

Impact of Patient Portal Messaging Reminders with Self-Scheduling Option on Influenza Vaccination Rates: a Prospective, Randomized Trial



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BACKGROUND: Patient portal messages have been used in a variety of ways to facilitate improved communication between provider and patient. These platforms have shown promise in many ways for improving various health outcomes and overall communication between patient and provider.

OBJECTIVE: Assess the impact of automated portal reminder messages and self-scheduling options on increasing rates of annual influenza vaccination.

DESIGN: This is a prospective, randomized, controlled study.

PARTICIPANTS: All patients who receive their primary care through an ambulatory primary care clinic at a large, multidisciplinary, academic health center.

INTERVENTIONS: One group of patients received a portal message reminder to undergo influenza vaccination. A second group received the same message with instructions to self-schedule the vaccination appointment. A third group received no portal message (control).

MAIN MEASURES: Rates of influenza vaccination in each group for previously unvaccinated patients in the 2019–2020 influenza season.

KEY RESULTS: For the group receiving the message with self-scheduling option ($n=5408$), the in-study vaccination rate was significantly greater than the group receiving no message ($n=5621$) (15.7% vs. 13.5%; $p=0.002$). For the group receiving a message alone (without self-scheduling) ($n=5699$), the in-study vaccination rate was significantly greater than the group receiving no message (15.1% vs. 13.5%; $p=0.01$). There was no significant difference in vaccination rate between the two intervention groups receiving messages (15.7% vs. 15.1%; $p=0.549$).

CONCLUSIONS: Portal messaging reminders increase annual influenza vaccination rates, but the addition of a self-scheduling option did not further increase rates.

KEY WORDS: vaccination patient portal messaging influenza

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INTRODUCTION

Influenza infection causes significant morbidity and mortality worldwide¹. Furthermore, the healthcare and societal costs associated with influenza are significant; poorly controlled annual epidemics account for over 600,000 life-years lost, average annual direct medical costs of over \$10 billion, and a total annual economic burden of \$87 billion². Due to rapid mutation and thereby significant variability in the antigenic and virulence profiles of influenza strains year-to-year, the Center for Disease Control (CDC) continues to recommend annual influenza vaccination for all persons ≥ 6 months of age³. Multiple studies have demonstrated the effectiveness of annual influenza vaccination in lowering overall mortality rates^{4,5}, as well as a significant impact on healthcare and societal costs^{6–8}.

Because of the COVID-19 pandemic, strategies to improve influenza vaccination rates have become increasingly important as some data shows a correlation between influenza vaccination and reduced severity of COVID infection^{9,10}. Additionally, influenza vaccination strategies are applied to COVID-19 vaccination campaigns with increasing frequency¹¹. Most pertinently, both the medical literature and the news media recognize heterogeneity in COVID-19 vaccine distribution and access mechanisms^{12,13}. More efficient scheduling systems are even shepherding patients across state lines for earlier vaccine access¹⁴. Now, in the face of a pandemic, efficient systems are necessary to maximize vaccine rates for both COVID-19 and influenza.

Despite the positive impacts of mass vaccination, large proportions of the population go unvaccinated every year, including more than 50% of the US adult population in the 2018–2019 flu season¹⁵. Various methods have been proposed, studied, and/or implemented to combat this with varying degrees of success. Hospitalized patients are often offered influenza vaccination during their hospital stay¹⁶. Redistribution of influenza vaccine campaigning to healthcare staff beyond physicians, such as pharmacists and nurses, has been another tactic^{17,18}.

Increasing patient awareness to flu season and scheduled reminders sent directly to patients have been an ongoing effort for decades, going back to the use of postcard reminders sent to patients' homes¹⁹. Since the advent of the internet, many electronic health records (EHRs) have incorporated digital

communication modalities akin to email and text messaging, so now more than ever there is a direct pathway for communication between providers and their patients. Unsurprisingly, the use of these messaging platforms, often colloquially termed a “patient portal” or something similar, has led to improved compliance in many facets of primary care²⁰. Furthermore, multiple studies have shown good results in improving vaccination rates in ambulatory primary care clinics by sending reminders directly to patients via their portals^{20–24}.

While these digital reminders show great promise in increasing annual vaccination rates, there continues to be room for improvement. The US Department of Health and Human Services targets 80% vaccination rate for the general population, so the vaccination rate cited above for 2018–2019, as well as every year prior, falls far short of this goal²⁵. While ongoing patient education and community outreach will remain cornerstones of this effort, exploring the capabilities and spreading the use of these patient portal messages appears to be a meaningful way to increase vaccine compliance.

