REDUCING SAME DAY MISSED APPOINTMENTS

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Abstract

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Radiology Associates (RA) is a diagnostic imaging center that offers high-quality, digital medical imaging and interventional radiology services for patients, physicians and healthcare organizations across the Central Coast. They are an ongoing problem that involves a considerable portion of their patients not showing up for their appointments

Our project aims to reduce same day missed appointments at Radiology Associates. Radiology Associates currently has a no-show rate of 13.48%. They lose approximately $240 for every same day missed appointment. Our goal was to find new ways to reduce their no-show rate to 8%. Based on our calculations, Radiology Associates could save $39,285.35 by reducing the no-show percentage by 5.5%. We researched literature on causes of no-shows and alternative scheduling methods. We then mapped out the scheduling process and analyzed data on no-shows. After discovering some potential causes for the high no-show rate, we constructed solutions and created standard operating procedures.

Acknowledgements

Many people provided their guidance and support throughout the course of this project. We are grateful to each and every one of them because our project would not have been as successful without their involvement. First we would like to thank everyone at Radiology Associates for entrusting us with copious amounts of confidential data, setting aside time out of their busy schedules to answer numerous questions, and responding to our multiple emails. Lastly, we would like to thank Kelly Kurtz (an IAB member) who was a source of positivity throughout the two quarter long process. All of Kelly's advice and positivity truly elevated our team and project greatly.

Table of Contents

List of Tables

List of Figures

I. Introduction

This report will describe Radiology Associates' same day missed appointments problem at their Digital Medical Imaging (DMI) facility in Santa Maria. Radiology Associates (RA) is a diagnostic imaging center that offers high-quality, digital medical imaging and interventional radiology services for patients, physicians and healthcare organizations across the Central Coast. A no-show patient is also classified as same day missed appointment for RA. Throughout this paper we will refer to same day missed appointments as no-show patients.

For years, RA has had trouble improving their no-show patient rate at their DMI in Santa Maria. This location has historically experienced far more no-shows than their Templeton and Pismo Beach locations. For example, RA in Templeton had a 8% no-show rate from January to September of 2017. RA in Santa Maria however, had a no-show rate of 13.48% for these same months. This high no-show rate is problematic because no-shows account for a loss in revenue. For every no-show patient, they could have scheduled an appointment in that time slot with someone who would have actually shown up to the appointment. Therefore, RA perceives this problem as an opportunity loss.

RA asked us to specifically focus on five of the seven total procedures performed at their DMI office. Our project will therefore look at same day missed appointments for Computed Tomography scans, Magnetic Resonance Imaging scans, Mammograms, Fluoroscopy tests and Ultrasounds. We will refer to these as CT, MRI, MAMMO, FL, and US throughout this paper.

For these tests alone, RA loses approximately $240 for every same day missed appointment. RA's total opportunity loss was $714,279 for January to September 2017 . The

goal of our project is to reduce the no-show rate to 8%. Reducing RA's no-show percentage by 5.5% would save them $39,285.35. Our project scope will focus on same day missed appointments, not rescheduled appointments. In order to complete this project we will analyze all of RA's current data on same day missed appointments including the amount of same day missed appointments for January to September of 2017, and patient reasons for missing the appointment for January 2016 to October 2017.

Problem Statement

"Radiology Associates of Santa Maria has a 13.48% no-show rate. They lose approximately $240 for every same day missed appointment."

II. Background

The process of performing imaging begins with a patient scheduling their own appointment or a physician scheduling a patient's appointment with RA. The appointment is typically made a few days prior to the test date. Same day appointments are uncommon due to RA's already booked schedule. Same day appointments are also uncommon because most procedures require patients to have prior preparations. Patients are given the liberty to cancel and reschedule an appointment at any point in time. RA does however ask patients to cancel an appointment at least 15 minutes prior the scheduled appointment. If a patient cancels 15 minutes before, RA does not count that appointment as a missed appointment. However, if a patient reschedules an appointment the day of their appointment, this too is considered a same day missed appointment if RA does not fill the time slot. When there is an open time slot, RA tries to fill the time slot by either contacting patients with later appointments or other patients that happen to be on site.

After booking an appointment with RA a patient would receive one or possibly two appointment reminders through a third party add on called DoctorConnect. DoctorConnect is the tracking and appointment reminder system that is currently used at all three of RA's facilities. Through DoctorConnect, a patient receives a text, phone call, and email all reminding them of their appointment date and time. The reminders also prompt patient interaction by asking a patient to confirm or reschedule their appointment. Upon confirming, the patient then receives a follow-up message detailing where the location of the facility is. If a patient does not confirm an appointment through the first text, call or email, the system will send another reminder the next

day. Though this seems like a great feature for reminding patients of their appointments RA do however have low response rates and confirmations through this service.

Any time a patient misses an appointment, RA calls the individual to inquire their reason for missing. They reach out to the patient by both phone and email. Though RA has a system for reaching out to patients for feedback, they continuously have a low response rate. From January 2016 to October 2017, 58.5% of same day missed appointments did not respond to their survey.

Although this is the first senior project to tackle RA's problem of reducing same day missed appointments, they have had many efforts centered around this in the past. RA has had project teams and individual projects done by their very own staff. Previous recommendations for decreasing no-show rate at their Santa Maria location have been the following: patients who missed appointments must pay a fee, having patients confirm appointments 48 hours prior, providing transportation for individuals that need assistance in getting to the imaging center, and many more. Many of these past efforts have gone on unsuccessful and thus had no effect on their no-show rate. These projects will give us insight to what has already been done so that we may tackle RA's same day missed appointment problem with fresh ideas.

Attempts to decrease the no-show rate will continue until RA sees a change in no-shows at their Santa Maria DMI location. We seek to bring in a new set of eyes and improve their same day missed appointments throughout the course of our project.

Literature Review

After choosing our senior project, we realized a lot of research needed to be done in order to fully inform ourselves on the characteristics of healthcare and imaging practices. We

researched numerous literature documents and found articles on factors for patients missing appointments, Stark Law, patient profiling, cancellation policies, the double booking process, effective appointment scheduling processes, and customer service. All of this information was pivotal because fulling understanding the situation is the first step to improving it.

A study we found concluded that the no-show rate in 10 main clinics was 18.8% [1]. Based on this, it was clear that no-shows impose a major burden on the health care system across the board. RA is not the only company with this problem, many others in the healthcare industry around the world have been grappling with unreliable patients. Any sense of patient unpunctuality has proven to be detrimental on provider productivity. This can lead to lower access to healthcare, underutilized resources, and higher health care costs [2]. We can then surmise that our project holds a strong relevance in the medical and financial practices of prudent business. For example, one team came up with a joint capacity control and overbooking model that controlled the booking while still maximizing profits [3]. Successfully maintaining a lower no-show rate has proven to save potentially lost revenue

A great deal of research has been done in regards to patient no-shows and the causes behind the missed appointments. A study performed in 2004 provided three main reasons why patients do not show up to appointments. Discovered reasons were the patients felt negative feelings about seeing a doctor, felt that the staff did not respect their time and emotions, and were unaware of the havoc that a missed appointment can cause [4]. When asking patients about their scheduling experience, it was found that females with poor education, no clarification on imaging instructions, and had a family member drive them were proportionally more likely to

reschedule an appointment [5]. In addition, we found it is actually a small proportion of the total patient population that accounts for the majority of no-shows [6].

