It is difficult for patients to keep track of their active medications and refill their availability in traditional scenarios. The most challenging aspect is that patients who do not have any refills are often unable to readily contact their physician to have their prescriptions reissued. Medication refill pickup from the pharmacy can involve significant effort, including travel to the pharmacy and long waiting times, especially in a busy hospital or pharmacy. However, MyChart is a highly beneficial patient portal that can overcome these challenges. Some MyChart utilization studies have been published in different areas, such as symptom reporting in cancer patients, joint arthroplasty emergency department visits and readmissions, and quality of life measurement in patients with inflammatory bowel disease patients (Zylla et al., 2020). (Reich et al., 2019).(Plate et al., 2019). However, to our knowledge, medication renewal and refill pickup through MyChart in ambulatory care settings are not well documented in the literature. We believe there is an urgent need to raise the healthcare industry's attention to its serviceability and helpful digital health in ambulatory care settings. Hence, we attempted to analyze the utilization and effectiveness of MyChart for medication renewal and refill pickup in an ambulatory care setting of a multi-specialty tertiary care hospital in Saudi Arabia (see Table 1).

Table 1

Descriptive statistics of medication renewal and pickup through MyChart and refill pickup by pharmacy visit. The mean and standard deviations were calculated monthly using 24 months of the total study period.

Particulars (Monthly Data)	Mean	SD.
Pharmacy visited patients	35,241	7464.57
MyChart utilized patients	4320	1529.06
Refill medications processed through MyChart and dispensed at collection sites	10,376	5700.15
Refill medications dispensed at Pharmacy	27,306	2251.62
Medications renewal request sent to Physician through MyChart	15,132	2995.5
MyChart renewal request denied	663	134.51

Note: Number of medications used in the study did not confuse the number of prescriptions. The numbers presented are number of medications and are not the number of prescriptions.

2. Methods

2.1. Epic MyChart patient portal

MyChart is an integrated patient portal of EHR Epic that allows patients to access their medical records and enables secure communication between patients and healthcare providers. Patients can access MyChart through a desktop or mobile application. An important feature of MyChart is its 24/7 secure, personalized accessibility, which eliminates the need to reach the physician's office to renew prescriptions and visit a pharmacy to pick up their medications (especially refills). The benefits and functions include scheduling medical appointments, viewing lab test results, requesting prescription refills and renewal, communicating securely with clinicians, viewing health summaries, viewing and printing immunization records, and receiving health reminders for preventive screenings and immunizations ("About MyChart | MyChart," n.d.) ("MyChart - Login Page," MyChart-Login Page, n.d.).

2.2. MyChart process for medication renewal and refill pickup at Johns Hopkins Aramco healthcare

Patients can request medication refills and renewals through MyChart. In the case of refill pickup, the request reaches the pharmacy and appears under the ambulatory care pharmacy Epic Willow MyChart workflow. The pharmacist verifies and fills the prescriptions and sends them to the selected collection locations. Johns Hopkins Aramco Healthcare (JHAH) offers location-specific medication pickup services to our patients through 25 pickup locations across different geographic regions of Saudi Arabia. Patients can request their medication through MyChart as home delivery or pick from the drive-through pharmacy or other available pickup locations at any time of the day from anywhere, provided an Internet connection is present, as discussed in our previous work (Thorakkattil et al., 2021). (AlAbbasi et al., 2021) The request is prepared for collection on the next business day. If there is no refill available, the request automatically goes to the patient's physician for review and renewal. The physician-approved prescriptions are then returned to the pharmacy for processing. Physicians may deny renewal requests in situations where direct patient examination is warranted. The workflow of MyChart for medication refill and renewal requests in our setting is illustrated in Fig. 1 ("Pharmacy and laboratory services | Johns Hopkins Aramco Healthcare," n.d.).

