


# Evaluation of an Automated Reminder System for Reducing Missed MRI Appointments

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## Abstract

**Background:** The high frequency of missed appointments continues to be a burden on healthcare providers, leading to decreased productivity, quality of service, and quality of outcome. The purpose of this study is to evaluate the effectiveness of Televox's automated appointment reminder service in reducing the missed appointment rate for MRI (magnetic resonance imaging). The appointment reminders were sent 72 h in advance. The total and no-show numbers were tallied to calculate missed appointment rates. Comparison of the missed appointment rate with and without Televox implementation and different payment types was performed. Temporal comparisons were also made across the corresponding time periods in order to control for seasonal fluctuations. **Results:** An insignificant decline in missed appointment rates was found in locations implementing Televox ( $P = .495$ ) overall, although a significant decrease in missed appointments was found among Medicaid patients ( $P = .0381$ ). **Conclusion:** Implementation of Televox appointment reminder systems did not significantly affect appointment attendance overall, but could be more useful specifically for encouraging Medicaid patients to attend MRI appointments.

## Keywords

appointments, radiology, MRI, reminders

## Introduction

The prevalence of patients failing to appear at scheduled appointments poses a significant burden across healthcare systems. No-shows can seriously hinder the productivity of clinicians, lead to missed revenue, in turn driving up the cost of healthcare services (1). The service's effective capacity is decreased, leading to longer wait times and a decrease in quality of the patient experience (2). A patient's higher propensity of no-shows has also been linked with suboptimal primary care outcomes (3). This is especially true for magnetic resonance imaging (MRI) appointments, which are essential for decisions in diagnosis and treatment. Lowering the no-show rate is thus a critical and relatively straightforward way in which a clinic can improve overall patient care quality.

Several demographic factors have been found to be associated with the likelihood of showing up to medical appointments. For instance, patients of lower age and socioeconomic status are often the most likely to miss their appointments, as well as those without private insurance or who live a far distance from the clinic (4,5). Appointments made long in advance of the date (high lead time) are also more likely to be no-shows (6).

Various interventions have been evaluated, from positive and negative financial incentives, to overbooking, to simply

providing more information about the planned procedures (7–12). Studies that have asked patients to report their reason for missing appointments have found the vast majority simply “forgot” and thus many interventions have been reminder-based (13). These have often been helpful in reducing the no-show rate across several types of practices, though they invariably add to the workload of the office (14–18). Automated systems such as Televox are marketed to ease this burden, thereby achieving intended quality improvements without augmenting the overall workload (19).

Intrado's Televox Appointment Reminders offer tools for delivery of high volumes of reminders, through phone, text, and email, and claim to lower no-show rates by 25%–30%. The service is designed to save staff time, generate patient responses, and be more cost-effective than mailed reminders (20). Our institution has subscribed to Televox for automated

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appointment reminders at several but not all locations, offering a unique opportunity to evaluate the system's efficacy through an ecologic and temporal comparison. The purpose of this study is to investigate the impact of this intervention in reducing the no-show rate for outpatient MRI appointments with the radiology department.

## Methods

This study was carried out within the University of Chicago Medicine system, an urban tertiary care academic medical center. Appointment status categories were recorded and collected from the EPIC electronic medical record system, with totals including all outpatient appointments scheduled. Cancellation counts include appointments that were both canceled and rescheduled, and no reason was collected for cancellations. For the Radiology Department at the locations where Televox was implemented, reminders were sent to patients who have both opted-in to receive reminders and made their appointments at least 72 h in advance via phone message. Televox reminders were sent 72 h prior to the scheduled appointments. All the outpatient MRI appointments that met the above criteria were included in the analysis with no sampling, maximizing this study's internal validity. The serviced outpatient MRI population demographics during the study period were 52.5% white, 37.7% black, and predominantly 50 to 73 years of age (47%). The most common scan type was MRI brain with contrast (12.2%), followed by MRI spine without contrast (8.2%). Appointments for MRI were scheduled on weekdays excluding federal holidays.

Data for missed appointments were available during the course of November 2017 to February 2020 at our institution. The missed appointment rates were computed and compared before and after the day of Televox implementation (October

15, 2018) at both the sites that implemented Televox and those that did not. The no-show rate is defined as cancellations as a percent of total outpatient appointments originally scheduled. Location-specific temporal comparisons were also made across the same time period in 2019 in order to control for seasonal fluctuations of potentially confounding variables at those locations. R software was used to run two-tailed *t*-tests to compare the pre-October and post-October groups at each location in each year, and the *p*-values of these tests are included in the table. A *p*-value of 0.05 was considered statistically significant.