A study done by a group of doctors determined if there was subsequent evidence to predict future no-shows by patients [7]. They did this using statistical and regression models of the patient data at an academic medical center. They found a 6.5% no-show rate and concluded the highest modalities were MAMMO and CT and the lowest were for positron emission tomography (PET) and MRI. Using stepwise logistic regression analysis, they found previous no-shows, days between scheduling and appointments, modality type, and insurance type were most strongly predictive of a no-show. These results can be helpful in targeting specific patents with reminders so that they are more likely to show up. On the other hand, we read that a patient's employment status, patients who English is their primary language, and the distance that the patient is away from the health center are not good predictors of no-shows [8].

Moving on, we also wanted to explore different scheduling processes facilities have used to solve the problem. Many of the models we found were based on finding a time slot that worked best for the patient. A major consideration for these models was that ignoring interruptions produced bad results, while policies that required equally spaced appointments performed reasonably well [9]. It was apparent that a static approach was not a sufficient method of scheduling; the system needed to take cancellations and interruptions into account. A dynamic system, which is one that is flexible in its ability to account for anomillis, works best to account for patients requests for specific appointments times [10].

Another reference we found created a cancellation policy which took into account current no-show rates, flow within the clinic, and other important factors [11]. They created a

simulation of the scheduling process and found there needed to be an increase in the time that patients call in for a no-show because of low appointment fill rates and the high no-show rate. We used this information to gain a better grasp of how clinics should respond to potential no-shows.

Although we did not consider double-booking because RA was against this, we researched some scheduling models that incorporated double booking in order to find the positive aspects of double-booking. Through different references, we found an overlapping characteristic that double booking could maximise the number of patients seen while minimizing waiting time and overtime [12] [14]. There was also a hybrid scheduling system that combined two different systems together [13]. This one was effective but also ran the risk of confusing the patient.

We also found a summary of the Stark Law in "Stark Laws Rules of the Road" [15]. This is a short document on the basics of the Stark Law intended for physicians who want to be more informed on the law. The Stark Law essentially prevents self referral with physicians for a monetary value. Additionally, in 2003 Congress extended the law to also cover some non-monetary remuneration where the referring physician had ownership or investment interest [16]. Our team also looked into the negative impacts a healthcare facility could undergo if they violated Stark Law. When a hospital violates the Stark Law, they are able to self report themselves to avoid legal consequences [17]. Often times when hospitals self report they pay less than if they were caught.

Finally, we researched information about customer service and how a company can become excellent at it. We found a paper that discussed the issues a company faced with

supporting its customers. It stressed the importance of taking an end-to-end view of the complete customer experience: from when problems first occurs right to when the customer is satisfied with an adequate solution [18]. In order to fully establish a customer service system, a company must incorporate its entire range of business functions toward satisfying the needs of each customers. Organizations can find success by focusing in three areas: customer friendly processes, employee commitment to customer service, and customer dialogue [19]. We can conclude that gathering information and feedback from the customer is critical in providing a service or product that suits the customer's needs [20].

III. Design

This section of the report will describe the specifications, requirements, and constraints for the design of our project along with our overall theory of approaching our problem of reducing same day missed appointments. The first major constraint on our project was to be in coherence with the Stark Law placed on all medical facilities including RA. These laws essentially prevent self-physician referral of a patient to any facility providing health services with a financial benefit. We conducted research on the Stark Law in order to become more versed on the subject and fully understand the limitations RA are bound by. We found that we had to narrow the scope of our improvement ideas to something that is reasonably within these boundaries. An additional requirement for our project was that the solutions we implemented must be profitable. For example, RA must reach a return on their investment if we are requiring them to spend money on one of our ideas. RA aims to increase their profits and our goals should aligned with theirs. Our last constraint was that our project was to only focus on same day missed appointments and not appointments that were rescheduled with RA.

Our approach on this project was to analyze data and records of same day missed appointments provided by RA. With this provided data we used process improvement fundamentals such as a fishbone diagram, an IMR chart, pareto charts, and oneway ANOVA tests. We used JMP to do the majority of the statistical analysis with the objective to discover any statistically significant trend. Our overall goal was to identify a trend among the data that would in turn help us understand the causes of no-shows.

When analyzing same day missed appointments we decided to start at the very beginning of it all, how appointments are made. We therefore created flowcharts to define the process of how RA makes appointments for all five tests (Appendix A-E). Our group visited RA in Santa Maria and met with a scheduler to record this appointment information. For each type of test we acted as a patient and went through the appointment scheduling process. After recording each test's process we asked the schedulers if there were any areas they believed the scheduling process needed to be improved. We found most schedulers agreed they only told patients about available ride services if they saw the patient had a physical impairment. Schedulers also told us appointment clarity and DoctorConnect confirmations was a big area they thought had room for improvement.

After speaking with many of RA's staff members, learning more about scheduling and same day missed appointments we decided to create a fishbone diagram. We used a fishbone diagram (Figure 1) to identify potential root causes of same day missed appointments and narrowed it down to four main areas to focus on. Patient transportation was the top area we wanted to target because there are ride services already available to patients.

