ORIGINAL RESEARCH ARTICLE

Digital Communication Technology: Does Offering a Choice of Modality Improve Medication Adherence and Outcomes in a Persistent Asthma Population?

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Perm J 2020;25:20.189

E-pub: 12/09/2020

https://doi.org/10.7812/TPP/20.189

ABSTRACT

Background: Use of digital communication technology has shown potential to improve asthma adherence and outcomes. Few studies have looked at patient preference around mode of medication reminders used to improve and maintain asthma medication adherence.

Objective: To determine if, in a population already receiving automated medication reminders, offering a choice for preferred mode of reminder (text, email, phone) would improve their adherence and asthma outcomes over a 1-year period.

Methods: This was a pragmatic, randomized controlled trial conducted at Kaiser Permanente Colorado involving 7522 adult patients with persistent asthma. Study patients were randomized to receive usual care or their choice of medication reminder. Differences between the 2 groups in both medication adherence and asthma outcomes were then assessed over the following year.

Results: Only 30% of those offered a choice of medication reminder modality responded by making a choice, with 52% preferring text messaging. There was less of a decrease in adherence rate over the 1-year period in those who made a choice regarding the mode of medication refill reminder. There was no difference in asthma outcomes between those who did make a choice compared with those who did not make a choice regarding the mode of medication refill reminder.

Conclusion: In a patient population already receiving medication reminders, offering a choice about what type of technology-enabled asthma medication reminder patients wanted did not improve outcomes but did enable a subgroup to better maintain their medication adherence.

INTRODUCTION

Digital communication technology (DCT), such as automated telephone calls, emails, and text messaging, triggered by information generated from an electronic medical record to promote asthma medication adherence, over sustained periods of time, offers the promise of being economical and scalable.[1,2]

Reasons for poor adherence are complicated. The World Health Organization (WHO) offers 3 broad categories of nonadherence: 1) erratic (forgetfulness), 2) unwitting (usually due to poor understanding of disease management, eg, using reliever as preventer), and 3) intelligent nonadherence (eg, due to fear of steroids or medication dependence).[3] Efforts to improve behavior around adherence have often used a multifaceted approach, involving face-to-face visits with different health care providers.[4-7] However, such efforts are complex, costly, and difficult to implement in the real world.[8] DCT has shown promise in helping to improve medication adherence.[9-15] In particular, DCT can help address category 1 of the 3 World Health Organization categories for nonadherence.

However, few studies have looked at patient preference for this type of health care-related communication. A study done in a population of veterans found that digital communications were preferred for routine needs (eg, prevention reminders, test results, and refills) but did not look at modality of digital communication.[16] Another study looked at communication modalities (print, telephone, email, text, or private social network messages) to promote physical activity in a population of patients with musculoskeletal disorders and found that most patients preferred print materials for this kind of communication.[17] Only 1 study looked specifically at modality of DCT for medication reminders in a small group of HIV patients, finding a preference for text messaging.[18]

In previous papers, we have shown that a DCT program used in a large integrated healthcare delivery system can improve and maintain medication adherence[9] and can be scaled up to serve a larger population at a relatively low cost.[10] In an effort to enhance and improve this DCT system, we examined whether giving patients some control over the type of DCT used to communicate with them would improve inhaled corticosteroid (ICS) adherence.

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Key words: adherence, asthma, communication preference, digital communication technology, inhaled corticosteroids ClinicalTrials.gov Identifier: NCT02761837

METHODS

Setting, Patients, and Study Design

This paper is the most recent in a series of studies focusing on care for patients with asthma, using DCT and integration with the electronic health record.[10, 19-22] As with those papers, this study was conducted at Kaiser Permanente Colorado (KPCO), an integrated healthcare system with more than 600,000 members in the Denver-Boulder metropolitan area in 2020. Study patients were ages 18 years and older with a diagnosis of persistent asthma. In addition to having a diagnosis of persistent asthma, participants had to have at least 1 fill of an ICS in the previous year. We excluded patients with a diagnosis of chronic obstructive pulmonary disease. The KPCO Institutional Review Board approved this study. With the Institutional Review Board's approval, patients were informed of the trial and given the opportunity to opt out by email or phone.

