

Investigating the Impact of Video Inpatient Medication Education on Patient Experience and Readmission Rate: A Retrospective observational cohort study with group comparison

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Investigating the Impact of Video Inpatient Medication Education on Patient Experience and Readmission Rate: A Retrospective observational cohort study with group comparison

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Abstract

Background: Effective communication about medications in acute healthcare settings plays a key role in long-term management and outcomes. Despite the importance of pharmacist-led interventions in improving patient understanding and medication adherence, face-to-face interventions are often costly, requiring significant amounts of clinical pharmacists' time, and cannot easily be scaled.

Objective: In this study, we assessed the efficacy of a scalable, video-based, text-initiated program where short medication videos were texted to inpatients in a large quaternary medical system.

Methods: A retrospective observational cohort comparison was conducted to analyze the outcomes of all patients who watched one or more of the medication education videos texted to them during and immediately following their inpatient visit between January 2024 and December 2024 and compared their outcomes with patients who did not watch the videos texted to them during the same time and on the same hospital units. "Watching the video" was operationalized as watching at least 50% of the video.

Our primary outcome measures were patient experience scores and readmissions.

Results: A total of 18,391 patients received 232,957 medication videos that were sent from January 1st to December 31st, 2024, across all 7 hospitals. Our findings suggest that those who watched at least 50% of the videos had significantly higher HCAHPS scores and significantly lower readmission when all domains were considered, as well as when only the communication about medications domain was considered, compared to those who did not watch at all.

Conclusions: While we documented variability related to age, gender, race, ethnicity, and admission type, more work is warranted to explore specific behaviors or patient characteristics that makes such interventions more effective.

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Title: Investigating the Impact of Video Inpatient Medication Education on Patient Experience and Readmission Rate: A Retrospective observational cohort study with group comparison

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Abstract

Effective communication about medications in acute healthcare settings plays a key role in long-term management and outcomes. Despite the importance of pharmacist-led interventions in improving patient understanding and medication adherence, face-to-face interventions are often costly, requiring significant amounts of clinical pharmacists' time, and cannot easily be scaled. In this study, we assessed the efficacy of a scalable, video-based, text-initiated program where short medication videos were texted to inpatients in a large quaternary medical system. A total of 18,391 patients received 232,957 medication videos that were sent from January 1st to December 31st, 2024, across all 7 hospitals. Our findings suggest that those who watched at least 50% of the videos had significantly higher HCAHPS scores and significantly lower readmission when all domains were considered, as well as when only the communication about medications domain was considered, compared to those who did not watch at all. While we documented variability related to age, gender, race, ethnicity, and admission type, more work is warranted to explore specific behaviors or patient characteristics that makes such interventions more effective.

Introduction

Self-management plays a key role in effective control of chronic diseases and seems to be a major contributor to the future of care (McQuaid & Landier, 2018). In such a care regimen, patients and families are often responsible for coordinating and implementing disease management, including medication administration (Thille & Russell, 2010). Patient adherence to medication instructions impacts clinical outcomes and is dependent on provider, patient, cultural, historical, and healthcare system factors (McQuaid & Landier, 2018). Thus, the ability of acute healthcare professionals to effectively teach patients and families, as well as patients' and families' ability to listen, comprehend, and retain medication instructions, is critical for long-term management and positive outcomes (Syrnyk & Glass, 2023; Bell et al., 2024).

The bulk of research focusing on the effectiveness of medication education has focused on

improving adherence and has evaluated outpatient or post-discharge interventions, including recurrent and personalized telephone counseling sessions, altering the medication regimen, having clinical pharmacist consultations for chronic disease co-management, providing incentives to promote adherence, and instituting medication-taking reminders (Kini & Ho, 2018). Reviews show that such interventions have had generally positive outcomes (Tan et al., 2018). However, despite the general recognition of the important role that medication education plays, our understanding of inpatient interventions has remained stagnant. Interventions for improving inpatient medication education have almost exclusively focused on face-to-face interventions, including written handouts or conducting teach-back methods of education, where nurses or pharmacists ask patients specific questions to assess gaps in understanding (Celio et al., 2018; Zoromski & Frazier, 2023). Meta-analyses have found pharmacist-led interventions successful in improving patient understanding and medication adherence, but face-to-face interventions are often costly, requiring significant amounts of clinical pharmacists' time, and cannot easily be scaled (Marcum et al., 2021). There is also a paucity of research focusing on the impact of medication education during hospitalization on patient satisfaction and quality of care or care transition indicators.