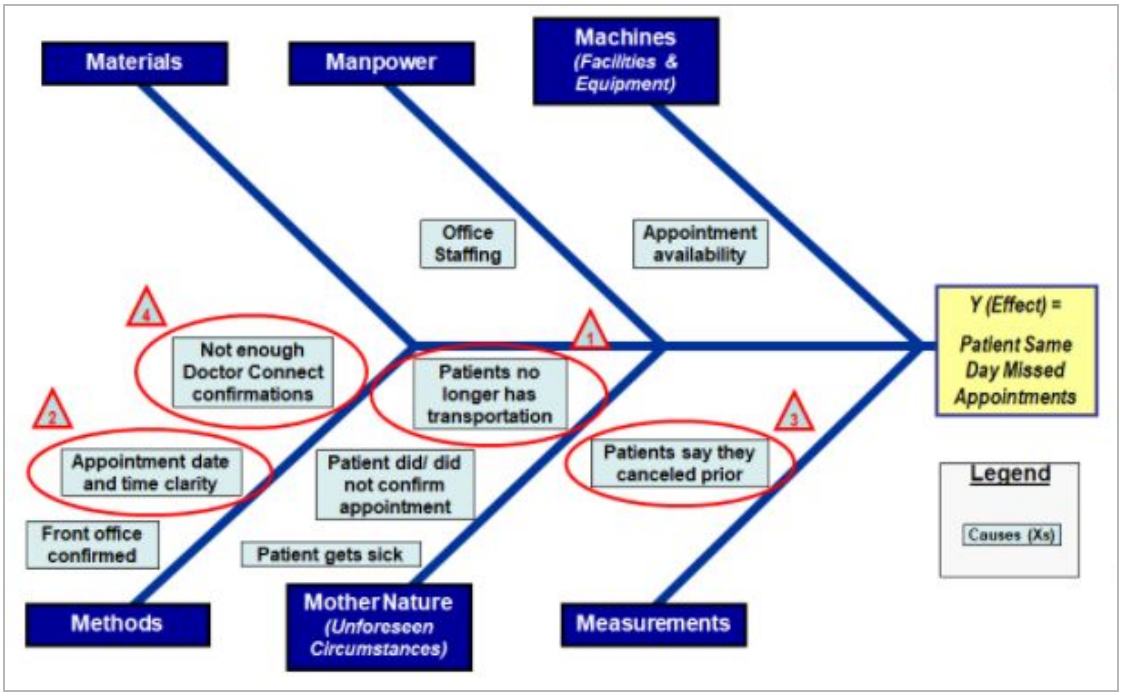

Figure 1: Fishbone diagram of potential root causes

RA currently advertises ride services from third party providers on their website. They do not, however, actively tell patients about these services. Our next areas of focus was appointment date and time clarity for patients that say they already canceled the appointment. Both of these areas involve the accuracy and clarity of the RA schedulers. Lastly, we decided to look into DoctorConnect appointment confirmations. DoctorConnect is a system designed to help remind patients of their appointments and confirm the date and time of the appointment. Focusing on this system can have a positive impact on both appointment accuracy and clarity.

RA provided us with same day missed appointment data for January 3, 2017 to October 5, 2017 for all three of their facilities. This raw data included every date of operation during these months (including the day of the week), every test performed at each location, the target number of appointments per test, the number of scheduled appointments per test, the number of appointments they actually had for each test, and the variance (variance is the scheduled versus

the actual). We used data from January to September 2017 as a baseline for all of our analysis. RA typically operates Monday through Friday, however they occasionally take appointments on Saturdays in order to accommodate patients who work during their normal business hours. For the purpose of maintaining uniformity within our data analysis we excluded one data point, Saturday, April 29, 2017.

RA operates Monday through Friday for 11 and a half hours per day. They have an internal goal of scheduling 114 appointments per day for these five tests alone and averaged 127 scheduled appointments per day from January through September 2017. RA currently goes above their target which is good for revenue, however they are then directly increasing their probability of no-shows as well. Using the provided data we created an IMR chart (Figure 2) to plot the number of missed appointments per day for these nine months. A total of 191 data points were used to find the average number of missed appointments per day. There are two outliers in this data set, one on Tuesday May 23rd and one on Monday June 26th. There were 35 and 41 missed appointments on those days alone. We looked to see if those days fell on holiday weekends, but they do not. We therefore do not necessarily know why the no-show rate is so high on these two particular days. The IMR chart shows RA averages 17 missed appointments per day. If we look at this number in context, that means on a normal business day they have roughly one and a half missed appointments every hour.

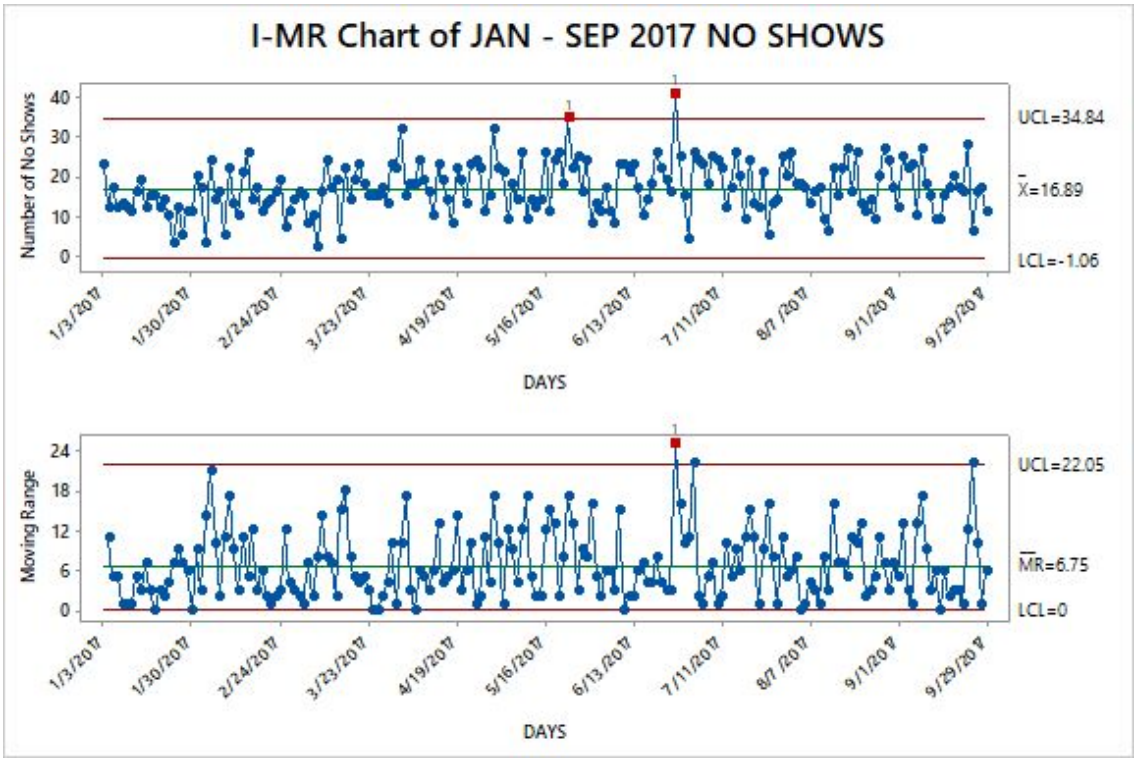

Figure 2: IMR chart of average daily no-show

Upon performing extensive data mining we generated multiple sets of values to compare. The first trend we decided to analyze was the initial breakdown of no-shows by test type. As stated earlier, our project specifically tracked same day missed appointments for CT, MRI, FL, MAMMO, and US. Using a pareto chart (Figure 3) we found US, MAMMO and MRI accounted for an overwhelming 90.5% of no-shows.