The study was designed as a pragmatic, randomized controlled trial. At KPCO, a reminder system sends text or phone reminders to patients with persistent asthma who are due to refill their ICS medications. In this system all patients or parents of patients with persistent asthma receive an ICS refill reminder by text or automated call when they are due (reminder sent 5-11 days prior to the refill due date) or overdue (reminder sent 30 days after the refill due date) for an ICS refill.

Prior to this study, as part of usual care operations, reminders were sent to patients less than 65 years of age. Starting with this study, to further expand this refill reminder service, reminders were sent to all patients with asthma, including those 65 years of age and older. In the prior medication reminder system, patients did not choose the refill reminder type they received. They received a text if the phone was a text-enabled phone or an automated telephone call if the phone was a land line or a cellular phone that was not text enabled. These refill reminders were sent using the KPCO automated Interactive Voice Response system, which has been successfully used in previous population-based interventions.[9,10, 23-26] Patients receiving this approach to the refill reminders constituted the usual-care group in our study.

For the intervention group, all patients who met study inclusion criteria were invited to choose a preferred DCT modality for receiving ICS refill reminders (detailed below). Patients who provided a preference received ICS refill reminders via that mode beginning with their first ICS refill after October 3, 2018. Patients who did not provide a preference received ICS refill reminders by text or automated call as part of routine healthcare operations and thus were treated as usual care in this study. Patients originally randomized to the usual-care group were not invited to choose a modality of receiving ICS refill reminders.

To elicit a preference for type of ICS refill reminders, patients in the intervention group were contacted by at least 2 of the following methods: mail, automated telephone call, or email. Contacts were continued until patients provided a preference or until they had been contacted at least 3 but no more than 5 times between June and August 2018. In these contacts, patients were directed to a website where they entered their name and date of birth into an encrypted verification system to confirm that they were part of the study cohort. Once patients were verified as being in the study cohort, they were invited to complete an online Research Electronic Data Capture (REDCap; Vanderbilt University, Nashville, TN) survey. The survey requested that the patient choose email, text, or automated telephone call as the preferred modality by which they would receive ICS refill reminders and to provide the contact information they wanted used for these reminders. Patients could select only 1 mode of refill reminder. Also, as part of the contacts, patients were provided information about how to reach the study team if they had questions, to provide their preference as an alternative to completing the online survey, or to opt out of participating in the intervention.

Data Sources and Variable Definitions

Outcomes were captured over a 1-year postintervention period (October 3, 2018 to October 2, 2019). Adherence was defined as the proportion of days covered (PDC) on ICS.[27] The asthma medication ratio (AMR) was defined as a ratio of asthma controller canisters dispensed to the sum of asthma controller plus asthma reliever canisters dispensed.[28] Asthma exacerbations were defined as oral corticosteroid bursts and asthma-related urgent care visits, emergency department visits, and hospitalizations, where there was a corresponding primary or secondary visit diagnostic code for asthma. More specifically, when oral steroids were prescribed, the exacerbation had to be linked to a diagnosis of asthma to be counted. For any emergency department visit, urgent care visit, or hospitalization, asthma had to be either a primary diagnosis or, if the diagnosis of asthma exacerbation was made, it counted regardless of whether it was a secondary or primary visit diagnosis. Characteristics of the study population included age, sex, race/ethnicity, socioeconomic status (education and income), and insurance plan type. In addition, for the year prior to the start of the ICS refill reminder intervention, baseline rates were examined for the number of clinic appointments missed, AMR, PDC, and asthma exacerbations.