To address this gap, we assessed the efficacy of a scalable, video-based, text-initiated program where medication videos were texted to inpatients. This study aimed to (1) examine the association between 232,957 inpatient medication videos texted to inpatients (January-December 2024) and Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) inpatient and observation survey outcomes; and (2) evaluate associations with readmissions for the same patients. By evaluating HCAHPS official and unofficial survey outcomes (i.e., inpatient status and observation status surveys) and readmissions across a large system involving thousands of patients, we hope to broaden the understanding and generalizability of inpatient medication interventions.

Methods

Study design and outcomes

The study was reviewed by the hospital's review board and determined that the work would not be considered regulated human subjects' research. All study data were aggregated.

A retrospective observational cohort comparison was conducted to analyze the outcomes of all patients who watched one or more of the medication education videos texted to them during and immediately following their inpatient visit between January 2024 and December 2024 and compared their outcomes with patients who did not watch the videos texted to them during the same time and on the same hospital units. "Watching the video" was operationalized as watching at least 50% of the video.

Our primary outcome measures were patient experience scores and readmissions. Patient experience was defined as patients' subjective evaluation of the sum of all interactions they experience in the healthcare system, across the continuum of care, often shaped by organizational culture (Oben, 2020). Patient experience was measured using the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey (**Appendix A**). While we focused on *Communication about Medicines* and summative dimensions such as *Overall Hospital Rating* and *Recommendation of Hospital*, the results for all dimensions are reported here.

Consistent with the inclusion and exclusion criteria set for by the Centers for Medicaid and Medicare Services methodological framework (CMS, 2023), readmission rates were defined as any subsequent unplanned inpatient admission to any of our acute care facilities within 30 days of hospital discharge. Unplanned, any cause, acute care inpatient admissions were evaluated, excluding transfer encounters.

Setting and Context

The study was conducted in a quaternary medical system in and around Houston, Texas. The system

consists of one academic medical center (>1,386 beds) and, at the time of this study being conducted, six community hospitals, ranging from approximately 200 to 500 beds. The sample was determined from the number of patients admitted during the study implementation period, and only patients 18 years of age or older were included.

Medication Video Protocol

For the standard of care, medication education was conducted by bedside nursing and reinforced by pharmacists, where indicated by nursing staff. Patient education was documented in the electronic health record (EHR) nursing flowsheets, as well as pharmacists' progress notes, which allow for customization for medication names, purposes, side effects, and health monitoring.

For the intervention cohort, Krames, a nursing-patient education vendor, supplied 150 medication 2–3-minute education videos that were used for this study, as well as 6, 30-second medication videos generated by pharmacy staff. On every hospital admission, registration staff asked patients whether they consented to receiving healthcare updates via text messages. Once consent was provided, the administrative staff entered the patients' and family members' phone numbers in the EHR. CareSense was the vendor used to deliver text messages with the medication videos during and following the hospital stay.

A participatory design method was used to design and review the text messages and the medication education videos. The initial set of text messages were developed iteratively by a task force consisting of three pharmacists, three nurses, and four patient experience representatives from different system hospitals. We also drew on the feedback of patient partners who recently experienced hospitalization.

Patients were included in the intervention cohort if they were started on at least one new medication during their hospital stay, i.e., medications that were not included on the admission medication list on any previous hospitalizations. The first automated message occurred whenever the patient reached inpatient bed status, and a nurse scanned a new medication into the medication administration report (MAR) within the EHR. This would then trigger the text message and video link to be sent to the patient. The content of these videos focuses on the education on the purposes and side effects of each new medication administered. The videos were specific to the medication that was scanned in the EHR, and the text message specified the number of medications (Figure 1).

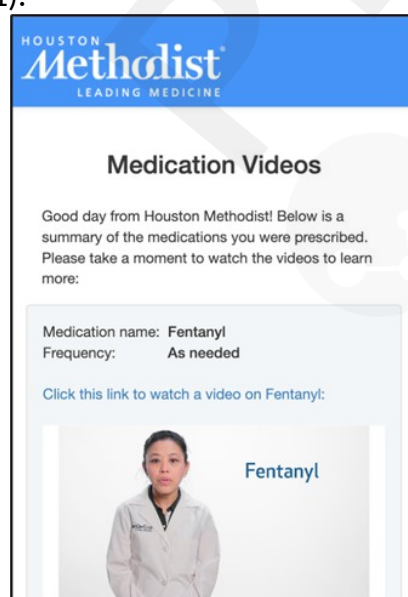


Figure 1. A sample screen from a medication video

Hello. I'm Dr. Kathryn Pidcock and I'm one of the pharmacists here at Houston Methodist Hospital. Today, I would like to talk to you about your medication, Fentanyl. This medication is used to ease pain. The most common side effects that you might experience are constipation, slow breathing, dizziness, and feeling confused. You should avoid driving and doing other tasks or actions that call for you to be alert until you see how this drug affects you. Please ask your nurse, doctor, or pharmacist any questions that you might have. Houston Methodist thanks you for your time.