2.3. Ethical consideration

This study was performed after obtaining ethical approval from the National Committee of Bio Ethics#H-05-DH-044 (IRB # 20–51).
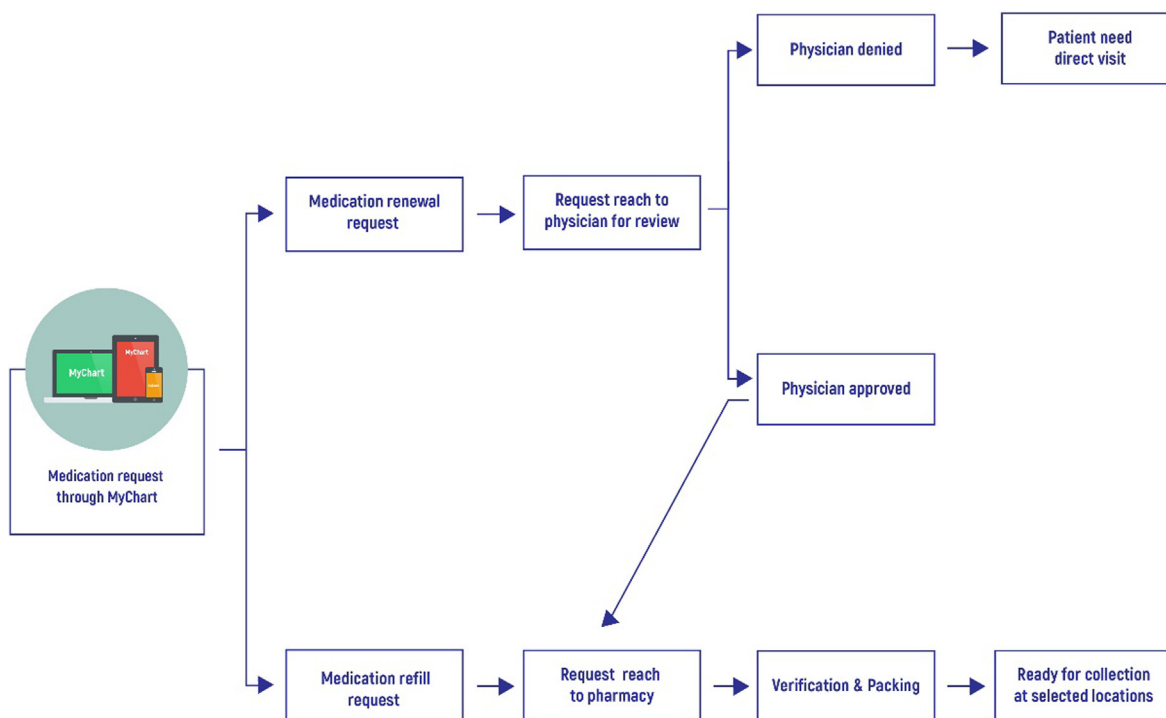
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Fig. 1. The flow chart of the MyChart process for medication refill and renewal requests at JHAH.

The study did not require informed consent because the design was retrospective in nature.

2.4. Study design, settings, and participants

A retrospective study was conducted in an ambulatory care setting at Johns Hopkins Aramco Healthcare (JHAH), Dhahran, Saudi Arabia. The utilization pattern of Epic-MyChart for medication renewal and refill pickup services by patients was reviewed from October 1, 2018, to September 30, 2020. The data were extracted electronically from the Epic hyperspace EHR system. The study population consisted of ambulatory care patients of all specialties at JHAH. This includes the eligible employees and dependents of Saudi Aramco, JHAH, and other patients covering treatment eligibility with JHAH. However, patients who were hospitalized for any medical condition were excluded from the study.

2.5. Data collection and variables

Multiple data were electronically retrieved, which included the number of patients who visited the ambulatory care pharmacy to collect their medications; the number of patients who utilized MyChart to collect their medications from different pickup locations, the number of refill medications dispensed through MyChart, the number of refill medications dispensed through direct pharmacy visits, the number of medications sent to physicians for renewal through MyChart, and the number of medication renewal requests denied by physicians that are sent through MyChart.