Patient demographic, administrative, utilization, and clinical data were extracted from the KPCO Virtual Data Warehouse. The Virtual Data Warehouse is a comprehensive medical data warehouse that includes data extracted from the electronic

medical record, health care claims, and socioeconomic indicators from census data.[29]

Statistical Analysis

Baseline characteristics of patients in the usual care and intervention groups were examined using descriptive statistics. In this study we analyzed 3 outcomes (change in PDC, AMR, and asthma exacerbation rates) using difference in differences models that compared rate changes from the prior year with the 1-year observation period for identified groups of interest. For comparisons of PDC and exacerbation rates, means were person-year adjusted rates. Poisson regression with overdispersion correction was used for PDC and asthma exacerbations, and binomial regression was used for AMR.

These outcomes were also examined in prespecified, nonrandom intervention subgroup analyses comparing persons who did and did not chose a preference as well as comparing persons by preferred outreach mode. Subgroup analyses were adjusted for baseline differences in age, sex, race/ethnicity, education, income, missed appointments, and insurance plan type. Statistical analyses used SAS Studio software (Release 3.7, Enterprise Edition; SAS Institute Inc., Cary, NC).

Satisfaction Survey

We also conducted a satisfaction survey by mail. The survey included a representative sampling of the intervention group (including representative sampling of each preference subgroup: phone, text, and email) and the usual-care group. We contacted the sample of patients using their preferred mode of contact for the intervention group who provided a preference, or text/automated telephone contact for those who did not provide a preference or were in the usual-care group and requested they complete the survey. The survey included questions about satisfaction with the reminder system, the frequency and timing of the reminder, whether it was important to have a choice for type of ICS refill reminder contact, engagement with technology, and effect of medication cost and contained other questions related to their medication refill experience as well as their overall experience of their asthma care at KPCO.

Results

A total of 7522 patients met the criteria to be included in the study. Of these, 4950 (65.8%) were randomized to the intervention group and offered a choice of DCT mode for their ICS refill reminder; 2572 (34.2%) were randomized to usual care (text or phone reminder with no choice regarding modality) (Figure 1). Of those offered a preference, 3075 (62%) did not provide a preference and were thus put into the usual-care group (total of 5647 for the usual-care group), 1496 (30%) did provide a preference, and 379 (7.7%) were not included due to disenrollment from the health care system or death (268 or 5% of the entire study population) or because they opted out of the reminder program (111 or 1.4% of the entire study population). Of those who provided a preference, 788 (52.6%) preferred text messaging, 101 (6.75%) preferred automated telephone call, and 607 (40.6%) preferred email. Thus, despite randomizing roughly twice as many to the intervention group, only 30% responded, and most of those responding opted for the same modes of communication that were already in use in usual care.

Patient characteristics of persons randomized to being offered a preference versus not offered a preference are shown in Table 1. There was no significant change over the 1-year observation period in PDC, AMR, or asthma exacerbations in either the group offered a preference or in the group that was not offered a preference (usual care) (Table 2) for ICS refill reminders. Because patients 65 years of age and older had not received a medication reminder prior to the start of this study in October 2018, a sensitivity analysis was conducted looking at the results in this age group, and they were the same.

There was a slight decrease in PDC over the 1-year time period across both arms (Table 2). However, in a subanalysis looking at patients offered a choice and comparing those who made a choice with those who did not make a choice, the decrease in adherence was significantly lower in those who made a choice regarding medication reminder modality compared with patients who did not make a choice. This significant difference remained even after adjustment for baseline differences in age, sex, race/ethnicity, education, insurance plan type, asthma exacerbations in the prior year, missed appointments in the prior year, and baseline PDC (Table 3; $p = 0.003$). There was no difference in AMR or asthma exacerbations between patients who provided a preference and those who did not.

Among the patients who did provide a DCT preference and stratified by the type of reminder preferred (email, phone, or text), no differences emerged over the 1-year observation period in either adherence or asthma exacerbations. However, statistical power may have been insufficient to detect differences in these small subgroups (Table 4).

