Using Video Telehealth to Facilitate Inhaler Training in Rural Patients with Obstructive Lung Disease

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Abstract

Background: *Proper inhaler technique is important for effective drug delivery and symptom control in chronic obstructive pulmonary disease (COPD) and asthma, yet not all patients receive inhaler instructions.*

Introduction: *Using a retrospective chart review of participants in a video telehealth inhaler training program, the study compared inhaler technique within and between monthly telehealth visits and reports associated with patient satisfaction.*

Materials and Methods: *Seventy-four (*N = *74) rural patients prescribed ≥1 inhaler participated in three to four pharmacist telehealth inhaler training sessions using teach-to-goal (TTG) methodology. Within and between visit inhaler technique scores are compared, with descriptive statistics of pre- and postprogram survey results including program satisfaction and computer technical issues. Healthcare utilization is compared between pre- and post-training periods.*

Results: *Sixty-nine (93%) patients completed all three to four video telehealth inhaler training sessions. During the initial visit, patients demonstrated improvement in inhaler technique for metered dose inhalers (albuterol, budesonide/formoterol), dry powder inhalers (formoterol, mometasone, tiotropium), and soft mist inhalers (ipratropium/albuterol) (*$p < 0.01$ *for all). Improved inhaler technique was sustained at 2 months (*$p < 0.01$*). Ninety-four percent of participants were satisfied with the program. Although technical issues were common, occurring among 63% of attempted visits, most of these visits (87%) could be completed. There was no significant difference in emergency department visits and hospitalizations pre- and post-training.*

Discussion: *This study demonstrated high patient acceptance of video telehealth training and objective improvement in inhaler technique.*

Conclusions: *Video telehealth inhaler training using the TTG methodology is a promising program that improved inhaler technique and access to inhaler teaching for rural patients with COPD or asthma.*

Keywords: *chronic obstructive pulmonary disease, patient education, self-care, telemedicine, inhaler training, asthma, rural health*

Introduction

Chronic obstructive pulmonary disease (COPD) and asthma are two common lung diseases in the United States, with COPD affecting 6.3%[1] and asthma 7.7% of U.S. adults.[2] Among rural patients, the burden of COPD is greater compared to urban patients with rural COPD patients having a greater risk of mortality and lower health related quality of life.[3–5] Rural patients with asthma are also less likely to have access to care.[6]

Inhaled therapy is important for COPD and asthma management and proper inhaler technique is needed for effective drug delivery and symptom control. However, one-third of patients have never received instructions on inhaler use,[7,8] and most patients have poor technique.[8,9] To be effective, inhaler training must be delivered by appropriately trained staff,[10] and to ensure longevity of proper technique, follow-up sessions should be included.[11,12]

Providing inhaler training via home computer video telehealth may be a promising way to expand access to inhaler instruction for patients living in rural areas where staff time and training may be limited, and enable repeated education over time. We report on a pilot program for rural patients who

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received inhaler training education sessions at home from a pharmacist over video telehealth.

Materials and Methods

We conducted a retrospective chart review of rural patients who received care at the Veterans Affairs (VA) Puget Sound Health Care System and participated in the Clinical Video Telehealth-to-Home: Advice and Training about Inhalers (CHAT) program between January 2014 and March 2016. The CHAT program was a pilot program funded by the VA Office of Rural Health that offered inhaler training via video telehealth to patients prescribed ≥1 inhaler. Patients were identified as rural if their zip code was defined as rural by the United States Census Bureau's urban-rural classification.[13]

Patients were provided with a webcam. A telehealth technician from the VA Telehealth Department worked with patients to install and test software (Cisco Jabber Video for TelePresence 4.5) on a personal computer or tablet. A program assistant scheduled each appointment between the patient and pharmacist using Video Anywhere software, which generated an email to the patient and provider with detailed instructions for logging into the Jabber software, including how to obtain the unique session specific username and password. All video sessions were secure and encrypted.