METHODS

Trial Design

We present a prospective, randomized, controlled trial assessing the impact of a self-scheduling option when added to patient portal reminders regarding influenza vaccination. While previous studies have demonstrated increased rates using portal message reminders, to our knowledge, this is the first study to examine the effect of incorporating a self-scheduling option to the reminders. This study was approved by the Institutional Review Board.

Participants and Randomization

Study participants were selected from patients receiving primary care at an ambulatory internal medicine clinic in a multispecialty, academic medical center in October 2019. Inclusion criterion was patient empanelment to one of the 50 primary care providers in the clinic, which included staff physicians, resident physicians, and advanced practice providers. Exclusion criterion was absence of a patient portal account. Randomization was based on the first letter of the participant’s last name. Three groups of approximately equal size were created and subsequent analysis confirmed no statistical differences in either demographics or comorbidities between the groups. Group 1, patients whose last name began with a letter from A through G, received a series of up to three portal reminders with a self-scheduling option. The self-scheduling option included a link to a web interface where the patient could schedule an appointment online, without contacting the care team. Group 2, patients whose last name began with a letter from H through O, received a series of up to three reminders that did not include a self-scheduling option. Group 3, patients whose last name began with a letter from P

through Z, served as a control and received no reminders. Following the initial reminders in mid-October, only subjects without evidence of influenza vaccination received the second and third reminders in late October and early November.

Vaccination Status

Vaccination status was assessed at the beginning of the study (10/25/2019) and at the end of the study (4/22/2020) using a built-in EHR tool. The EHR tool identified patients who had received vaccination in one of three different manners: (1) Administration of vaccine at the study clinic, (2) Patient report (during routine care, not as part of this study) of administration of vaccine at an external facility, and (3) Reconciliation of health information exchange data reporting vaccination at an external facility.

Outcome

The primary outcome in this study was receipt of influenza vaccination during the study period.

Statistical Analysis

Two sample t-tests and chi-squared testing with Fisher’s exact test of difference were used to explore baseline demographic data and notable comorbidities between the three groups to ensure appropriate randomization. The proportions of each group that received vaccination were tabulated, and these proportions were tested for significant difference using chi-squared contingency table testing. All statistical analysis was performed using XLStat (Addinsoft, Paris, France) with $p \leq 0.05$ being considered significant. Patients no longer receiving primary care at the study clinic were included in the final analysis based on the intention to treat principle.

RESULTS

Primary Analysis

We identified 19,344 patients who received primary care at the clinic and excluded 2616 patients (13.5%) who did not use the patient portal. The remaining 16,728 patients (86.5%) were randomized to three study groups (Fig. 1). In general, study population consisted of patients who were Caucasian, employed, and insured. Demographic data was compared to assess randomization and there was no statistical difference in baseline characteristics and examined comorbidities between the groups (Table 1).

Patients who had received influenza vaccination prior to initiation of the study were excluded from primary analysis. Because the study was initiated in mid-October, many patients (27.8%) had already received vaccination at a retail pharmacy; not including these patients in analysis better isolates the direct impact of messaging patients who remained candidates for vaccination at the time of initial intervention.