If the nurse scanned a medication that did not have a video on file, no text message was sent. The

videos were available in English, Spanish, Arabic, and Vietnamese, where the patients could toggle for their preferred language.

We held the dissemination of the videos for one hour after the nurse scanned medications to aggregate all videos together for any new medications so that the patients would only receive one text message, which was limited to a total of two text messages during the entire hospitalization, to limit the potential for overwhelming the patient with text messages.

A transcription including bullet points of key components accompanied the video for those patients who preferred written material. At the end of the video, patients were asked whether they had any questions in which they would like to speak to a pharmacist. If they clicked “yes” to indicate they had questions for a pharmacist, then we routed an alert via phone or email to the pharmacist assigned to that unit, so that they could talk in person with patients. A closed-loop feedback structure was implemented to ensure patient concerns were addressed by the pharmacist within a few hours of triggering notification.

Education and training for pharmacists and nurses

Nurses used a semi-scripted guide from a trained patient experience team member to answer questions from patients about the medication videos. The taskforce conducted two virtual sessions with acute care nurse leaders to bring awareness to the types of questions patients may ask about the videos and to explain the workflow of how alerts would be routed to pharmacy. The training was standardized using PowerPoint teaching material.

Pharmacists were taught by two pharmacy co-authors of this paper (GA, DP) how to receive notifications, where and how to identify the patient who wanted to speak with a pharmacist, and how to adapt the conversation based on the patient’s query.

Analysis methods

The primary independent variable was whether the video was watched and classified as binary (watched video= 1 vs not watched= 0). Readmissions were classified as binary (1=yes vs 0=no). Data were culled from CareSense and then imported to a secure Structured Query Language, or SQL, server. From the SQL server, statisticians who are co-authors on this paper joined the CareSense data to the electronic health record database, where readmission data are stored. Once the databases were scrubbed for duplication, the data was imported into Tableau to aid in performing calculations for distinct encounter counts.

For the HCAHPS question analysis, a multivariable generalized linear regression using the generalized estimating equation (GEE) accounting for repeated measurements was built, controlling for demographics (Age, gender, race, and ethnicity) and admit type. We have reported odds ratios (OR), estimated differences ($\Delta\beta$), and 95% confidence intervals [CI]. For the readmissions, a multivariable generalized logistic regression model was built controlling for demographics (Age, gender, race, and ethnicity) and admit type. We have reported odds ratios (OR) and 95% confidence intervals [CI]. A $p < 0.05$ was considered statistically significant. All statistical analyses were performed in R v.4.4.1.

Results

A total of 18,391 patients received 232,957 medication videos that were sent from January 1st to December 31st, 2024, across all 7 hospitals. Medication education videos watched at least 50% or more accounted for 13% of the videos ($n=30,495$).

From the patients who watched the videos, 17,149 matched encounters were within the system quality database for patients with an inpatient or observation status encounter for the study period. Of those 17,149 patients, 3,900 completed the HCAHPS survey, and 2914 patients responded to the medication questions on the HCAHPS survey.

Patient demographics

Females were more likely to watch the medication video than males for both inpatient (54% versus 46%, respectively) and observation status patients (58% versus 42%, respectively) at every hospital in our system (Table 1). The ages are stratified in Table 2, showing that younger age cohorts, aged 18-34, comprised 5% of video watchers, with females comprising 63% of video watchers aged 18-34 video watchers and males constituting 37% of video watchers, aged 18-34. Patients aged 80 or above constituted 20 of video watchers, whereas adults aged 50-79 comprised approximately 64% of video watchers. Most patients (87%) who watched the video were discharged home or home with home health.

Table 1. Number (top) and percentage (bottom) of female vs. male video watchers

Site	Inpatient			Observation			Total Video Watchers		
	Female	Male	IP Total	Female	Male	OBS Total	Female	Male	Total
Hospital 1	737	680	1417	360	221	581	1097	901	1998
Hospital 2	425	391	816	189	158	347	614	549	1163
Hospital 3	1611	1456	3067	667	541	1208	2278	1997	4275
Hospital 4	1190	1010	2200	632	407	1039	1822	1417	3239
Hospital 5	346	269	615	97	56	153	443	325	768
Hospital 6	1117	966	2083	590	487	1077	1707	1453	3160
Hospital 7	1100	894	1994	324	228	552	1424	1122	2546
Total	6526	5666	12192	2859	2098	4957	9385	7764	17149