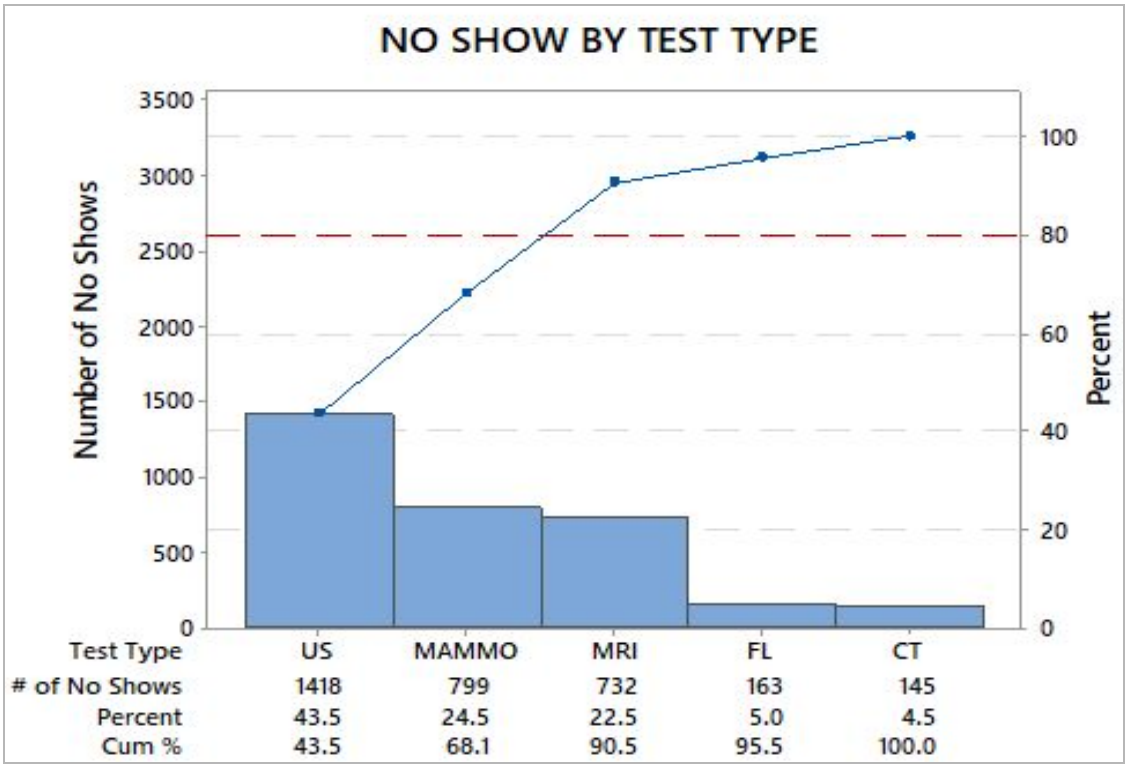

Figure 3: No-show percentage given the test type

This high representation of no-shows for these three tests directly correlates with RA's high targets. RA has an internal target of scheduling 9 CT, 32 MRI, 3 FL, 34 MAMMO, and 36 US per day. Identifying no-shows by test was key to our project because we could then analyze the opportunity loss to RA regarding each specific test.

The next trend we decided to analyze was the time of the year that no-shows occured. RA averages 362 same day missed appointments in a month. We categorized no-shows by month with a pareto chart and found January and February had the least amount of no-shows while May had the highest (Figure 4). All of the other months had a similar mean number of missed appointments.

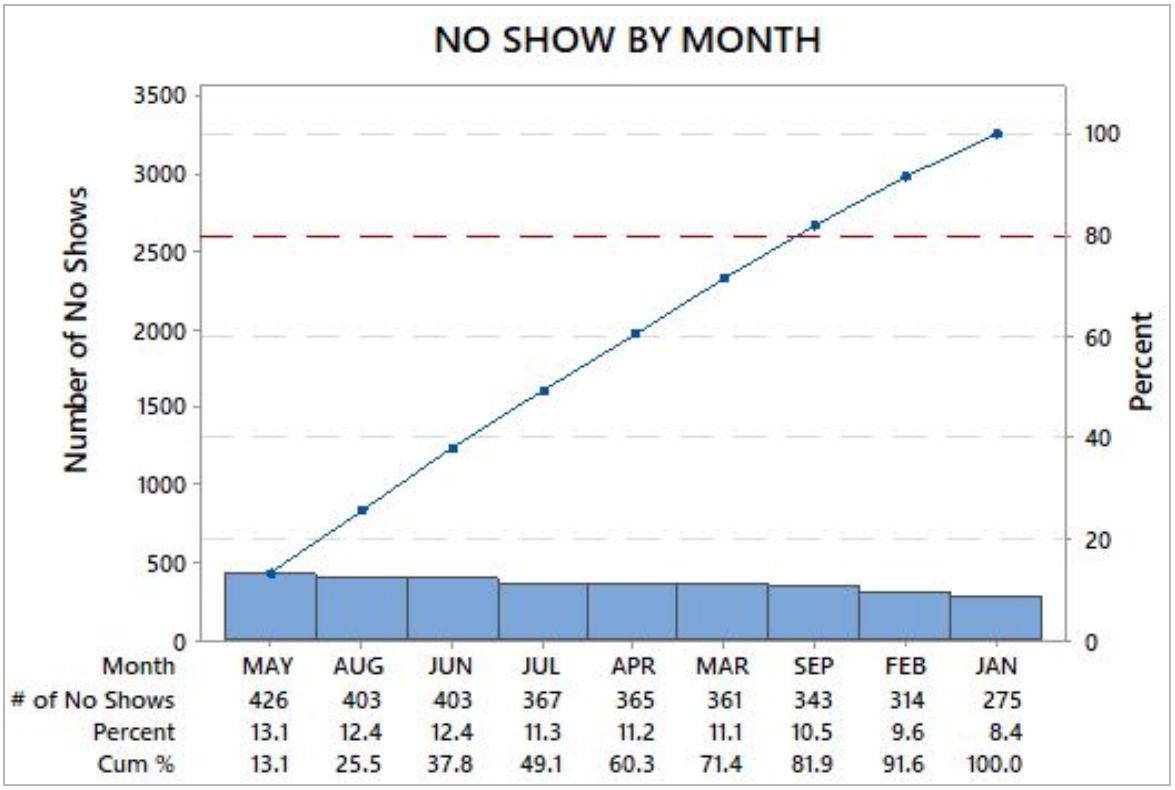

Figure 4: No-show percentage by month

We performed a oneway ANOVA to test if there was a significant difference between the number of no-shows and the months. We generated a p-value of .027 which is less than .05, thus showing a significant difference between at least one of the months, which was in fact between January and May. Although we found a significant difference between these two months, we wanted to further investigate no-shows by month. We analyzed no-shows by month for each individual test and did not find a compelling trend.