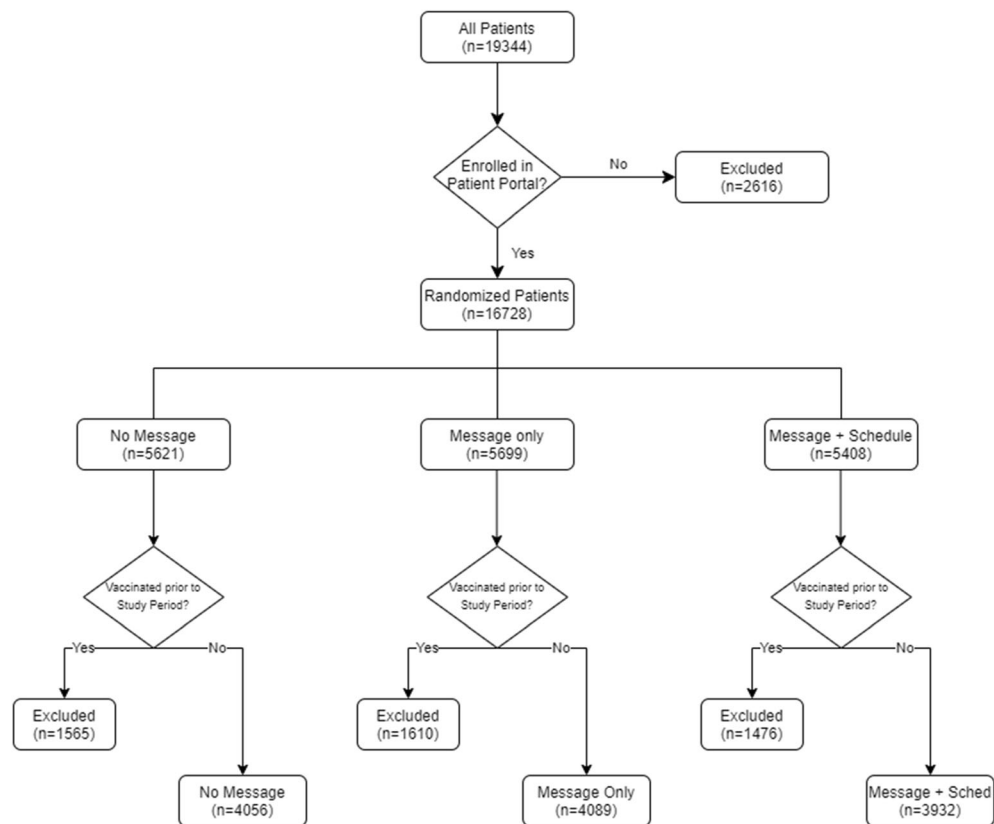


Figure 1 Inclusion criteria and randomization diagram.

The total 2019–2020 influenza season vaccination rates (including those vaccinated prior to and within the study period) for the three groups were as follows: Group 1=43.0%, Group 2=43.4%, Group 3=41.4% (Table 2). For the primary endpoint of this study, the percentages of unvaccinated (i.e., vaccine-eligible) subjects who received vaccination during the study period were: Group 1=15.7%, Group 2=15.1%, Group 3=13.5%. A significantly larger proportion of vaccine-eligible patients in group 1 received vaccination during

the study period compared to control group 3 ($p=0.01$) as well as group 2 compared to control group 3 ($p=0.002$); there was no significant difference between vaccination rates in the study period between the two intervention groups, groups 1 and 2 ($p=0.549$). We recognize that these observed vaccination rates very likely underrepresent the true vaccination rate due to patient underreporting to our facility, external facility underreporting to the state database, and unreconciled information in our EHR, due to the manual nature of the reconciliation process.

Table 1 Characteristics and Prevalence of Comorbidities in Study Groups^a

Characteristic	All patients (n=16728)	Control		Intervention		p value
		No message (n=5621)	Message alone (n=5699)	Message + scheduling (n=5408)		
Age-median (years)	62.3	62.4	62.5	62.0		0.506
Female (%)	52.4	51.9	52.3	53.0		0.544
BMI-median (kg/m ²)	26.9	26.9	26.9	26.9		0.628
Smoking status (%)						0.700
Never smoker	60.0	60.0	59.8	60.1		
Former smoker	30.6	30.7	31.1	30.1		
Current smoker	4.0	4.0	3.7	4.1		
Not on file	5.4	5.3	5.4	5.5		
COPD (%)	1.7	1.5	1.7	1.9		0.429
Hypertension (%)	33.9	34.2	33.5	33.9		0.675
CHF (%)	1.8	1.8	1.7	1.9		0.716
CAD (%)	11.2	11.1	11.8	10.7		0.222
CKD (%)	4.6	4.9	4.5	4.3		0.327
Liver disease (%)	4.8	4.5	4.8	5.0		0.453

^aCOPD, chronic obstructive pulmonary disease; CHF, congestive heart failure; CAD, coronary artery disease; CKD, chronic kidney disease

Table 2 Vaccination Rates of Control and Intervention Groups in Study Period

	No Message (n=5621)	Message alone (n=5699)	Message + Scheduling (n=5408)
Vaccinated during study period (%)	13.5	15.1	15.7
Chi-squared <i>p</i> -value compared to control		0.01	0.002
Chi-squared <i>p</i> -value compared between intervention groups			0.549
Vaccinated prior to study (%)	29.5	28.3	25.7
Total Vaccinated (%)	43.0	43.4	41.4

DISCUSSION

This study adds to the existing evidence that use of a patient portal increases influenza vaccination rates in primary care^{20,24}. As increased numbers of practices continue to adopt these technologies, providing more direct communication pathways between patient and provider, they create an ideal opportunity for increasing vaccination rates overall. Specifically for influenza, hopefully these efforts will assist in pushing the population as a whole towards the aforementioned vaccination goals²⁵. Because of the variance in COVID-19 vaccine rollout strategies across the nation, extrapolating patient portal use to COVID-19 vaccination might be even more effective than when applied to influenza vaccination¹⁴.