For the satisfaction survey, 354 (14%) out of 2485 patients completed the survey. Overall, regardless of the type of outreach they received, patients were satisfied with receiving reminders, were satisfied with the frequency and length of ICS refill reminders, and endorsed that having a choice of reminder type was important. Those who selected a preference for refill reminders had ICS prescriptions refilled by online pharmacy more often than those who did not select an outreach preference for ICS reminders. Thirty-five percent

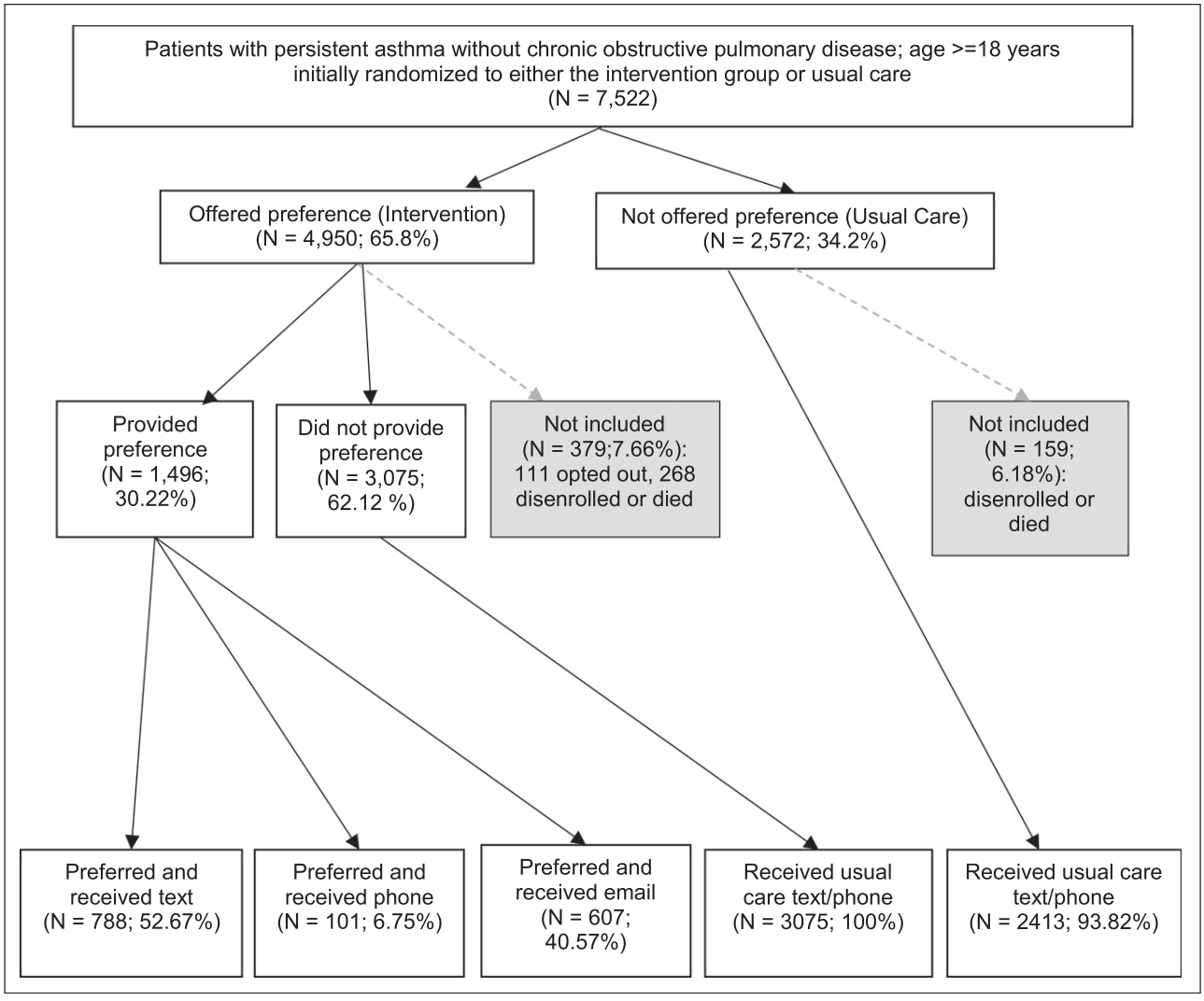

Figure 1. Breathewell study patients and preferences for inhaled corticosteroid refill reminders.

of respondents stated it was sometimes or always difficult to pay for their asthma medications. Overall, patients in the study were satisfied with the asthma care they received.