After categorizing no-shows by month we decided to dig even deeper and see if there was a significant difference between the amount of appointments missed on each day of the week. Our team performed a oneway ANOVA and found there was no significant difference between the number of appointments missed every day of the week (Appendix F). Again, we further

analyzed no-shows by weekday for each of the five tests and still found no significant trend among the data.

Overall, the data regarding the number of same day missed appointments did not quite paint a clear picture. Even though we had records and numbers, these things alone do not always tell the whole story. Our team therefore decided to move on to more of a root cause analysis approach.

After every same day missed appointment RA calls a patient to inquire about their reasoning for no-showing. Although they were at first reluctant to give us this information, after signing HIPAA forms, RA provided us with their patient reasons for no-showing archives. Their no-show tracker data included information on when the appointment was scheduled, the date of a patient's appointment, who the appointment was scheduled by, whether or not the patient confirmed the appointment through Doctor Connect, a patient's reasons for no-showing, and whether or not the appointment was rescheduled. The data used to analyze patient reasons for no-showing was taken from January 2016 to October 2017.

First we analyzed who scheduled the appointment and found that the majority of the time patients who no-showed scheduled their own appointments. We also looked at whether or not the patient confirmed the appointment through DoctorConnect. A patient confirmed their appointment through DoctorConnect, the Front Office, or not at all respectively 30%, 28%, and 42% of the time. Next, we moved on to analyze the biggest root cause, a patient's personal reasons for no-showing.

We created a pareto chart to summarize the top reasons a patient no-showed (Figure 5). This chart shows that RA was not able to reach patients an astounding 58.5% of the time. Some

assumptions for this could be that patients who missed their appointment, did not want to talk to them any further. Other reasons noted by RA was that they were unable to reach a patient due to having a wrong or a number that was disconnected.

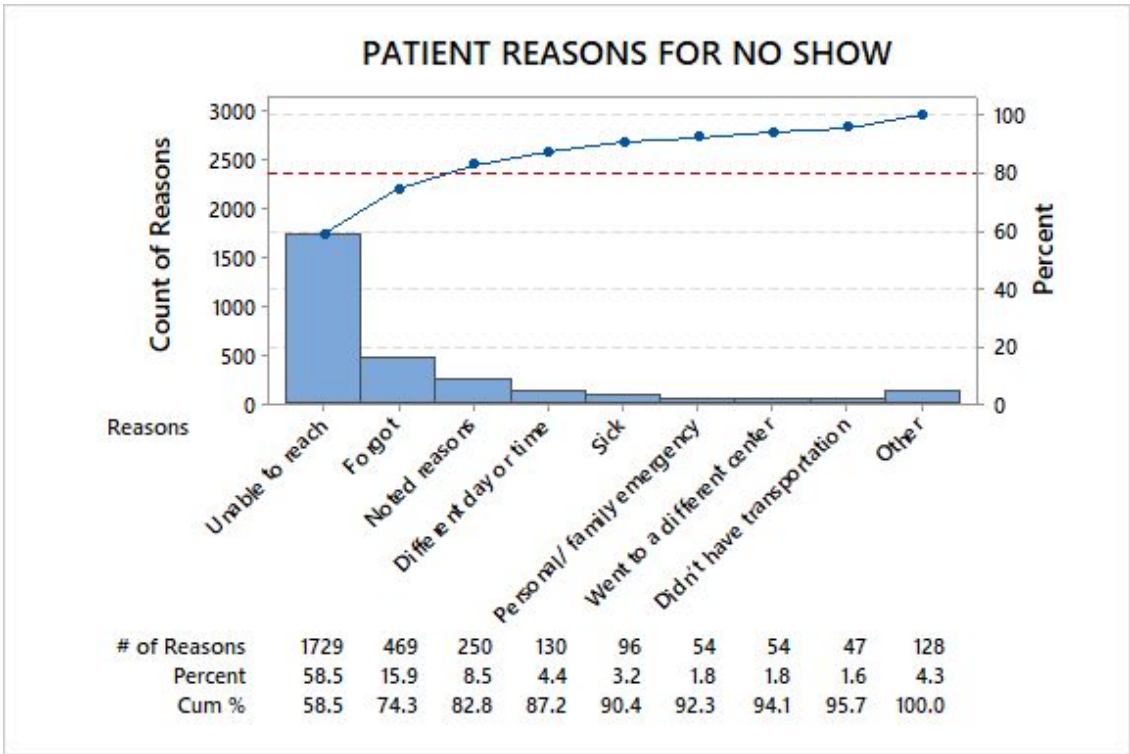

Figure 5: Patient's personal reasons for no-showing (all)

If an RA staff member was able to leave a message, they left a message letting a patient know to reschedule. Whenever an RA staff member was able to talk to a patient, they did not reschedule their appointment 69% of the time.

When we solely looked at documented reasons for patients that RA was able to talk to, we identified five main reasons that accounted for 81.4% of no-shows (Figure 6). As seen from the chart, a patient forgot about their appointment was the highest reason given.