Site	Inpatient			Observation			Total Video Watchers		
	% Female	% Male	% IP Total	% Female	% Male	% OBS Total	% Female	% Male	% Total
Hospital 1	52%	48%	100%	62%	38%	100%	55%	45%	100%
Hospital 2	52%	48%	100%	54%	46%	100%	53%	47%	100%
Hospital 3	53%	47%	100%	55%	45%	100%	53%	47%	100%
Hospital 4	54%	46%	100%	61%	39%	100%	56%	44%	100%
Hospital 5	56%	44%	100%	63%	37%	100%	58%	42%	100%
Hospital 6	54%	46%	100%	55%	45%	100%	54%	46%	100%
Hospital 7	55%	45%	100%	59%	41%	100%	56%	44%	100%
Total	54%	46%	100%	58%	42%	100%	55%	45%	100%

Table 2. Comparison of male vs. female video watchers by age

Age	Fem ale	Male	Total	% Watched by Age		% Female	% Male	Total	Diff Female to Male by Age
18-34	538	319	857	5%		63%	37%	100%	26%

35-49	1079	723	1802	11%		60%	40%	100%	20%
50-64	1986	1781	3767	22%		53%	47%	100%	5%
65-79	3755	3449	7204	42%		52%	48%	100%	4%
80+	2023	1490	3513	20%		58%	42%	100%	15%
Total	9381	7762	17143	100%		55%	45%	100%	9%

Patient experience

The breakdown in HCAHPS scores can be found in Table 3. Five of the 7 hospitals (including the large urban hospital) experienced higher scores on the medication questions on the HCAHPS survey (average: 3.12 points improvement) when comparing patients who watched the video versus those who did not watch the video in the same units/hospitals. Two community hospitals experienced a decline in the medication questions (average: 1.3 points of deterioration). All hospitals experienced higher scores in the video-watching cohort on at least 5 HCAHPS domains out of the 9 HCAHPS domains. Five hospitals were experiencing increased scores in every HCAHPS domain (average: 3.12 points). One hospital experienced an improvement of an average of 3.5 points in every domain, and another top-performing hospital improved by an average of 4.9 points in every domain, when comparing video-watchers to non-watchers.

The domains that were most improved were: overall hospital rating, likelihood to recommend the hospital, responsiveness, and communication with medications. In terms of demographics of the hospitals, the two community hospitals with the most diverse patient populations and the highest case mix indices also experienced the most improvements in HCAHPS performance for video-watchers compared to non-watchers. The two hospitals with the fewest improvements in HCAHPS have the least diverse patient populations.

As shown in Table 4, the multivariable generalized linear regression showed that participants who watched 50% or more had higher HCAHPS scores when all domains were considered compared to those who did not watch at all [Mean = 76.7 vs 74.3; $\Delta\beta = 2.28$; 95% CI [1.33, 3.23]; $p < 0.001$]. There was no significant difference in the positive score domain between those who watched less than 50% of the videos and those who did not watch at all [Mean = 76.2 vs. 74.3; $\Delta\beta = 1.91$; 95% CI [-0.11, 3.93]; $p = 0.06$]. In addition, age was a significant predictor of satisfaction. Each additional year of age was associated with lower odds of reporting high satisfaction by an average estimate of 0.08 (95% CI [1.01, 1.01]; $p < 0.001$). Gender was significantly associated with HCAHPS scores overall. Male patients were significantly more likely to report higher satisfaction than females ($\Delta\beta = 1.29$; 95% CI [0.39, 2.19]; $p < 0.01$). Race was significantly associated with overall satisfaction. Black patients had higher odds of reporting higher satisfaction compared to White patients ($\Delta\beta = 3.44$; 95% CI [2.15, 4.73]; $p < 0.001$). Ethnicity was also a significant predictor, with Hispanic patients being significantly more likely to get readmitted compared to non-Hispanic patients ($\Delta\beta = 6.2$; 95% CI [4.89, 7.51]; $p < 0.001$). Finally, Admission Type was significantly associated with HCAHPS scores. Patients admitted for elective and urgent procedures had greater odds of reporting higher satisfaction than those admitted for emergency procedures ($\Delta\beta = 4.45$; 95% CI [3.41, 5.49]; $p < 0.001$ and $\Delta\beta = 2.79$; 95% CI [0.18, 5.39]; $p < 0.04$).