The same type of analysis was run with the no show rates for several groups by payment type as well. These payment type groups include patients across all five locations, and thus lose information about Televox status. The monthly rates across the same time periods before and after October were averaged and *t*-tests were performed comparing the pre- and post-October groups for each year and payment type.

The data was additionally tabulated in contingency tables, involving the counts for the number of appointments completed and the number of no shows, where each table represents one set of locations (with or without Televox) in a single year (2018 or 2019). Within the tables, the counts were further broken down by appointment success and pre- and post-October time periods. Fisher's exact test was then run on the contingency tables in order to determine if the appointment success and pre- or post-October time period were dependent on one another. It was expected when there was no exogenous change in October for the locations without Televox in 2018 and in 2019, and for the locations with Televox in 2019, the variables would be independent. For locations where Televox was implemented in October 2018, it was expected that the appointment success and time periods will be dependent on one another. Fisher's test was selected over the classic chi-squared test because there are

**Table 1.** Location Analysis, Using *t*-Tests.

	2018 (Televox implemented October 2018)					2019 (no new policy change in October)				
	Pre-October		Post-October		<i>P</i> -value	Pre-October		Post-October		<i>P</i> value
	Average	Standard deviation	Average	<i>S</i> Standard deviation <i>D</i>		Average	Standard deviation	Average	Standard deviation	
Total (all locations) ( <i>n</i> <sub>2018</sub> =6761, <i>n</i> <sub>2019</sub> =7525)	1.384%	0.50%	1.379%	0.48%	0.495	5.596%	0.93%	5.575%	0.36%	0.485
Without Televox* ( <i>n</i> <sub>2018</sub> =1385, <i>n</i> <sub>2019</sub> =853)	1.332%	0.27%	2.182%	1.52%	0.173	1.204%	1.61%	0.329%	0.66%	0.186
With Televox* ( <i>n</i> <sub>2018</sub> =5376, <i>n</i> <sub>2019</sub> =6672)	1.393%	0.67%	1.197%	0.43%	0.322	5.989%	0.95%	6.440%	0.45%	0.219

\*The UChicago Medicine locations where Televox was implemented in October 2018 were DCAM, Mitchell, and Orland Park. Televox was not implemented at the remaining two locations: CCD and Comer.

**Table 2.** Payment Type Analysis, Using *t*-Tests.

	2018 (Televox implemented October 2018)					2019 (no new policy change in October)				
	Pre-October		Post-October		<i>P</i> -value	Pre-October		Post-October		<i>P</i> value
	Average	Standard deviation	Average	Standard deviation		Average	Standard deviation	Average	Standard deviation	
Total ( <i>n</i> <sub>2018</sub> =6761, <i>n</i> <sub>2019</sub> =7525)	1.384%	0.50%	1.379%	0.48%	0.4955	5.596%	0.93%	5.575%	0.36%	0.4846
Blue Cross/ Blue Shield ( <i>n</i> <sub>2018</sub> =2064, <i>n</i> <sub>2019</sub> =2274)	0.882%	0.52%	1.543%	0.73%	0.9020	4.194%	1.42%	3.386%	0.38%	0.1713
Medicaid ( <i>n</i> <sub>2018</sub> =1213, <i>n</i> <sub>2019</sub> =1415)	2.798%	1.09%	1.390%	0.57%	<b>0.0381</b>	10.87%	2.93%	10.15%	2.86%	0.3686
Medicare ( <i>n</i> <sub>2018</sub> =2277, <i>n</i> <sub>2019</sub> =2572)	1.272%	0.89%	0.870%	0.39%	0.2271	4.691%	0.87%	5.521%	1.48%	0.8106
Private ( <i>n</i> <sub>2018</sub> =1141, <i>n</i> <sub>2019</sub> =1210)	0.708%	0.58%	1.355%	1.44%	0.7735	3.237%	1.98%	3.391%	1.06%	0.5516
Self ( <i>n</i> <sub>2018</sub> =66, <i>n</i> <sub>2019</sub> =54)	1.786%	3.57%	20.83%	25.0%	0.8874	14.55%	19.0%	51.11%	33.4%	0.9408

Bold indicates significant value.

generally low counts of no shows, especially in the locations without Televox in 2019.

## Results

The no show rates for each time period and location are included in Table 1, in which only patients that opted to receive reminders at the sites where Televox was available were included and all patients at the sites without Televox were included. Across all five subsites of our campus, there was a slight drop in the no-show rate after October 2018 that was not statistically significant ( $P = .495$ ). In 2019, the no-show rates were generally higher than during the previous year, but there was a slight drop in the no-show rate after October 2019 ( $P = .485$ ).