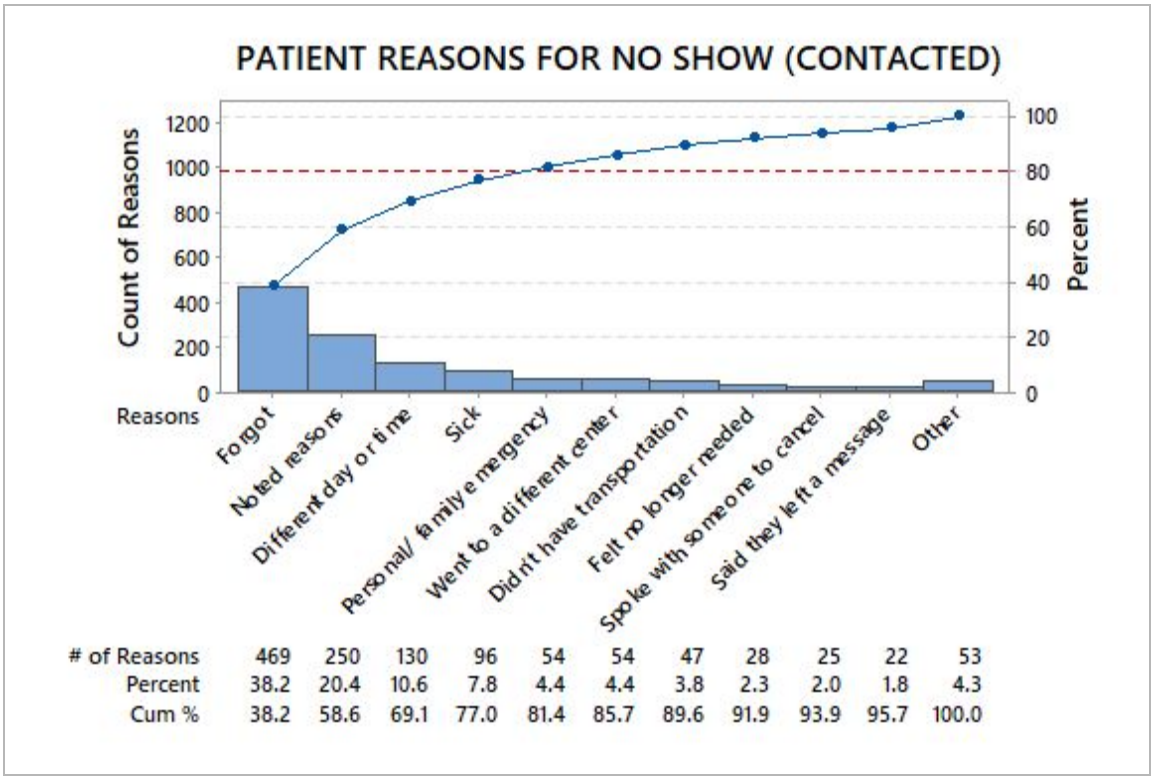

Figure 6: Patient's personal reasons for no-showing (only those who answered)

Some of the miscellaneous noted reasons given to RA was that the patient arrived after table time, which is more than 15 minutes late, they were not able to afford the copay or did not want to reschedule because of the amount due, or the patient was lost. From this chart we also found that patients forgetting about their appointment or thinking it was at a different date or time accounted for 48.8% of no-shows. Overall, we observed that many patient reasons for no-show were simply due to human error.

We also looked at the trend of missed appointments by how many days in advance the appointment was booked. With this histogram (Appendix G), we found the further in advance patients schedule their appointments, the higher probability they are to no-show. The highest no-show rate was when a patient booked their appointment a week in advance.

Lastly, we looked at the amount of patients who no-show based on their primary insurance providers. We found patients who had Cencal/ Medi- Cal and undocumented insurance, meaning RA did not record the insurance, accounted for 57.7% of no-shows (Appendix H). Although we categorized no-shows by insurance providers, we did not find much significant data. We also did not know how identifying primary insurance providers would help RA reduce no-shows. Identifying insurance providers by the amount of no-shows would solely be a way for RA to track and predict no-shows in the future or assist in further developments for possibly double-booking patients.

To our dismay, we found little statistically significant data regarding the no-show rate at RA. After digging through all possibilities whether it be the time of the year all the way to a patient's personal reasons why, we discovered there was no major key element that explained why patients were not coming to their appointments. Our team concluded patients who missed their appointments mainly came down to human error which had reasons beyond our given data. Data regarding the specific time of day an appointment was missed or a higher response rate from patient surveys would have truly helped point us in a clearer direction. Moving forward we would suggest RA change the type of data they are tracking regarding the same day missed appointments and add new areas to study. If RA is going to accomplish the task of significantly reducing their same day missed appointments they must start looking at things with a new mindset.

Because we found little supporting data pointing to a primary root cause, our team decided to take a different approach and think outside the box moving forward. Our ideas would

therefore consist of ones that incentivized and proactively sought after retaining patients appointments. With this new approach in mind, we brainstormed a list of ideas to implement.

IV. Methods

After concluding our analysis, we brainstormed a total of eight ideas to propose to RA (Appendix I). We also gave RA a table containing advantages and disadvantages with these proposed solutions (Table 1). Of these eight ideas, we created standard work and scripting that schedulers would use for four of them. After receiving feedback on our solutions and standard operating procedures we edited them and sent them to RA to use and customize to their liking.

Solution	Advantages	Disadvantages	Standard Work
Offer Every Patient a Ride (in person & on phone)	If a patient had a ride but then lost it, they then would recall the available ride services.	Making appointments take slightly longer.	Y
Alternative Sign	A custom inflatable dancer, inflatable blimp or inflatable arch would serve as an indicator that the patient arrived to the correct destination.	Requires Radiology Associates to spend money.	N
Customized Reminder Call (in person & on phone)	Patient can personalize the date and time of their reminder in hopes that they know when is a best time for them to be reminded of their appointment.	Making appointments take slightly longer.	N
Improve Website	Ride information would be clear and easier to find.	None	N
	Telling a patient there will be snacks after	Making appointments take slightly longer.	

Offer Snacks (in person & on phone)	an appointment they have fasted for would serve as positive reinforcement and would help get them to show up to the appointment.	Requires Radiology Associates to spend money.	**Y**
Likelihood Scale (in person & on phone)	Radiology Associates would be able to rate and track how likely a patient would "no-show".	Making appointments take slightly longer. Patient could feel offended.	**Y**
"On-Call Patients" (in person & on phone)	Radiology Associates would be able to fill appointments that "no-show".	Making appointments take slightly longer. Patients could waste their time waiting for potential "no-shows".	**Y**
Document Times	Would allow Radiology Associates to further track missed appointment trends. Can potentially help with double-booking or "on-call" patients	Adds on another step for documenting missed appointments	**N**

Table 1: Solutions Matix

Rides

The first proposed solution was the simplest solution. RA has information about ride services by third party providers on their website, however they do not actively tell patients about these services. As stated earlier, some schedulers only tell patients about these ride services if they see a patient has a physical impairment. For our solution, we proposed RA share the information about the ride services with every patient both either making an appointment in

person or on the phone. We created standard operating procedures for RA schedulers to use as an example for this solution (Figure 7).

STEP	OPERATOR	TASK DESCRIPTION	TOOLS REQUIRED	CYCLE TIME
1.	Front Office	Once finished with scheduling a patient and verifying the date and time of their appointment: • Relay that there are ride services available to them if they need assistance getting to their appointment ○ **Scripting:** "Lastly, I would like to inform you there are some services available to you that provide free transportation to and from your appointment. If you would like more information about them please refer to our website or feel free to call us if you have any questions." ■ At the scheduler's discretion, scripting can change from directing to website to giving the information directly.		

Figure 7: Standard operating procedure for offering ride information

RA would share the information with all patients even if a patient did have a ride. Our reasoning for this solution is if a patient did have a ride originally but then later lost it, they would remember the ride services available to them. Offering rides to every patient would help reduce no-shows by bringing patients to their appointments. Not only this, but sharing ride services with patients would show patients that RA cared about them and was practice that went above and beyond. This type of customer service, we hypothesize, would increase patient satisfaction.

Signage

Our next proposed solution was to find alternative signage for RA. Many patients have gotten lost when trying to find RA's Santa Maria location and have either arrived after table time or went to another center altogether. Because of RA's inconspicuous location, many of their

patients unknowingly go to other imaging facilities and get services there. When our senior project group first visited RA located in Santa Maria we too got lost. We mistakenly went to another medical facility thinking it was RA. When we realized we hadn't arrived at RA, it still took us quite some time to find their location. RA disclosed to us they were aware of their location's difficulties and had considered getting a new sign in the past. RA also told us they looked into putting their sign on a funeral homes' property located on the corner of the main street that would help lead patients to their location. The funeral home however was not open to this idea, and RA did not pursue a new sign anymore after this.