2.6. Statistical analysis

The data were retrieved from Epic Hyperspace monthly for the total study period of 24 months, pooled into Microsoft Excel, and analyzed using SPSS Version 26.0 (IBM SPSS Inc., Chicago, IL, USA)("SPSS Statistics 26.0 Fix Pack 1," 2021). Descriptive statistics were used, and data were expressed as frequencies and percent-

ages. We calculated the mean and standard deviation of patients who visited the pharmacy, utilized MyChart, medications processed through MyChart, medication dispensed at the pharmacy, MyChart renewal requests sent to physicians for renewal, and MyChart renewal requests denied by physicians. In addition, a comparative analysis was used to analyze the effect of year of access (2018, 2019, and 2020) and COVID-19 (Non-COVID vs. COVID-19) through ANOVA and an unpaired t-test, respectively. March 2020 was considered as a cut-off for COVID parameters, since the first case of COVID-19 was reported on March 2, 2020, in Saudi Arabia. A probability of less than 0.05 was considered to be significant.

3. Results

3.1. MyChart active status based on the age of the patient population

At JHAH, a total of 1,25,538 patients were registered and had an active status for using the MyChart patient portal. Children under 12 years represented 21% of patients, 9% were adolescents (12–18 years), 59% were adults (18–60 years), and 11% were senior adults (60 years and above).

3.2. Overview of study results

Over the 24-month study period, the number of patients who visited the pharmacy was on a monthly average, 34241 ± 7464 [SD]. MyChart was utilized by patients on a monthly average of 4320 [SD 1529.06]. The monthly average number of medications refilled at the pharmacy without using MyChart was 27306 ± 2251.62 [SD], whereas the monthly MyChart utilization for medication refill and dispensed at different pickup locations was, on average, 10376 ± 5700.15 [SD] medications. The average number of medications sent to physicians for renewal through MyChart per month was 15132 ± 2995.50 [SD]. The denial rate

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was negligible and applied to a monthly average of 663 ± 134.51 [SD] medications.

3.3. Pattern of medication refilling through MyChart and by direct pharmacy visit

In a total study period of two years, 948,927 patients utilized pharmacy services for refill pickup through MyChart or directly visited the pharmacy. In the first year (October 1, 2018, to 30 September 2019), out of 509,127 patients, 465,064 patients visited the pharmacy, and 44,063 patients depended on MyChart to refill their medications. Of the 42,990 medication refills, 92,997 were through MyChart and 336,923 were through direct visits to the pharmacy. In the second year (1 October 2019 to 30 September 2020), out of 439,800 total patients, 59,622 patients used MyChart, and 380,178 patients directly visited the pharmacy for refill pre-scription pickup. In the first year, 8.7% of the total patients used MyChart, which increased to 13.6% in the subsequent year. The number of refill medications through MyChart was 92,997 in the first year and 156,020 in the second year, representing 21.6% and 32.9% of the total refills, respectively (Fig. 2).

3.4. Pattern of medication renewal through MyChart

In the study period, a total of 363,159 medications were sent through MyChart to a physician for renewal: 44.2% of refill requests were sent in the first year and 55.8% in the second year. The renewal request denial rate through the MyChart was only 5.4% in the first year (October 1, 2018, to September 30, 2019) and 3.6% in the second year of the study (October 1, 2019, to September 30, 2020) (Fig. 3).

3.5. Monthly utilization of MyChart Vs. Pharmacy for medication management

Based on 24 months of study data, we observed a decrease in the number of patients who depended on the pharmacy to collect their medications. The number of medications dispensed at the pharmacy also decreased. Over the study period, a drastic increase in MyChart utilization was observed in the number of patients and medications. A positive trend in MyChart use and a negative trend in pharmacy visits were observed. In addition, a positive trend was observed in medication renewal using MyChart, while the request denial rate decreased (Fig. 4). In March and April 2020, when COVID-19 was first reported in Saudi Arabia, 7448 and 9130 patients used MyChart, respectively. The number of medications requested through MyChart and collected from different pickup locations was 22,019 and 30,508 in March and April 2020, respectively, where the medication filled at the pharmacy was 25,638 and 26,633, respectively. Likewise, the number of medications sent to physicians for renewal was 18,752 and 22,970 in the same month (Fig. 4).