DISCUSSION

In this study, we attempted to increase patient engagement with our medication reminder system by offering patients a choice as to what type of DCT reminder they would like to receive (text, automated phone call, or email). Text was the preferred modality by a little over half of patients who made a choice. However, only 30% (n = 1496) of patients provided a choice, and just a little over 40% (n = 607) of those chose an option (email) not provided in usual care. This is an obvious study limitation and could potentially be the reason for a lack of difference between the intervention and the usual-care groups. For patients who did respond with a preference, adherence was statistically better maintained (although this might not be clinically significant) during the 1-year observation period.

The absence of a difference between the intervention group and usual care in either adherence rate or asthma outcomes during the 1-year observation period may be attributable to several factors. Asthma patients less than 65 years of age in this population (nearly 75% of the cohort) were already accustomed to receiving reminders about their daily controller medication for their asthma. Patient interest in selecting a DCT preference may have been diminished because the choice offered just one other reminder modality beyond what they were already receiving (email rather than text or phone). Further, patients who had enough interest to select a communication option were those who were already more adherent to their medication and possibly more

Table 1. Baseline characteristics of patients offered and not offered a preference for the modality of receiving inhaled corticosteroid refill reminders

Characteristic	Not offered preference (n = 2413; 34.55%)	Offered preference (n = 4571, 65.45%)
Enrolled continuously as a KPCO member > 1 y prior, n (%)	2223 (92.1)	4211 (92.1)
Age in years, mean (SD)	52.40 (17.2)	51.75 (17.0)
Age group, n (%)		
< 65 y	1741 (72.2)	3412 (74.6)
≥ 65 y	672 (27.9)	1159 (25.4)
Female, n (%)	1508 (62.5)	2845 (62.2)
Race/ethnicity, n (%)		
Hispanic	358 (14.8)	711 (15.6)
Non-Hispanic White	1705 (70.7)	3256 (71.2)
Non-Hispanic Black	141 (5.8)	249 (5.5)
Non-Hispanic Asian	41 (1.7)	100 (2.2)
Multiracial, Native American, or unknown	168 (7.0)	255 (5.6)
Less than high school education, mean (SD) in census block	8.46 (9.9)	8.63 (10.1)
Family income, census block, n (%)		
< $50,000	340 (14.1)	604 (13.2)
$50,000-$100,0000	1357 (56.2)	2521 (55.2)
> $100,000	716 (29.7)	1446 (31.6)
Insurance plan type, n (%)		
Traditional HMO	1047 (43.4)	1912 (41.8)
Deductible HMO	965 (40.0)	1787 (39.1)
High deductible	182 (7.5)	442 (9.7)
Medicaid	148 (6.1)	296 (6.5)
Other	71 (2.9)	134 (2.9)
Missed appointments in prior year, n (%)		
≥ 1 missed appointment(s)	836 (34.7)	1611 (35.2)
No missed appointments	1484 (61.5)	2746 (60.1)
No scheduled appointments	93 (3.9)	214 (4.7)
ICS PDC, mean (SD)[a,b]	0.55 (0.3)	0.56 (0.3)
ICS PDC categories, n (%)[a,b]		
< 50%	1037 (46.0)	1932 (44.8)
50% to < 80%	649 (28.8)	1213 (28.1)
≥ 80%	571 (25.3)	1166 (27.1)
AMR categories (with missing), n (%)[a,c]		
≥ 0.50	1929 (79.9)	3781 (82.7)
< 0.50	363 (15.0)	579 (12.7)
Missing	121 (5.0)	211 (4.6)
Total asthma exacerbations, mean (SD)[a,d]	0.34 (0.8)	0.32 (0.8)