Importantly, our study did not demonstrate our primary hypothesis, that the addition of a self-scheduling option to a reminder message would increase vaccination rates more than a message alone. We believe one of the major reasons for this outcome is earlier and more widely available influenza vaccination in the community, partially evidenced by the 27.8% pre-study vaccination rate. Retail pharmacies frequently begin advertising for flu vaccinations as early as July, while our clinic typically does not receive a supply of vaccine until September. Additionally, patients can receive the vaccine without an appointment, even more convenient than self-scheduling. Due to the ubiquitous nature of retail pharmacies, most patients will live closer to a retail pharmacy than their primary care clinics. The role of these pharmacies in increasing vaccination rates has been well documented in individual studies as well as systematic review²⁶.

Furthermore, there remains significant opportunity to “customize” the way these portals are used to reach and impact patients. Some studies have looked at methods to target “high use” portal uses in particular²⁴. Other studies, not specific to vaccines, have explored the integration of checklists and delivery of personalized educational materials based on specific patient comorbidities to the portal in an effort to promote individual positive patient outcomes²⁷.

As with non-medical smartphone applications, there will always be opportunities and related psychological factors that can be studied to improve patient portal usage rates and efficacy^{28,29}. One such suggestion would be to create patient portal checklists containing age and gender-specific health maintenance items sent directly to the patient that they can “check off” when completed. A variety of positive reinforcement techniques could be applied to this setting and these are well known to commercial smartphone application developers. Another option would be geotracking-related reminders that create a smartphone reminder to encourage a patient to request vaccination when they are connected to clinic Wi-Fi network, thus using the patient’s physical presence in a clinic to prompt a timely reminder.

This study does suffer from certain limitations. Firstly, the patient population in this study skews towards more affluent patients with possibly higher health literacy, financial means, and access to smartphones, personal computers, and adequate insurance coverage. Our findings may not hold as true or be as applicable to the general population which may encompass more patients without electronic devices or insurance, in particular lower socioeconomic status.

Health equity and improving vaccination rates in underserved communities is an omnipresent topic in health maintenance and merits its own discussion. Many epidemiologic studies attempt to ascertain the underlying cause for the association between lower socioeconomic status (SES) and lower vaccination rates^{30,31}. Limited data suggests that misconceptions about undisclosed vaccine ingredients may play a role³¹. Lack of health insurance also correlates with lower rates of vaccination; however, confounding variables in this setting make this difficult to interpret³⁰.

Some populations can be especially challenging to reach with vaccination education and medical care overall, with one example being homeless patients. Pertinent to our study, populations such as the homeless who are less likely to present for routine, preventative medical care are even less likely to have

access to a personal computer or smartphone, and thus a patient portal. As mentioned above, the idea of opportunistic vaccination when patients present to the hospital for other reasons has been a well-known and successful methodology for some time¹⁶. Furthermore, the use of student-run free clinics and other clinics that actively provide outreach into the local community represent another avenue for improving vaccination rates in homeless and low socioeconomic populations, however further study is needed³². Some of these clinics are held within soup kitchens or other locations at which patients can be approached regarding vaccination when they otherwise would not present in a healthcare setting³³.

Regarding other limitations, this is a study of adults only, so these results are not directly applicable to children (who should otherwise be vaccinated as noted above). Additionally, the proportion of patients which opened and/or read the portal messages cannot be ascertained from the EMR. While the vaccination rates for each of the three groups as a whole (including patients vaccinated prior to study period) approach national estimates, it is worth noting that limitations of ascertaining vaccine status from EMR data likely underestimate the true vaccination rates to some degree; this could likely account for why all three groups had a vaccination rate slightly lower than the 45% reported by the CDC for 2018–2019 influenza season.

In summary, the patient portal has demonstrated itself time and again in improving a multitude of individual and public health targets, and vaccination in particular has shown benefit in multiple studies, including this study. It is clear their use moving forward will only increase, and this will likely be with associated benefits of increased vaccination rates, details of individual health goals, and overall improved communication between the patient and care team. Specifically, this study supports the use of automated patient portal reminder messages for increasing annual influenza vaccination rates, while the use of a self-scheduling option did not directly translate to any further increase in the vaccination rate. Further studies similar to this will be required to determine other possible optimization techniques for the patient portal and how they may play into improving vaccination and other health outcomes even further.

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