3.6. Factors affecting the MyChart utilization

3.6.1. Year of access
The year-wise distribution of MyChart application use revealed a significant increase in terms of average MyChart utilization
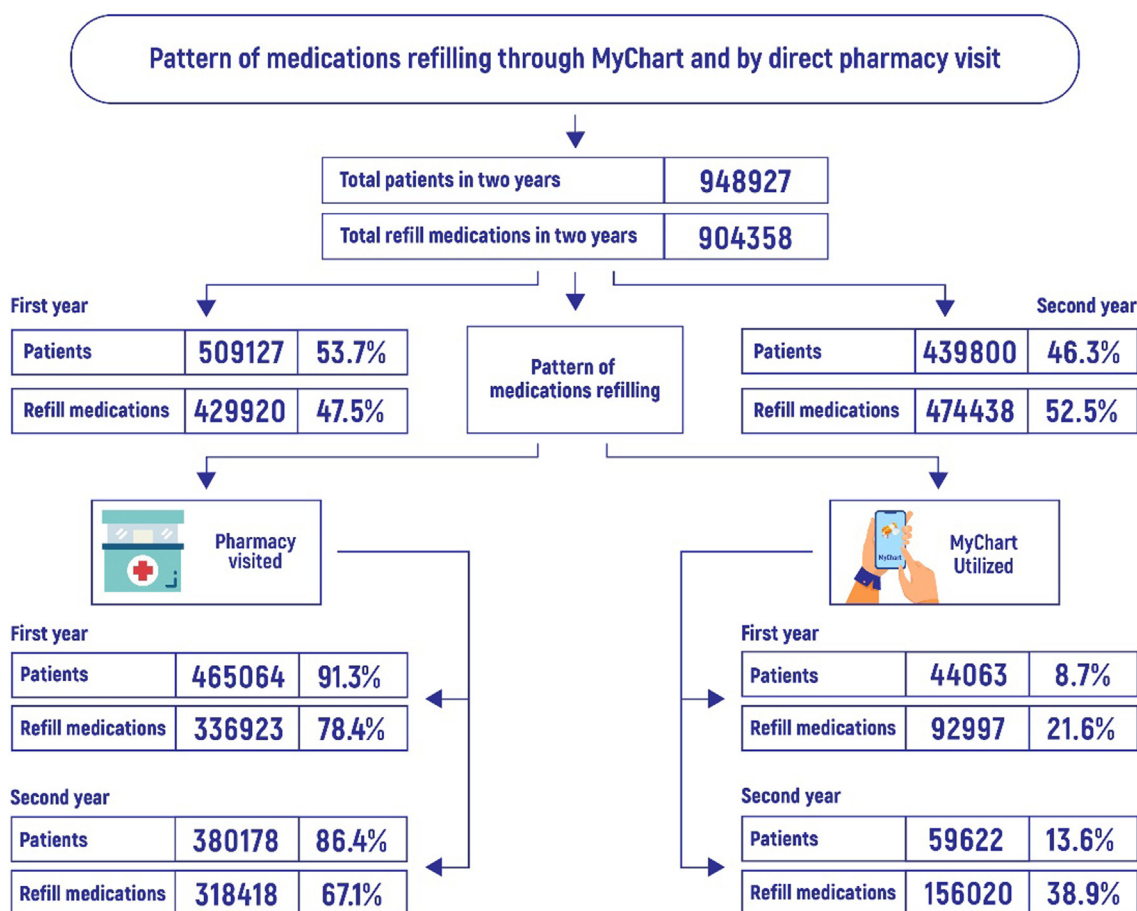