Our team looked into alternative signage RA could rent or purchase. Instead of investing in an expensive, new sign they could use an identifier. We researched and quoted prices for a custom inflatable air dancer, inflatable arch, or inflatable blimp. Any of these items would serve as an indicator that the patient arrived to the correct destination. The only disadvantage of this alternative sign would be that RA would have to spend money. RA was open to the idea of renting one of these items and told us to look into whether or not they needed a permit to have one. After speaking with the city of Santa Maria we found it was illegal to have any inflatables for more than a day. As a result of this we stopped looking into alternative signage for RA.

Reminders

Another solution we looked into was having customized appointment reminder calls. Patients know when they tend to forget about things, and could thus set their own reminder call for their upcoming appointment. Our solution was to give a patient the option personalize the date and time of their reminder in hopes that they knew when was the best time for them to

receive the call. One disadvantage of this was it would cause making appointments to take slightly longer. RA was open to the idea behind this solution, however they did not want to add on more work for the schedulers. They therefore asked us to look into their DoctorConnect system and find out if it was possible to customize the automated calls by person. Within RA's current DoctorConnect settings the reminder calls were standardized for all patients. After discussing our idea with a manager at DoctorConnect they told us it was not possible to set different reminder calls for an individual patient. We therefore moved on to our next proposed solution.

Website

The next solution was to improve RA's website layout by creating a "ride services" tab. Currently information about the ride services available to patients is located under their "our locations" tab. Putting the services in this area is not a clear and intuitive place to find them. Not only this, but we believe the website should list the information in Spanish as well, for any ESL patients. Creating a separate "ride services" tab would be easier for patients to find out more about the ride information.

Snacks

We decided to propose a solution that would target patients who made appointments for specific types of tests. RA would use this next solution when making the appointment both in person and on the phone. For our solution, we wanted RA to offer snacks to patients who were

required to fast for CT, FL, and US. If we assume we would reduce no-shows by 10% for each of these three tests, then RA would make $98,956 in revenue.

We created standard operating procedures along with this solution to help RA implement the process and create scripting (Figure 8). As seen from the standard operating procedure, RA would tell a patient that for their convenience there would be snacks waiting for them after their appointment.

2.	Front Office	Once finished with scheduling a patient and verifying the date and time of their appointment: • Relay that because they need to fast for X amount of hours before this appointment, you all will have complimentary snacks once they have finished their test. ○ **Scripting:** "Lastly, because you are fasting before your appointment we will have some snacks available for you to enjoy at the end of your appointment."		

Figure 8: Standard operating procedure for offering snacks

Telling a patient there would be snacks after an appointment they have fasted for would serve as positive reinforcement and potentially would help get the patient to show up to the appointment. RA currently uses this same type of positive reinforcement for patients that undergo MAMMO tests. After a patient has taken a MAMMO, RA gives them a flower. Not only do both of these actions act as a positive reinforcement, but they too improve patient satisfaction. The disadvantages we analyzed for this solution was that it would cause making appointments to take slightly longer and would also require RA to spend money. We discussed the potential disadvantages to RA and they did not see them as a problem.

Likelihood

Our next proposed solution, compared to previous ones discussed, was a bit more controversial. We wanted schedulers at RA to ask a patient, both when making in person appointments and phone appointments, to rate the likelihood they would make their appointment. A patient would be asked to score on a scale of 1-7, 1 being probably going to forget about the appointment, to 7 being it is in their schedule and they plan on making it. We reasoned some patients may be honest when answering and could potentially help RA define another way to track no-shows. When bringing this solution to RA, we understood the complexity of this idea and understood patients could potentially be offended when asked this. Our standard operating procedure's script (Figure 9) for the solution therefore incorporated schedulers telling patients that it was a test for our purposes. By disclosing this information, we hoped to put all of the blame on ourselves and not RA. Our scripting also included the option for a patient to decline answering if they did not feel comfortable.

3.	Front Office	Once finished with scheduling a patient and verifying the date and time of their appointment: • **Scripting:** "We are currently implementing a new system as a test for some Cal Poly students where we ask patients to score how likely they are to make their scheduled appointment. For data purposes it would be helpful to have honest feedback. Do you mind answering on a scale of 1-7 how likely are you to attend your appointment you have scheduled with us today? 1 being probably going to forget about my appointment, to 7 being it is in my schedule and I plan on making it. If you do not feel comfortable answering you may decline to." ○ Upon answering note the patients answer under their scheduled appointment.		

Figure 9:Standard operating procedure for a patient's likelihood to make an appointment

“On-call”

The prime reason for using the likelihood scale, was to not only use it as a way of tracking missed appointments, but to also use it for our “on-call” patients solution. RA would use this solution when making appointments both in person and over the phone. We wanted to use “on-call” patients as a means of double-booking without actually double-booking. RA did not want to use double-booking as a way to combat no-shows because they did not want to have to turn people away and tarnish RA’s name in the event that two people did in fact show up for the same appointment.

Our “on-call” patient solution would be to offer patients who were really adamant about having a certain appointment time, the opportunity to volunteer and wait to see if an appointment no-showed. An advantage to this proposed solution is that RA would be able to fill appointments that no-show. However some disadvantages could be that making an appointment would take slightly longer and patients could waste their time waiting for a potential no-show. A way to combat patients wasting their time was to use the likelihood scores alongside this solution. As seen in our standard operating procedure (Figure 10), schedulers would only tell a patient they are welcome to wait at their preferred appointment time for a patient to no-show if the preferred appointment was noted with a likelihood of 4 or below. Overall this solution would strictly be according to a patient volunteer basis and not offered to everyone.

4.	Front Office	Once finished with scheduling a patient and verifying the date and time of their appointment: If scheduling a patient that did not receive their preferred appointment time **AND** their preferred appointment time is noted with a likelihood scale of 4 or below ask them the following: • **Scripting:** "I'm sorry that your preferred appointment time was already booked. We have noted however that there is a chance your preferred appointment will become available. You are free to come to your preferred appointment time and wait to see if someone does not show up, however it is not guaranteed that you will be able to be seen. Would you like to do this?" ○ If **"Yes"** note the patient's name under the preferred appointment date and time. ○ If **"No"** verify the scheduled appointment once more and continue with scheduling.		

Figure 10: Standard operating procedure for "on-call" patients

Times

Lastly, we proposed a solution that would help RA to further track and analyze same day missed appointment trends. We suggested they document the times of future missed appointments. Although we realize this adds on an additional step for documenting missed appointments, they could use this information to test double-booking. RA could even use the most frequent times missed as an alternative to the likelihood scale and combine it with our "on-call" patient solution.