Teach-to-goal (TTG) inhaler training sessions for all prescribed inhalers were provided by a pharmacist via video telehealth (D.M.W., E.H.K.N., B.K.T.). The TTG method breaks down the technique for each inhaler into a standardized checklist of 12–17 separate steps, depending on the inhaler. After observing the patient's "pretraining" technique and assigning a score, the pharmacist demonstrated correct inhaler technique, and patient technique was reassessed. The training was repeated until the participant demonstrated mastery (missed ≤2 steps) or after three cycles. At each visit, TTG scores (e.g., "pretraining, post-training 1, post-training 2") were used as an objective measure of inhaler technique.

Initially patients received four inhaler training visits occurring approximately once a month. The number of visits later decreased to three based on participant feedback that four were too many visits. We therefore report on the TTG scores of the third telehealth visit and do not report the scores of the subset of patients who completed a fourth training visit.

To measure the interrater reliability for TTG scores, inhaler technique was observed by both the CHAT pharmacist and a trained program staff for a subgroup of inhaler instruction visits. We calculated the kappa statistic for 79 pre- and post-training TTG scores comparing the CHAT pharmacist and the program staff.

Patients reported prior inhaler training and inhaler confidence (0 = not at all confident to 10 = very confident) in a pre-training survey. We computed descriptive statistics for demographic and baseline factors. The Wilcoxon signed rank test was used to examine whether TTG scores improved after training for the following: (1) within-visit comparisons between pretraining TTG scores and the final post-training scores for each inhaler during a single inhaler training session, and (2) between-visit comparisons of pretraining TTG scores to assess the durability of the training at the third visit before receiving the final training session. Because not all patients with metered-dose inhalers (MDIs) used a spacer at each visit, and some changed from no spacer to using a spacer at their second or third visit, we combined the TTG scores with and without spacers for participants using either an albuterol MDI or a budesonide/formoterol MDI for analyses.

Patients provided feedback for the CHAT inhaler training program following completion of the final training session, or upon exiting the program. A research assistant abstracted from the patient's VA medical record all-cause acute care events (emergency department [ED] and hospitalizations) and respiratory acute care events for the 6 months before the training program and 6 months after the baseline training visit. These were compared using the Wilcoxon signed rank test. Technical issues were summarized from pharmacist support staff logs.

Results

During the pilot home video telehealth program, 852 patients were invited to participate. Among those, 240 (28%) did not have access to a computer or internet, 358 (42%) were not interested in the training program, and 161 (19%) were otherwise ineligible. Among the 93 patients who enrolled in the home telehealth program, 19 (20%) encountered technical issues with the computer and/or video telehealth software that prevented them from participating. Pharmacists completed 218 inhaler training visits for 74 patients, and of these 69 (93%) patients completed the 3 to 4 monthly inhaler training visits offered through the CHAT video telehealth program.

Participants in the home telehealth program were male (100%) and predominantly Caucasian (93%) with a mean age of 69.2 years (*Table 1*). Patients lived an average of 52 miles from the VA Medical Center in Seattle, WA. The average pretraining inhaler use confidence was 7.6 (possible range: 0–10) and 21 participants (29%) reported never to have previously received inhaler education from a healthcare provider.

Table 1. Baseline Characteristics of Telehealth Inhaler Training Participants

	N = 74
Demographics	
Age, mean (SD)	69.2 (8.5)
Male, *n* (%)	74 (100.0)
Caucasian, *n* (%)	69 (93.2)
Distance to nearest VA clinic, miles, mean (SD)	20.9 (13.6)
Distance to VA Medical Center, miles, mean (SD)	52.2 (23.7)
Current smoker, *n* (%)	13 (17.6)
Smoking pack years, mean (SD)	47.9 (28.9)
Lung disease	
COPD, *n* (%)	69 (93.2)
Asthma, *n* (%)	5 (6.8)
FEV1 liters, mean (SD)[a]	1.8 (0.6)
FEV1 percent predicted, mean (SD)[a]	54.4 (20.0)
FEV1/FVC ratio, mean (SD)[a]	53.6 (13.7)
Respiratory medication use	
Total No. of inhaler medications, mean (SD)	2.6 (0.9)
Short-acting beta-agonist, *n* (%)	68 (91.9)
Short-acting anti-cholinergic, *n* (%)	22 (29.7)
Long-acting beta-agonist, *n* (%)	56 (75.7)
Long-acting anticholinergic, *n* (%)	38 (51.4)
Inhaled corticosteroid, *n* (%)	55 (74.3)
Chronic prednisone use, *n* (%)	4 (5.4)
Home oxygen use, *n* (%)	22 (29.7)
Baseline inhaler knowledge	
Previous inhaler instruction	
Medical provider, *n* (%)	36 (50.7)
Pharmacist, *n* (%)	14 (19.7)
Package insert only, *n* (%)	20 (28.2)
No training, *n* (%)	1 (1.4)
Reported demonstrating inhaler use to provider, *n* (%)	17 (24.6)
Average pretraining inhaler use confidence, mean (SD)[b]	7.6 (2.0)