Fig. 2. Flowchart of yearly based (first year, 1 October 2018 to 30 September 2019; second year, 1 October 2019 to 30 September 2020) utilization pattern of MyChart Vs. pharmacy for medication pickup.
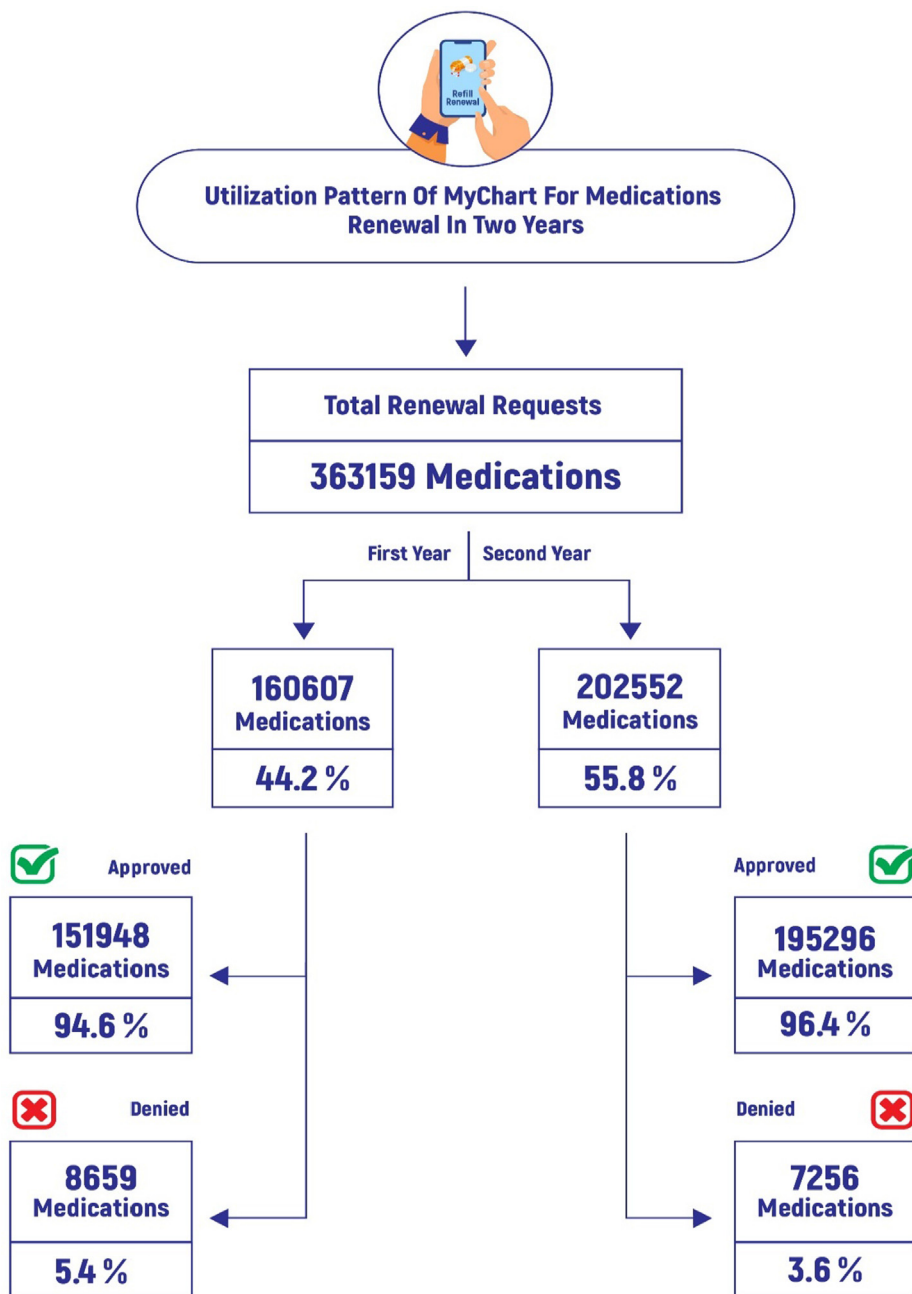
Fig. 3. Flowchart of yearly-based patient's use of MyChart for medication renewal by sending a request to physicians without vising the hospital and subsequent approval and denial rates.

(p = 0.043), average medications requested through MyChart (p = 0.017), and average medication renewal through MyChart (p = 0.001). Although there was a decrease in physician denial on the average medication requested through MyChart, it was not significant (p = 0.451) (Table 2).