[a] Year prior to preference intervention.
[b] Proportion of days covered (n = 6568; excludes 16 persons enrolled < 6 mo and 400 with no inhaled corticosteroid days' supply in prior year).
[c] Asthma medication ratio (n = 6652; estimates excluded 16 persons enrolled < 6 mo and 316 without captured asthma prescription dispensings in prior year).
[d] Includes asthma-related urgent care visits, emergency department visits, hospitalizations, and corticosteroid bursts.
KPCO = Kaiser Permanente Colorado; SD = Standard deviation.

engaged with their healthcare team. In a previous report,[21] we showed that patients who provided a preference had a higher baseline adherence rate than those who did not provide a preference. Thus, patients who did provide a preference may have had a personality trait that led to greater engagement in the healthcare system and to stronger adherence behaviors. Finally, as noted in a previous paper, baseline adherence rates for our population of asthma patients was already higher than noted in similar populations studied in previously published papers.[10]

Table 2. Change in asthma medication adherence and asthma exacerbations among patients offered and not offered a preference for the modality of receiving inhaled corticosteroid refill reminders

Outcome[a]	Not offered preference (n = 2413)		Offered preference (n = 4571)		p value[b]
	Baseline[c]	Follow-up	Baseline[c]	Follow-up	
Proportion of days covered,[d] n	2257		4311		
Mean[e]	0.55	0.52	0.56	0.54	
95% CI	0.54-0.56	0.51-0.53	0.56-0.57	0.53-0.55	0.211
Asthma medication ratio,[f] n	2292		4360		
Mean	0.73	0.74	0.74	0.75	
95% CI	0.72-0.74	0.73-0.75	0.73-0.75	0.74-0.76	0.817
Asthma exacerbations,[g] n	2413		4571		
Mean[e]	0.35	0.28	0.32	0.27	
95% CI	0.32-0.38	0.25-0.31	0.30-0.35	0.250.29	0.775

[a] Within 12 mo after initiating preference-based inhaled corticosteroid reminders.
[b] Poisson regression with overdispersion correction for proportion of days covered and asthma exacerbations. Binomial regression used for asthma medication ratio.
[c] Each model only adjusted for baseline value.
[d] Patients with < 6 mo enrollment or proportion of days covered = 0 at baseline excluded.
[e] Person-year adjusted rates.
[f] Patients with < 6 mo enrollment or no asthma canisters dispensed at baseline excluded.
[g] Includes asthma-related urgent care visits, emergency department visits, hospitalizations, and corticosteroid bursts.
CI = Confidence interval.

Several randomized trials have demonstrated the use of DCT can result in increased adherence.[30-32] However, the conclusion that such interventions can disseminate into routine practice is tempered by the recognition that many of these were small studies that screened patients, offered incentives, and had a short follow-up.[11-13] In this pragmatic trial, the DCT intervention was delivered to a large patient population in routine care, with few exclusion criteria and with 1-year follow-up. These results add new insight into the dissemination of DCT in routine care and clearly demonstrate the challenges of gaining and maintaining patient interest in DCT. Another pragmatic trial using DCT to improve adherence in 7000 adults with asthma found no overall impact on adherence; however, 12-month adherence was improved in the subset of patients who engaged and participated in the intervention.[14]

Although the promise of DCT to improve patient adherence is robust, recent studies demonstrate the challenges of adoption and sustained use of such technologies. Although as many as 90% of patients indicated interest in using an app (another form of DCT) to communicate with their provider in a recent survey,[33] half of the 934 patients who downloaded a health app in another study reported that they stopped using the app shortly thereafter, primarily due to burden, loss of interest, or hidden cost.[34] Hence, the challenges of using DCT include both initial engagement and then keeping patients engaged.