[a]Lung function data abstracted from the medical record when available for 58 patients.

[b]Confidence reported on a 11-point scale where 0 = no confidence and 10 = complete confidence.

COPD, chronic obstructive pulmonary disease; FEV1, forced expiratory volume in 1 s; FVC, forced vital capacity; SD, standard deviation; VA, Veterans Affairs.

The mean number of prescribed inhalers per participant was 2.6. The interrater reliability ranged across devices with the highest kappa being 0.8 for the MDI without spacer at visit 1 and 0.67 for all devices combined. Median pretraining scores at the initial training session ranged from 8 (possible range: 0–13) for ipratropium MDI to 13 (possible range: 0–17) for formoterol (*Table 2*). We noted a statistically significant improvement in each inhaler score comparing the pretraining score to the post-training score, except for ipratropium MDI, which was only used by three patients. At the third visit, the improvement was sustained. The median pretraining score was higher at the third visit than at baseline for each inhaler except ipratropium (*Table 3*). For example, the median pretraining scores increased by 1 point ($p < 0.001$) for albuterol MDI.

Chart abstraction revealed that 16 exacerbations occurred among 11 participants during the 6 months before the training program, and 9 exacerbations occurred among 8 participants during the 6 months following the training ($p = 0.23$). There was not a significant difference in the count of pre- and post-training all-cause ED and hospitalizations ($p = 0.12$).

Ninety-one percent of patients returned a program evaluation of the CHAT program, including three of the five patients who exited the program before completing all three telehealth visits. Of the 67 patients who evaluated the program, the majority (94%) reported being satisfied with the home telehealth inhaler education program, and 92% would recommend it to others (*Table 4*). Nearly all (96%) participants preferred video telehealth rather than traditional face-to-face inhaler training visits at the medical center; in fact, 76% of participants who completed the evaluation reported that they would not have received any additional inhaler training if they had not done the home telehealth program.

A quarter of the participants reported technical problems with the computer software during "most" to "every" session, which is consistent with the pharmacist reporting technical issues on 149 (63%) of scheduled home telehealth visits. Despite the technical troubles, the majority of visits experiencing technical issues were carried through to completion (87%). Nineteen visits (13%) were postponed or only partially completed due to unresolved technical issues during the appointment. Patient errors or confusion with the video telehealth program were common (41% of scheduled visits), such as difficulties following the multiple steps of the program generated email to log into the Jabber program and connect to the video call, as well as unfamiliarity with basic computer skills. Issues with the computer or software occurred during

Table 2. Change in Teach-to-Goal Scores During the Initial Telehealth Video Visit

INHALER	RANGE OF SCORES	INITIAL VISIT			
		N	PRETRAINING TTG SCORE MEDIAN (IQR)	POST-TRAINING TTG SCORE MEDIAN (IQR)	*p*
Albuterol MDI	0–13	59	10 (10–11)	13 (12–13)	<0.001
Budesonide/formoterol MDI	0–13	41	10 (8–11)	12 (12–13)	<0.001
Formoterol	0–17	15	13 (13–14)	17 (16–17)	<0.001
Ipratropium MDI	0–13	3	8 (6–11)	11 (10–12)	0.11
Ipratropium/albuterol SMI	0–13	16	10.5 (9.5–12)	13 (11.5–13)	0.001
Mometasone DPI	0–12	15	11 (10–12)	12 (12–12)	0.003
Tiotropium DPI	0–15	35	11.5 (10–13)	15 (14–15)	<0.001

DPI, dry-powder inhaler; IQR, interquartile range; MDI, metered-dose inhaler; SMI, soft mist inhaler; TTG, teach-to-goal.