Table 3. Comparison of HCAHPS dimensions across sites

HCAHPS Domain	Hospital 1 Watched n=305	Hospital 1 Did not watch (n=1575)	Diff watched vs not watched	Hospital 2 Watched n=359	Hospital 2 Did not watch (n=1906)	Diff watched vs not watched	Hospital 3 Watched n=1114	Hospital 3 Did not watch (n=8034)	Diff watched vs not watched
Overall Hospital Rating	83.9	82.7	1.2	85.0	80.4	4.6	83.4	79.9	3.5
Willing to Recommend	87.5	84.1	3.4	83.4	78.3	5.1	84.8	82.9	1.9
Nurse Communication	87.3	85.6	1.7	85.7	84.0	1.7	81.2	79.6	1.6
Doctor Communication	82.4	80.7	1.7	82.2	79.6	2.6	85.5	83.0	2.5
Care Transition	65.9	62.8	3.1	63.0	58.3	4.7	64.2	61.5	2.7
Communication About Medication	69.1	66.4	2.7	73.0	67.3	5.7	62.2	61.8	0.4
Discharge Information	90.7	90.3	0.4	90.0	89.7	0.3	89.7	88.7	1.0
Responsiveness	76.9	74.1	2.8	74.1	70.6	3.5	65.7	62.2	3.5
Cleanliness	78.0	79.7	-1.7	87.3	83.6	3.7	77.4	74.3	3.1
HCAHPS Domain	Hospital 4 Watched n=748	Hospital 4 Did not watch (n=3368)	Diff watched vs not watched	Hospital 5 Watched n=197	Hospital 5 Did not watch (n=4170)	Diff watched vs not watched	Hospital 6 Watched n=658	Hospital 6 Did not watch (n=2736)	Diff watched vs not watched
Overall Hospital Rating	83.4	82.5	0.9	89.8	84.1	5.7	86.9	83.8	3.1
Willing to Recommend	84.7	83.8	0.9	90.7	86.0	4.7	87.4	84.9	2.5
Nurse Communication	81.7	81.3	0.4	85.7	82.5	3.2	84.8	83.3	1.5
Doctor Communication	80.3	81.1	-0.8	80.7	79.9	0.8	83.6	81.9	1.7
Care Transition	58.7	60.3	-1.6	64.3	61.4	2.9	65.7	62.6	3.1
Communication About Medication	61.4	63.8	-2.4	65.1	64.5	0.6	67.6	67.8	-0.2
Discharge Information	88.0	87.2	0.8	91.5	89.2	2.3	88.8	89.3	-0.5
Responsiveness	63.1	64.1	-1.0	63.5	67.5	-4.0	69.6	68.7	0.9

Cleanliness	83.7	82.5	1.2	87.2	84.1	3.1	85.8	85.2	0.6
HCAHPS Domain	Hospital 7 Watched n=470	Hospital 7 Did not watch (n=3273)	<i>Diff watched vs not watched</i>						
Overall Hospital Rating	85.1	77.1	8.0						
Willing to Recommend	83.8	77.5	6.3						
Nurse Communication	86.7	81.5	5.2						
Doctor Communication	82.9	78.9	4.0						
Care Transition	63.1	59.4	3.7						
Communication About Medication	69.8	63.6	6.2						
Discharge Information	91.1	87.5	3.6						
Responsiveness	73.2	67.7	5.5						
Cleanliness	82.5	79.9	2.6						

Table 4. Group comparison results for all HCAHPS domains

Variables	$\Delta\beta$	Lower CI	Upper CI	P- value
(Intercept)	76.75	74.12	79.38	<0.001
Group = Not Watched	Ref	Ref	Ref	
Group - Watched 0-49%	1.91	-0.11	3.93	0.06
Group = Watched 50% or more	2.28	1.33	3.23	<0.001
Admit Age	-0.08	-0.11	-0.04	<0.001
Gender- Male [Female = Ref]	1.29	0.39	2.19	0.01
Race- White- Ref	Ref	Ref	Ref	
Race- Black	3.44	2.15	4.73	<0.001
Race- Asian	0.26	-1.9	2.42	0.81
Race- Others [Native American + Declined + Unavailable]	0.03	-2.75	2.81	0.98
Ethnicity - Hispanics [Non-Hispanics = ref]	6.2	4.89	7.51	<0.001
Admit Type- [Emergency]	Ref	Ref	Ref	
Admit Type- Elective	4.45	3.41	5.49	<0.001
Admit Type- Urgent	2.79	0.18	5.39	0.04

The same analysis for the *Communication about Medicines* domain revealed that, on average, patients who watched 50% or more of the educational videos reported higher positive scores compared to those who did not watch the videos [Mean = 65.7 vs 63.6; $\Delta\beta$ = 2.58; 95% CI [0.68,

4.49]; $p = .01$]. Additionally, as shown in Table 5, there was no significant difference in the reported scores between those who watched less than 50% and those who did not watch at all [Mean = 66.8 vs. 63.6; $\Delta\beta = 3.57$; 95% CI [-0.67, 7.82]; $p = .10$]. In addition, with every unit increase in age, patients were more likely to have lower satisfaction with communication about medicines by an average estimate of -0.29; 95% CI [-0.35, -0.22]; $p < 0.001$. Gender was also a significant predictor, with Male patients reporting significantly higher satisfaction with medication communications compared to females ($\Delta\beta = 3.73$; 95% CI [1.92, 5.54]; $p < 0.001$). Race was also a significant predictor, with Black patients reporting significantly higher compared White, Asian, and Other races ($\Delta\beta = 8.51$; 95% CI [5.88, 11.14]; $p < 0.001$). Finally, ethnicity was also significant. Hispanic patients were significantly more likely to report satisfaction with medication communication ($\Delta\beta = 8.22$; 95% CI [5.47, 10.96]; $p < 0.001$).