Frequency, timing, and content of the message are likely important. In a previous study, we engaged the expertise of patients with asthma through focus groups to determine what patients might prefer regarding a speech recognition reminder system. Through this preliminary work, we determined that patients preferred short communications that were identified as coming from their prescribing provider and that facilitated the refill process within the KPCO system.[9] Similarly, patients prefer apps that are easy to use and facilitate communication with a provider.[33]

In this study, text was the preferred modality by a little over half of those who made a choice. Communication by text has been shown to be a simple, patient-accepted intervention to improve adherence with several disease states[15] and a preferred mode over email and phone in at least 1 other study.[18] It is also relatively easy and inexpensive to implement, maintain, and scale up.[10,23] Still, the degree to which DCT can replace direct care from a provider remains to be further investigated. Human interaction, whether in person or by phone, can effectively identify barriers to adherence, deliver tailored support strategies specific to that identified barrier, and engage patients with motivational interviewing[35,36] or shared decision-making.[37]

Even where adherence is improved, outcomes do not always follow, as our own research has shown.[9,10] A large improvement in asthma medication adherence may be necessary before outcomes such as urgent care visits and hospitalizations are improved.[38] In milder asthma, as a recent revision in Global Initiative for Asthma guidelines suggests, strict ICS adherence may not be necessary, and providers may need to adopt a different perspective regarding medication adherence in this group.[39,40] Addressing nonadherence in a population with more moderate to severe asthma may provide clearer evidence that DCT interventions can change outcomes. Specifically, reaching out to

Table 3. Adjusted change in asthma medication adherence and asthma exacerbations among patients offered a preference for the modality of receiving inhaled corticosteroid refill reminders

Adjusted outcome[a]	Offered preference				p value[b]
	Did not provide preference (n = 3075)		Provided preference (n = 1496)		
	Baseline[c]	Follow-up	Baseline[c]	Follow-up	
Proportion of days covered,[d] n[e]	2797		1421		
Mean[f]	0.49	0.47	0.60	0.58	
95% CI	0.47-0.52	0.45-0.49	0.57-0.62	0.56-0.61	0.003
Asthma medication ratio,[g] n[e]	2844		1419		
Mean	0.71	0.72	0.78	0.79	
95% CI	0.69-0.73	0.69-0.74	0.75-0.80	0.76-0.81	0.371
Asthma exacerbations,[h] n[e]	3010		1461		
Mean[f]	0.21	0.17	0.21	0.17	
95% CI	0.15-0.29	0.12-0.24	0.15-0.31	0.12-0.25	0.736

[a] Within 12 mo after initiating preference-based inhaled corticosteroid reminders.
[b] Poisson regression with overdispersion correction for proportion of days covered and asthma exacerbations. Binomial regression for asthma medication ratio.
[c] Each model adjusted for baseline differences in age, sex, race/ethnicity, education, insurance plan type, income, and missed appointments in prior year.
[d] Patients with < 6 mo enrollment or proportion of days covered = 0 at baseline excluded. Patients with missing baseline covariates excluded.
[e] Cases with missing covariates are excluded.
[f] Person year adjusted rates.
[g] Patients with less than 6 mo enrollment or no asthma canisters dispensed at baseline excluded. Patients with missing baseline covariates excluded.
[h] Includes asthma-related urgent care visits, emergency department visits, hospitalizations, and corticosteroid bursts.
CI = Confidence interval.

Table 4. Adjusted change in asthma medication adherence and asthma exacerbations among patients expressing a preference for text, phone, or email modality of receiving inhaled corticosteroid refill reminders

Adjusted outcome[a]	Provided preference						p value[b]
	Text (n = 788)		Phone (n = 101)		Email (n = 607)		
	Baseline[c]	Follow-up	Baseline[c]	Follow-up	Baseline[c]	Follow-up	
Proportion of days covered, n[d]	754		94		573		
Mean[e]	0.64	0.62	0.55	0.55	0.61	0.60	
95% CI	0.59-0.68	0.57-0.66	0.49-0.63	0.49-0.62	0.56-0.65	0.55-0.65	0.557
Asthma exacerbations,[f] n[g]	773		96		592		
Mean[e]	0.29	0.24	0.43	0.28	0.28	0.22	
95% CI	0.15-0.56	0.13-0.46	0.20-0.90	0.13-0.61	0.15-0.52	0.11-0.41	0.617