11% of visits, and audio or video troubles were experienced on 25% of sessions.

Discussion

Inhaler training delivered via video telehealth by a pharmacist was well-received among rural, male, predominantly Caucasian patients who had access to a personal computer and internet. Despite technical problems associated with participants' lack of familiarity using computers and issues with the video telehealth program, participants reported that convenience, decreased travel time, reduced travel expenses, and increased privacy were benefits of the internet-based program.

Inhaled therapy is an important component for managing both COPD and asthma that can improve symptoms and quality of life, and reduce exacerbations.[14] Teaching correct inhaler technique followed by regular retraining by healthcare professionals to reinforce skills is recommended.[11] Consistent with reports from non-VA settings,[7,8] close to one-third of CHAT patients reported never before receiving inhaler training from a healthcare provider. Like previous in-person intervention studies[12,15] and a video telehealth training for urban patients,[16] the TTG inhaler training delivered via internet video telehealth demonstrated an improvement in inhaler technique during the initial visit, with sustained improvement at the third visit for each inhaler, with the exception of ipratropium MDI, which was likely due to a relatively small sample. Face-to-face inhaler training is more effective than watching an inhaler training video,[17] and it is not possible

Table 3. Durability of Training Comparing Initial Visit Pretraining Teach-to-Goal Scores to Third Visit Pretraining Teach-to-Goal Scores

INHALER	RANGE OF SCORES	COMPLETED INITIAL VISIT AND THIRD VISIT, *N*	INITIAL VISIT TTG SCORE[a] MEDIAN (IQR)	THIRD VISIT TTG SCORE MEDIAN (IQR)	*p*-VALUE COMPARING INITIAL TO THIRD VISIT
Albuterol MDI	0–13	52	11 (10–11)	12 (11–13)	<0.001
Budesonide/formoterol MDI	0–13	34	10 (9–12)	13 (12–13)	<0.001
Formoterol	0–17	14	13 (13–14)	16 (16–16)	0.001
Ipratropium MDI	0–13	2	9.5 (8–11)	10 (8–12)	0.32
Ipratropium/albuterol SMI	0–13	15	10 (9–12)	13 (12–13)	0.004
Mometasone DPI	0–12	14	11 (10–12)	12 (12–12)	0.006
Tiotropium DPI	0–15	30	12 (10–13)	14 (14–15)	<0.001

[a]Initial scores in Table 2 may not correspond due to patients missing scores at third visit.

Table 4. Program Feedback Reported by Patients Completing One or More Inhaler Training Telehealth Visits and Summary of Technical Issues

PARTICIPANT SURVEY EVALUATION OF VIDEOCONFERENCING PROGRAM	$N=67$[a]
Overall satisfaction	
Built a good relationship with the pharmacist, *n* (%)[b]	66 (98.5)
Satisfied with the training, *n* (%)[b]	63 (94.0)
Would recommend the training, *n* (%)[b]	61 (92.4)[c]
Prefer videoconference training to visits at the medical facility, *n* (%)[b]	64 (95.5)
If you had not done the telemedicine inhaler training, how long would you have waited until you traveled to a VA facility to receive the same training?	
Would have gotten the same training at VA within the next 6 months, *n* (%)	14 (22.6)[c]
Would have gotten the same training elsewhere, *n* (%)	1 (1.6)[c]
Would not have gotten the same inhaler training at all, *n* (%)	47 (75.8)[c]
Benefits of the internet-based home videoconferencing program	
Program is convenient, *n* (%)	56 (83.6)
Program saves time, *n* (%)	48 (71.6)
Program saves travel expenses, *n* (%)	58 (86.6)
Program provided increased privacy, *n* (%)	32 (47.8)
Program makes it easier to keep a scheduled appointment, *n* (%)	34 (50.8)
Decreased anxiety compared to visits at the medical center, *n* (%)	26 (38.8)
Internet-based home videoconferencing program setup	
Received easy to follow instructions at the beginning the program, *n* (%)[b]	66 (100.0)[c]
Setting up the equipment was easy, *n* (%)[b]	61 (91.0)
Visit-related technical issues	
VA staff were quick to fix any problem, *n* (%)[b]	61 (100.0)[c]
Portion of time technical problems occurred during visits	
Never or rarely (≤10%), *n* (%)	37 (56.9)[c]
Sometimes (11–49%), *n* (%)	12 (18.5)[c]
Most or every time (≥50%), *n* (%)	16 (24.6)[c]
Pharmacist-reported videoconferencing visit outcomes	$N=218$
Completed visits with technical issues, *n* (%)	130 (59.6)
Duration of technical issues during a visit, minutes, mean (SD)	8.4 (11.5)