3.6.2. Effect of COVID-19

COVID-19 significantly affected patient use of MyChart. There was a significant increase in average MyChart utilization (p = 0.002), average medication request through MyChart (p = 0.000), and average medication renewal through MyChart (p = 0.000) during COVID-19 compared to the non-COVID period. Although there was a decrease in the average MyChart renewal request denied

by physicians, it was insignificant (p = 0.527). The effects of COVID-19 on MyChart utilization are shown in Table 3.

4. Discussion

A phase of transformation was observed in the medication management process from traditional systems to digital health technologies, such as using the EHR-integrated MyChart patient portal. Here, we report a high MyChart utilization rate and consistency in its use. Since this study was conducted using a relatively large population for an extended period, the results obtained provide an exceptional model for other institutions to implement a system similar to MyChart and create a patient-centered culture of healthcare delivery. Patients, especially those who are chroni-
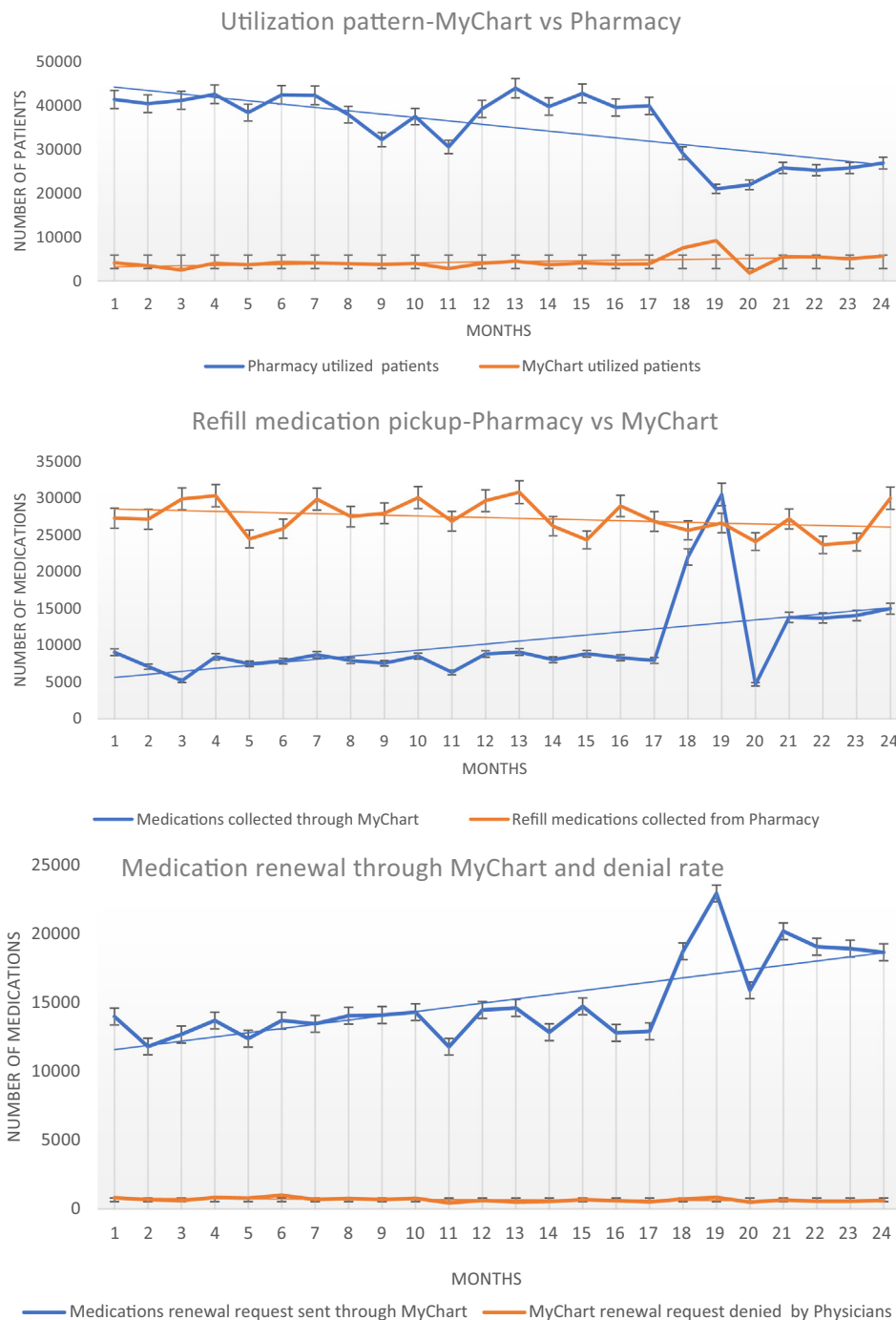
Fig. 4. Trends in patients' preferences of MyChart vs. pharmacy to collect their medications in terms of the number of patients and medications. Moreover, the medications renewal request sent to physicians for approval and subsequent denial rate are also presented (Months from October 2018 to September 2020).