Table 5. Group comparison for communication about medicines domain

Variables	$\Delta\beta$	CI_lower	CI_upper	Pr(> t)
(Intercept)	78.5	73.55	83.46	<0.001
Group = Not Watched	Ref	Ref	Ref	Ref
Group = Watched 0-49%	3.57	-0.67	7.82	0.1
Group = Watched 50% or more	2.58	0.68	4.49	0.01
AdmitAge	-0.29	-0.35	-0.22	<0.001
Gender- Male [Female = Ref]	3.73	1.92	5.54	<0.001
Race- White- Ref	Ref	Ref	Ref	Ref
Race- Black	8.51	5.88	11.14	<0.001
Race- Asian	1.49	-2.58	5.56	0.47
Race- Others [Native American + Declined + Unavailable]	0.69	-4.87	6.25	0.81
Ethnicity - Hispanics [Non-Hispanics = ref]	8.22	5.47	10.96	<0.001
Admit Type- [Emergency]	Ref	Ref	Ref	Ref
Admit Type- Elective	1.31	-0.96	3.58	0.26
Admit Type- Urgent	5.18	-0.36	10.71	0.07

Readmissions

For readmissions, there were 54,477 patients readmitted during the study period who did not watch the videos, and 16,144 readmitted patients who watched 50% or more of the video. The patients who watched the videos were, at best (in one hospital), 31% less likely to be readmitted compared to patients who did not watch the videos (7.7% v. 11.2%) and, at worst, 17% less likely to be readmitted (8.2% vs 10.1%), with a system average of 25% less likely to be readmitted.

In terms of the demographics of the hospitals, the academic medical facility with the largest number of beds is the hospital that also experienced 31% of patients having watched the video being less likely to be readmitted. The smallest hospital (acute care beds=178) experienced the fewest reductions, with 17% of patients who had watched the video being less likely to be readmitted. The large community hospitals with 300-400 experienced varying degrees of readmission, ranging from 18% to 29% reductions. Two hospitals that experienced a large number of reductions (27% and 29%, respectively) had the most diverse patient populations and the highest case mix indices.

As shown in Table 6, the findings from the multivariable generalized logistic regression model showed that patients who watched at least 50% of the videos were 29% less likely and those who watched less than 50% were 24% less likely to be readmitted compared to those who did not watch at all (OR= 0.76; 95% CI [0.67 - 0.87]; $p < .001$ and OR= 0.76; 95% CI [0.67 - 0.87]; $p < .001$,

respectively). Age was a significant predictor of readmission. Each additional year of age was associated with higher odds of readmission (OR = 1.01; 95% CI [1.01, 1.01]; $p < .001$). Gender was also a significant predictor, with males having higher odds of being readmitted (OR = 1.08; 95% CI [1.03, 1.13]; $p < .001$). Race was significantly associated with readmission overall. Black patients had higher odds of readmission compared to White patients (OR = 1.25; 95% CI [1.26, 1.34]; $p < .001$). Ethnicity was also a significant predictor, with Hispanic patients being more likely to get readmitted compared to non-Hispanic patients (OR = 1.08; 95% CI [1.01, 1.15]; $p < .03$). Finally, Admission Type was significantly associated with readmission. Patients admitted for elective and urgent procedures had greater odds of readmission than those admitted for emergency procedures (OR = 0.52; 95% CI [0.47, 0.57]; $p < .001$ and OR = 0.72; 95% CI [0.61, 0.84]; $p < .001$).

Table 6. Group comparison analysis for readmission

Variables	Odds Ratio (95% CI)	P- Value
(Intercept)	0.06 [0.05 - 0.07]	< .001
Group = Not Watched	Ref	Ref
Group - Watched 0-49%	0.76 [0.67 - 0.87]	< .001
Group = Watched 50% or more	0.71 [0.66 - 0.75]	<.001
Admit Age	1.01 [1.01 - 1.01]	< .001
Gender- Male [Female = Ref]	1.08 [1.03 - 1.13]	< .001
Race- White- Ref	Ref	Ref
Race- Black	1.26 [1.19 - 1.34]	< .001
Race- Asian	0.94 [0.84 - 1.05]	0.25
Race- Others [Native American + Declined + Unavailable]	0.9 [0.77 - 1.04]	0.14
Ethnicity - Hispanics [Non-Hispanics = ref]	1.08 [1.01 - 1.15]	0.03
Admit Type- [Emergency]	Ref	Ref
Admit Type- Elective	0.52 [0.47 - 0.57]	<.001
Admit Type- Urgent	0.72 [0.61 - 0.84]	<.001