After October 2018 in the locations where Televox was not implemented, there was a slight increase in the no-show rate of 0.85%, while there was a more notable decrease across the same time period in 2019 from 1.2% to 0.3%. However, neither change was found to be statistically significant ( $P = .173$  and  $0.186$ , respectively).

In the locations where Televox was implemented, there was a slight drop in the no-show rate in October 2018 (which would be expected with an effective reminder service), contrary to the concurrent increase in the other locations of the campus. This drop, however, was slight, and not statistically significant ( $P = .322$ ). Across the same time period in 2019, there was an increase of about equal degree, although the rates themselves were notably higher.

**Table 3.** Location Analysis Using Contingency Tables and Fisher's Exact Test: *p*-Values.

	With Televox	Without Televox
2018	0.54819	0.30153
2019	0.47866	0.19353

The 2019 increase in no-show rate in locations with Televox was similarly not statistically significant ( $P = .219$ ).

Table 2 summarizes the results of the payment type analysis, including average no-show rates for each time period and payment type across all five campus locations. The changes in no-show rate following Televox implementation were largely not significant, with only one group showing a significant change: Medicaid patients ( $P = .0381$ ). In this group, the no-show rates declined by about half, from 2.80% to 1.39%. For Medicare patients in 2018, the rates also declined but not significantly, from 1.27% to 0.87%. These were the only two groups to decline in no show rate after the implementation of Televox in 2018. Groups of patients by other payment types, like Blue Cross/Blue Shield, private insurance, or self-pay, saw an increase in the no show rate over this time period (each with  $P > .05$ ).

The results of the contingency table analysis are included in Table 3. For the experimental group with Televox in 2018, the appointment success and time period variables before and after October 2018 were found to be independent of one another, suggesting again that Televox implementation in October 2018 did not have a strong effect on whether patients

showed up to their appointments ( $P = .548$ ). For the ecologic control—the locations without an intervention in 2018—the appointment status and time period categorical variables were similarly found to be independent, as well as for both location sets across the same time range in 2019.

## Discussion

At locations where Televox was implemented, there was a slight decrease in the no-show rate after October 2018, while there was a slight increase in the no-show rate at locations where Televox was not implemented. Over the same time frame in 2019, the locations with Televox saw a slight increase in no-show rate, suggesting that the observed decrease after the intervention in 2018 may be in part obscured by seasonal fluctuations for this location-set. Other literature on factors attributed to no-show rates suggests that the missed appointment rate is generally *higher* in the summer than in the winter, as we do observe in aggregate, although this is not consistent with the observations of the locations with Televox (21).

At the largest site on our campus, one of the three where Televox was implemented, there was a quite noticeable increase in the no-show rate after February 2019, contributing to the higher rate of missed appointments in 2019 for the Televox and Total categories. The reason for this increase is unclear since there were no other major changes made to appointment scheduling or the manner in which Televox was implemented during this period. It is unlikely that the drastic increase can be attributed to Televox since it occurred five months after implementation, but it certainly cannot be eliminated as a potential reason.

The analysis again showed no significant impact of Televox implementation in October 2018 on appointment success rates. The control groups showed largely independent relationships between the variables as well, although it is notable that the locations without Televox showed very low no show counts overall, going down to 2 from only 4 before October 2019. The number of appointments completed at those locations in 2019 is generally much lower than the other groups as well.

The only group by payment type that saw a significant decrease in the no show rate before and after October 2018 was Medicaid patients, suggesting their rate decrease contributed to the decrease seen in locations where Televox was implemented. Medicare patients also saw a decrease, though slight, suggesting Televox was a more successful tool to decrease the no-show rate with patients with Medicaid or Medicare insurance. Groups by other payment types saw an increase across this time period, suggesting Televox reminders were less effective for patients with those payment methods. It is well-documented that patients of lower SES or without private insurance are more likely to no-show, and a more pronounced effect for Medicaid patients is likely reflective of this fact. A key limitation of this part of the analysis is that the data by payment type

obscures location information, so it is unknown how many patients in each payment type group were actually reminded of Televox. Future work with a closer analysis of the public insurance subgroup is thus likely to yield a stronger effect.

Some additional limitations of this study include that it was not recorded how patients responded to Televox appointment reminders, and it is unknown if they were well-received or at all regarded. Future studies could survey patients that do show up to their appointments and whether they were aware they received a reminder from Televox and follow up with those that did not to ask why they did not make their appointment.

## Conclusion

Implementation of Televox appointment reminder systems did not significantly affect appointment attendance overall, but could be more useful specifically for encouraging Medicaid patients to attend MRI appointments.

## Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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