Table 2
Year of access on MyChart utilization.

Variable	2018 (Mean ± SD)	2019 (Mean ± SD)	2020 (Mean ± SD)	p-value
MyChart utilization (Patients)	3306 ± 821.36	3855.16 ± 415.44	5278.33 ± 2138.44	0.043
Medication request through MyChart	7117.33 ± 1934.56	8136 ± 780.73	14448.11 ± 7840.74	0.017
Medication renewal through MyChart	12840.67 ± 1096.58	13693.67 ± 921.91	17812.56 ± 3342.54	0.001
MyChart renewal request denied by Physicians	697.33 ± 103.74	688.92 ± 155.33	617.33 ± 111.15	0.451

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Table 3
Effect of COVID-19 on MyChart utilization.

Variable	Non-COVID (Mean ± SD)	COVID (Mean ± SD)	p-value
MyChart utilization (Patients)	3753 ± 498.79	5697.71 ± 2274.55	0.002
Medication request through MyChart	7955.05 ± 1025.01	16254.43 ± 8051.61	0.000
Medication renewal through MyChart	13446.06 ± 944.18	19225.14 ± 2102.31	0.000
MyChart renewal request denied by Physicians	674.59 ± 142.36	635.28 ± 138.44	0.527

cally ill, benefit significantly from having access to a hassle-free medication management, renewal, and refill process through applications such as MyChart, which can bypass the lengthy in-person appointment process.

Numerous studies have evaluated the Epic-MyChart electronic patient portal since its development. However, this is first study to focus on MyChart use for refill pickup and renewal. We observed a higher usage among the adult population than among children and senior adults. This may be due to less disease prevalence in children and a lack of knowledge among seniors regarding the utilization of MyChart. Now, JHAH patients will be able to securely log in and access their medical records at their convenience in-app and desktop versions.

The significant finding of our study was the high acceptance and utilization of MyChart in the medication refill pickup process. Although the number of patients in the second year was less than that in the first year of study, the percentage of patients who visited the pharmacy decreased in the second year, while the MyChart utilized patients increased. Likewise, the medication refill pickup through MyChart increased considerably in the second year, resulting in a massive decrease in medication pickups by directly visiting the pharmacy. This reflects the transition of patients' preferences from usual practice to digital technology. Comparing patients who visited the pharmacy with those who used MyChart will not provide an accurate comparison because the chance of using MyChart is negligible in acute and emergency cases. A good alternative is to compare medications refilled via MyChart with those refilled at the pharmacy because app use is more prevalent in refill cases (Fig. 4). In monthly data analysis, this study revealed an unprecedented hike in MyChart utilization in March and April 2020, during which COVID-19 was first reported in Saudi Arabia (الصحة, n.d.). In April 2020, the number of medications requested through MyChart and collected at selected pickup locations was more than the refill medications dispensed to patients at the pharmacy, and it was almost equal in March 2020 (Fig. 4).