As shown in Table 7, the same analysis for the *Communication about Medicines* domain revealed that patients who watched at least 50% of the videos were 26% less likely to be readmitted compared to those who did not watch at all (OR= 0.74; 95% CI [0.6, 0.91]; $p < .001$). However, the difference between those who watched 0-49% and those who did not watch was not statistically significant. Age was a significant predictor of readmission. Each additional year of age was associated with higher odds of readmission (OR = 1.01; 95% CI [1.01, 1.02]; $p < .001$). Gender was also a significant predictor, with males having higher odds of being readmitted (OR = 1.17; 95% CI [0.97, 1.42]; $p < .001$). Finally, Admission Type was significantly associated with readmission. Patients admitted for elective procedures had greater odds of readmission than those admitted for emergency procedures (OR = 0.57; 95% CI [0.43, 0.76]; $p < .001$). Race and Ethnicity differences were not significant.

Table 7. Group comparison for communication about medicines domain

Variables	Odds Ratio (95% CI)	P-Value
(Intercept)	0.03 [0.02 - 0.06]	<.001
Group = Not Watched	Ref	Ref
Group - Watched 0-49%	1.08 [0.71 - 1.64]	0.72
Group = Watched 50% or more	0.74 [0.6 - 0.91]	<.001
AdmitAge	1.01 [1.01 - 1.02]	<.001
Gender- Male [Female = Ref]	1.17 [0.97 - 1.42]	0.09

Race- White- Ref	Ref	Ref
Race- Black	0.97 [0.73 - 1.28]	0.84
Race- Asian	0.85 [0.55 - 1.32]	0.47
Race- Others [Native American + Declined + Unavailable]	1.31 [0.75 - 2.27]	0.34
Ethnicity - Hispanics [Non-Hispanics = ref]	0.82 [0.61 - 1.12]	0.21
Admit Type- [Emergency]	Ref	Ref
Admit Type- Elective	0.57 [0.43 - 0.76]	<0.001
Admit Type- Urgent	0.86 [0.47 - 1.55]	0.61

Discussion

To our knowledge, most of the research conducted on medication education has focused on the outpatient setting. Of the work that has been conducted in the inpatient setting, traditional methods have predominantly involved face-to-face education and written materials. However, these methods of medication education are often expensive, impractical from a staffing perspective, time-consuming, and challenging to scale to many patients. A digital mode of communication may provide a more cost-efficient and scalable alternative. Video messaging services are widely available, and most hospitals have access to such services. Furthermore, videos themselves are often integral to many, if not most, patient education vendor libraries. Indeed, we did not create new content or select new vendors for this study. We were able to connect two different vendors that our hospital system already used for all forms of patient texting and patient education at no additional cost.

There have been other studies on medication education videos. A recently published systematic review of patient education videos found 12 articles from four countries on medication education interventions that met inclusion criteria (Weidmann et al., 2023). The systematic review also found that very few studies were well-designed enough to discern the mechanism for behavior changes. The findings also suggested that videos utilized in previous studies were notably long, ranging from four minutes to 60 minutes, and included a maximum of 112 patients. Moreover, the primary endpoint in those studies on medication education videos focused on increasing patients' understanding and knowledge using a variety of self-reported questionnaires. None of those studies evaluated other endpoints, like patient experience or readmissions. Our study addresses these gaps by examining other endpoints associated with medication videos and includes a relatively large sample of patients in both the control and intervention cohorts across a large, diverse healthcare system with several hospitals.

We found that a digital mechanism for providing patient education is feasible, is associated with improved patient experience as measured through HCAHPS performance and is associated with a significant reduction in readmissions.

An interesting finding in our study is that the hospitals with the highest acuity and most diverse populations arguably performed the best in both readmissions and patient experience, whereas the less diverse, often more affluent hospitals with higher socioeconomic patient populations performed modestly. Given that our study is exploratory and is not designed to make causal assertions, we cannot make sound causal inferences or concrete statements on why these findings occurred. There is some insight, perhaps, in a study conducted by Abed et al. (2014) in that those investigators identified factors that may be linked to the efficacy of video-assisted patient education: the format in which the information is presented and the complexity of the addressed behavior. They found that patients in audio-visual cohorts demonstrated higher recall. Because we used both written and audio-visual content in our study, and the videos were short and relatively non-complex, we could perhaps speculate that the videos appealed to a wider audience and met the

cues and interplay requirements articulated by Abed and colleagues.