[a.] Within 12 mo after initiating preference-based inhaled corticosteroid reminders.
[b.] Poisson regression with overdispersion correction for proportion of days covered and asthma exacerbations.
[c.] Each model adjusted for baseline differences in age, sex, race/ethnicity, education, insurance plan type, income, and missed appointments in prior year.
[d.] Patients with < 6 mo enrollment or proportion of days covered = 0 at baseline excluded as well as those cases with missing covariates.
[e.] Person-year adjusted rates.
[f.] Includes asthma-related urgent care visits, emergency department visits, hospitalizations, and corticosteroid bursts.
[g.] Cases with missing covariates excluded.

patients who have had an exacerbation requiring oral steroids in the last year or who have poorer pulmonary function tests may yield more benefit from asthma medication adherence DCT interventions.[41-43]

Another limitation of our study is that we chose to use a provider diagnosis of persistent asthma and did not use other criteria such as AMR, frequent use of β-agonists, frequency of asthma flares, or other criteria to define this population. This may have led to either an over- or underestimation of this population in our study. In an effort to eliminate patients who may have truly had intermittent asthma, we did add an additional criterion that patients had to have filled at least 1 ICS prescription in the previous year. Asthma is a variable disease over time, making it difficult to accurately make a diagnosis of persistent asthma at a given point in time.

In conclusion, we showed that offering patients a choice of mode of asthma medication reminders engaged only a small segment of our population, resulting in no improvement in their adherence, although it may have helped to maintain their adherence. Patients nonetheless indicate that having a choice for receiving a reminder message is important. Text messaging appears to be the most acceptable mode of technology-enabled medication reminders and is

relatively easy to implement, scale up, and maintain. Future work is needed to look at ways to further engage patients in DCT, to strike a balance between technology and human interaction, and to determine how to tailor DCT interventions in subpopulations of asthma patients. ❖

Disclosure Statement

The author(s) have no conflicts of interest to disclose.

Authors' Contributions

Each author of the manuscript has contributed to its entirety, has agreed to be named as coauthor, has reviewed the final version, and has approved it for publication. Peter Cvietusa, MD, was the scientific lead of the study, led the analysis of the data, and wrote and prepared the manuscript. Nicole Wagner, PhD, contributed to the design, data collection, and analysis of the study and reviewed and provided input into the drafts and final manuscript. Jo Ann Shoup, PhD, contributed to the design, data collection, and analysis of the study; analyzed the survey data; provided administrative support to the study; and reviewed and provided input into the drafts and final manuscript. Glenn Goodrich, MS, contributed to the data collection and performed analytic methods and reviewed and provided input into the drafts and final manuscript. Susan Shetterly, MS, contributed to the study design and data collection, performed analytic methods, and reviewed and provided input into the drafts and final manuscript. Diane King, PhD, contributed to the interpretation of the analysis of the study and provided significant input through subject matter expertise to the drafts of the manuscript. Marsha Raebel, PharmD, provided scientific and administrative leadership to the team during the conduct of the study, provided significant input into the analytic methods of the study, and provided significant input to the drafts of the manuscript. Catherine Riggs, PharmD, provided clinical expertise to the study design, developed the satisfaction survey, and provided significant input through subject matter expertise to the drafts of the manuscript. Bruce Bender, PhD, obtained funding for the study, provided scientific leadership in the design, conduct and data analysis of the study, and reviewed and provided significant input into the drafts and final manuscript.

Role of Funder

This work was supported by the National Institutes of Health, National Heart Lung and Blood Institute, grant number R01HL084067-05. The National Institute of Health, as role of funder, had no input on the design, conduct or data collection and analyses in this study.

Funding source

This work was supported by the National Institutes of Health, National Heart Lung and Blood Institute, grant number R01HL084067-05. The funder had no role in the design, data collection, analysis or preparation of this manuscript.

How to Cite this Article

Cvietusa PJ, Wagner NM, Shoup JA, et al. Digital communication technology: Does offering a choice of modality improve medication adherence and outcomes in a persistent asthma population? Perm J 2020;25:20.189. DOI: https://doi.org/10.7812/TPP/20.189

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