Another intriguing application of MyChart is the ability to renew prescriptions for chronic diseases by making requests to the treating physician without visiting the hospital. In addition, it is highly cost-effective and time-saving. A comparative study reported that the average Internet physician consultation charged $55 (Bloom and Iannacone, 2006). A study in China reported that the web-based medical consultation fee for physicians is an average of $5 (Li et al., 2019). However, refill renewal through MyChart is cheaper in terms of time and consultation fees as the physician does not see the patients face-to-face, thereby avoiding extra financial burden on organizations or patients. For JHAH, a Planetree International gold-certified institute for excellence in person-centered care, ("Person-Centered Care Certification | Johns Hopkins Aramco Healthcare," n.d.) MyChart's services have contributed significantly towards creating a person-centered care model. The percentage of renewal requests sent through MyChart increased in the second year, indicating that the app became familiar and that more patients

began to make use of it. The denial rate was negligible, and denial primarily occurred in situations when the physicians wanted to see patients in person due to a lack of lab reports, titrate doses, or therapy modification. Through internal policies, healthcare quality is significantly preserved, such as blocking renewal requests through MyChart of acute care medications such as analgesics, antihistamines, antibiotics, and chemo- and high-alert medications.

However, some studies have found that the use of electronic patient portals is unsatisfactory (Ancker et al., 2011) (Cotten, 2001) (Grant et al., 2006). Maintaining patients as active users is the largest challenge in portal use. A review (Ancker et al., 2011) reported that among the 60% of patients who had signed up to use the portal, only half of them had used it twice or more in a 2-year study period. In a 1-year retrospective study in the United States, published in 2016, among the underserved population on adaptation and utilization of Epic's MyChart patient portal, only 29% accessed the portal and 6% logged in two or more times (Wallace et al., 2016). JHAH succeeded in keeping their patients active, as the study shows that utilization rates increased in the second year of the study. Furthermore, the availability of several medication pickup locations in different parts of the kingdom facilitated the high utilization of MyChart in medication refill requests.

This study offers a credible understanding of utilization aspects of electronic health records integrated with the patient portal Epic-MyChart in the healthcare system, particularly in ambulatory care settings, and its correlation with enhanced patient engagement in their healthcare, in which accessibility and ease of the digital design play a pivotal role in creating a better patient-centered care model.

The findings of our study are relatively more reliable because prior studies have generally been based on a single homogenous population. Our study of the Saudi Aramco and Johns Hopkins Aramco healthcare communities covers diverse patients from different parts of the world and includes a relatively large number of patients over a longer study period. This study offers concrete evidence that MyChart may simplify the difficulties in the medication management process of outpatients.

Moreover, our study indicates a significant increase in MyChart utilization, medication requests, and renewal requests using the MyChart portal, projecting the wide acceptability of the system in our population. Moreover, a decreasing trend was observed in the physician denying the medication renewal request through MyChart, which is a good sign of going forward. The additional finding is the efficiency of the MyChart portal during the unanticipated and demanding pandemic COVID-19. Hence, the system was observed to be adaptable to any condition.

While MyChart has many benefits, we observed a few limitations in MyChart services. The primary issue was that patients failed to pick up their medications after making a request through MyChart. Patient no-shows at the specified pickup locations created an additional workflow burden on the pharmacy. It is also easy to request unwanted renewals on MyChart, such as renewal requisition for medications that are not therapeutically necessary for the patient. In the future, the proficiency of MyChart interactivity may be optimized by enforcement of internal barriers that prevent the request of medication to be renewed in the event of inadequate laboratory results and preclude the need for medications requiring further medical assessments. Further research, such as individual patient-based studies, concerns about polypharmacy, or surveys about MyChart, are required to better explain the success of its use. Furthermore, our study used an advanced and well-developed population, and our findings may not be generalizable to all other populations.

5. Conclusion

Our study indicates wide acceptability and utilization of Epic-MyChart among patients for medication renewal and refills pickup in the ambulatory care setting. Moreover, there has been a significant increasing trend in its use over time and due to the COVID-19 pandemic. MyChart allows physicians and patients to have timely access to medical records and to easily communicate. With increased utilization and higher acceptability, the internet-based patient portal continues to have great potential for providing quality healthcare services by increasing access and keeping patients in control of their healthcare.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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