Another significant contribution of our study is that the preexisting studies on medication education videos exclusively focus on patients with specific health conditions, like rheumatology (Katz et al., 2015) or dermatological conditions (Correnti et al., 2014). Our intervention was applied to patients in any condition for which the medication was prescribed, thereby increasing the generalizability of this study. Because we did not find any discernible differences in the health conditions of patients who watched the videos versus those who did not watch, and we did not find any notable differences in the health conditions of those readmitted or those who scored HCAHPS higher or lower, we can speculate that videos likely hold some efficacy across patients of any healthcare condition.

This study has limitations. One limitation is that we were limited to the quality of the documentation provided in the EHR, and there could have been data errors within the documentation. For instance, to record mobile cell phone numbers, patients verbally provide their cell phone number to registration staff who then manually enter it in the mobile cell phone field. The data entry could have been incorrect, and videos could have been sent to landlines and entered the mobile cell field within the EHR. A second limitation is that we were constrained by the vendor limitations. Specifically, if there was no pre-existing medication video on file within the library, then no video was sent to the patient for a specific new medication administration. A third limitation is that there could be coding errors in reviewing, interpreting, and coding patient comments. Finally, we did not measure readmissions in facilities outside Houston Methodist because we were limited to the data source of the EHR, which captures only the system's readmissions. It is possible that a patient could be re-admitted to a different hospital system's facility, which will count as a new admission to that facility.

Perhaps the most significant limitation of this article is also an area ripe for future research: the behavioral mechanisms that create or cause greater efficacy in medication education. It could very well be the case that patients who tend to be active in their healthcare, including watching educational videos, are also likely to be more adherent in following post-discharge care regimens and therefore less likely to be readmitted. Or maybe patients who are fully engaged and activated in their healthcare are also happier with their hospital experience and therefore report higher scores on the HCAHPS survey. Given the exploratory nature of this work, we cannot even begin to make definitive claims about what behaviors or attributes influence outcomes. We can only identify associations and note that there is evidence in the literature suggesting that activated patients achieve healthier outcomes and feel more positive about their healthcare experience (Hibbard & Greene, 2013; Hibbard et al., 2013), so there is likely some latent causal attribute that remains undetected.

Conclusion & Future Research

Our study advances the literature in that we found that medication education videos can be scaled across thousands of patients in the inpatient setting in a short time frame, at little cost. Patients who watch videos are likely to have fewer readmissions and stronger patient experience scores across multiple domains. What remains to be seen—and what we suggest as areas of future research—is identifying the behaviors or attributes that manifest for patients who watch videos and whether and how those behaviors can be promoted by healthcare systems. For instance, while existing literature shows that patients who are more engaged in general also participate in preventive behaviors, like immunizations and screenings (Mosen et al., 2007; Hibbard et al., 2007), and more likely to adhere to treatment (Greene & Hibbard, 2012), it is unclear what characteristics predispose someone to watch a video and how that links with their outcomes. One way this could be done is to analyze the patient characteristics and activation levels for those who watch

medication education videos versus those who do not. There are existing activation scales that could be administered with patients, and a taxonomy of characteristics for video-watchers could be developed and applied with higher or lower “activators” to determine whether and how there might be a connection between activation characteristics and behaviors and video-watching.

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Appendix A. HCAHPS Questions and Dimensions

Dimension (Composite)	HCAHPS Questions (Abbreviated)
Communication with Nurses	- How often did nurses treat you with courtesy and respect? - How often did nurses listen carefully to you? - How often did nurses explain things in a way you could understand?
Communication with Doctors	- How often did doctors treat you with courtesy and respect? - How often did doctors listen carefully to you? - How often did doctors explain things in a way you could understand?
Responsiveness of Hospital Staff	- After pressing the call button, how often did you get help as soon as you wanted? - How often did you get help in getting to the bathroom or in using a bedpan as soon as you wanted?
Communication about Medicines	- Before giving any new medicine, how often did staff tell you what it was for? - How often did staff describe possible side effects in a way you could understand?
Discharge Information	- Did someone explain what you needed to do during your recovery at home? - Did you get information in writing about what symptoms or health problems to look out for?
Care Transition	- Staff took my preferences and those of my

	family into account when planning care. - I had a good understanding of the things I was responsible for in managing my health. - I clearly understood the purpose for taking each of my medications.
Cleanliness of Hospital Environment	- How often were your room and bathroom kept clean?
Quietness of Hospital Environment	- How often was the area around your room quiet at night?
Overall Hospital Rating	- On a scale from 0 to 10, how would you rate this hospital?
Recommendation of Hospital	- Would you recommend this hospital to your friends and family?