[a]Sixty-seven out of 74 (91%) participants returned a program evaluation.

[b]Responded to "agree" or "strongly agree."

[c]Due to missing data the frequency and percentage may not correspond to $n=67$ (100%).

to assess inhaler technique by phone. Video telehealth offers a means to accomplish a face-to-face inhaler training visit in the patient's home.

Critical errors in inhaler technique are associated with an increased risk in all-cause hospitalizations and ED visits[18] and correcting technique before hospital discharge has been shown to be associated with fewer all cause acute care visits at 30 days, yet this was not sustained at 90 days.[12] While this study did not detect a difference in ED and hospitalizations for all-causes or respiratory exacerbation specific, a larger sample size and longer follow-up time may be necessary to detect a significant difference in healthcare utilization. Also, these acute care visits may have occurred at a non-VA facility, and therefore may not have been documented in the patient's VA medical record.

We observed relatively high pretraining TTG scores among the outpatient participants in the CHAT inhaler training program (e.g., median MDI score of 10 correct steps out of 13) compared with other studies of inhaler technique.[12,19] Relatively better inhaler technique before receiving training among the CHAT cohort may have attributed to better inhaler adherence and potentially fewer hospitalizations at baseline.[20] A future randomized intervention study powered to compare ED visits and hospitalizations among patients receiving the telehealth intervention and patients receiving standard of care may be necessary.

Despite having greater health comorbidities and lower health-related quality of life, rural Veterans use fewer VA and Medicare services compared to urban counterparts.[21,22] By using home video telehealth technology, the CHAT inhaler training program provided an alternative to in-person visits at the medical center for rural patients where geography and travel distance may be barriers to receiving this training.

Although a telehealth technician was available to help with software set up and troubleshooting before the video telehealth visits, participants and staff spent considerable time addressing technical issues. The pharmacist reported some difficulty with either logging into the software, or problems with the video image or audio quality for most visits. Participants often required assistance to locate and

open the software video telehealth program or to copy and paste their unique session username and password. Addressing these technical issues will be important to increase the use of telehealth inhaler training in the future.

Despite these technical issues, more than 90% of participants reported that the equipment was easy to set up. Nearly all participants were satisfied with the home video telehealth inhaler training program and would recommend it to others. A majority (96%) preferred home video telehealth for inhaler training to going to the medical center for in-person training. Participants listed the main benefits of the program as convenience, time-saving, and decreased travel expenses. It therefore appears that for this sample of rural patients, home telehealth is an acceptable means to deliver inhaler training and this approach could also be used to provide education for other medications or healthcare programs.

Providing inhaler training via video telehealth improved inhaler TTG scores, and the improvement was maintained 2 months after the initial training session. Program strengths include eliminating travel barriers to the medical center and providing face-to-face training to patients, many of whom had not previously received instructions for inhaler use by a healthcare provider. However, 28% of patients contacted for the program did not have access to a computer with internet. Expanding the telehealth program to alternate forms of technology such as smartphones may help to increase access. Even among patients with computers and internet, technical issues were common and will need to be continually addressed as technology changes and improves. Despite these shortcomings, inhaler training via video telehealth is a promising approach to providing needed inhaler training to rural patients.

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Disclaimer

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