In conclusion, we tried our best to bring forth fresh ideas to implement and combat RA's same day missed appointment problem. Although we did not find much significant data pointing toward primary root causes, we proposed solutions that would affect different aspects of RA's no-shows. Some solutions were strictly geared toward incentivizing patients to get their to their

appointments, while others were geared toward increasing patient satisfaction or strictly helped RA to track no-shows in new ways. After finalizing our proposed solutions and standard operating procedures, we provided them to RA to implement them and customize them to their liking.

V. Economic Case

No-show patients for RA are classified as an opportunity loses. Whenever a patient does not show up for their appointment, RA misses a chance to potentially fill that time slot with another patient who will actually come to the appointment. RA currently loses approximately $240 for every no-show patient. $240 is the average amount of revenue that CT, MRI, MAMMO, FL and US make. Individually CT, MRI, MAMMO, FL and US make respectively $274, $440, $195, $180, and $118 in revenue. Using this information, we found RA's total opportunity loss for January to September 2017 was $714,279. As stated earlier in this paper, reducing RA's no-show percentage by 5.5% would save them $39,285.35. We believe that even if we impacted just one or a few of these imaging tests with our solutions, we could make RA a lot of money in the long run.

RA specifically would like to decrease same day missed appointments for MRI tests because they generate the greatest revenue. Although we could not create solutions that directly affected MRI tests we tried to impact other tests. Our team discovered another way to approach same day missed appointments by specifically tackling CT, FL and US through our offering snacks solution. Even though MRI tests have the greatest revenue for RA, if we could specifically impact CT, FL and US, they together create a higher profit margin. Not only this, but CT, FL and US in total make up more than 2.35 times the appointments missed for MRI. If we assume we would reduce no-shows by 10% for each of these three tests, RA would then make $98,956 in revenue.

Another solution we proposed to RA, sharing the ride service information, would directly impact all of the tests. Even if we only impacted the amount of tests that patients missed solely due to not having transportation (some patients missed due to more than just this reason, and therefore were put into another category) they would make $9,872 in revenue.

VI. Recommendations

Using the data analysis we conducted, we comprised additional recommendations that aim to reduce the number of no-shows at RA's Santa Maria location. These additional recommendations are not included in our solutions, but are ideas we recommend RA consider doing as they continue to battle high no-shows in the future.

Firstly, we suggest RA conduct an anonymous survey for patients. The survey would contain questions regarding RA's service and how it could be improved. Their feedback would serve as valuable insight on how to improve the scheduling system from the customer's perspective. An experienced outsider's point of view would have improvement ideas that RA could not see otherwise.

Revisiting the fact that 58.8% of the patients who RA attempts to reach after a no-show did not respond, we found one of the causes was due to an incorrect cell phone number or primary contact number. When RA has an incorrect phone number for a patient, they are not able to confirm the patient's appointment or relay any important information to them. Verifying a patient's cell phone number would help RA maintain a clear line of communication with their patients and improve customer service. We therefore recommend RA confirm a patient's cell phone number when making an appointment by calling and having a patient show then they received the call.

In addition to calling patients who have no-showed, RA emails patients. Despite supplementary effort, the email response rate is too unsatisfactory. This low response rate is not desirable because key information that could help them improve their services is lost. Finding

ways to improve the email response rate would help RA significantly. We recommend RA have patients confirm their email address as well by creating a verification process. This could also be beneficial to patients who experience little face-to-face contact with RA because it gives them an avenue to communicate with RA on possible improvements.

RA currently has a system in place for patients to confirm their appointments through DoctorConnect. Although RA assumes a patient will successfully make their appointment, it does not always happen. Incentivizing patients to confirm their appointment would help them remember to show up for their appointment and would also help tell RA whether or not a patient is coming to their expected appointment time.

The solutions explained above are all feasible ideas RA can take to further help reduce their no-show rate. We have learned that there is no singular solution that will reduce the amount of no-shows permanently. Research has shown us there will always be a problem that will persist in every appointment scheduling system. While we can work on decreasing the amount of no-shows, there will always be individuals who forget about their appointment or miss because of unavoidable circumstances.

Lastly, we are still willing to work with RA stakeholders to customize our previous solutions to their liking. The appointment making process does not only work with one department, but multiple departments who each have their own approach on process improvement. Every department interacts with patients in a different manner, which gives each department a different insight and perspective on how to improve the no-show rate.

VII. Conclusions

A high no-show rate is a historical problem throughout all appointment based businesses, especially at medical centers. It is pivotal for companies to find ways to combat this in order to make a profit. Our team worked with Radiology Associates to help reduce the amount of no-shows, specifically at their DMI in Santa Maria. Over the course of our project, we analyzed same day missed appointments data and surmised a variety of solutions and recommendations to reduce their no-show rate. We created four standard operating procedures for RA to implement as well as additional recommendations to help them reduce the amount of no-shows in the future. Some conclusions we made throughout the course of this project are the following:

- RA's total opportunity loss for January to September 2017 was $714,279, reducing their no-show rate by 5.5% would save them $39,285.35.
- We learned that strict laws and limitations are in place that everyone must follow. These laws limited the amount of new ideas we could come up with.
- Mapping out how appointments are made greatly helped us understand the scheduling process and identify areas for improvement.
- A clear line of communication between scheduleers and patients is critical.
- RA averages 17 missed appointments per day which means on a normal business day they have roughly one and a half missed appointments every hour.
- US, MAMMO and MRI accounted for an overwhelming 90.5% of no-shows.
- RA averages 362 no-shows in a month.
- There was no statistically significant differences between day of the week.

- A patient confirmed their appointment through DoctorConnect, the Front Office, or not at all respectively 30%, 28%, and 42% of the time.
- RA was not able to reach patients an astounding 58.5% of the time partially because they had a wrong or a number that was disconnected.
- The top reasons for no-shows given by patients were forgetting, other noted reasons, and thinking that the appointment was on a different day or time.
- The highest no-show rate was when a patient booked their appointment a week in advance.
- Patients who had Cencal/ Medi- Cal and undocumented insurance, meaning RA did not record the insurance, accounted for 57.7% of no-shows.
- We provided a total of eight proposed solutions to RA, two of which were not feasible.
- Given the nature of appointment scheduling, no-shows will always be perplexing problem for imaging facilities because of human error.

We learned several things throughout the completion of this project. Medical imaging is a unique division of the medical practice because their services do not incorporate many return patients. Patients often have several alternative options for where they can get their imaging completed. RA must therefore be flexible in the way they approach their appointment scheduling system in order to maintain patient satisfaction. After this project, we have gained a deeper appreciation for the struggles that these types of companies face on a daily basis.

Change within any organization is hard, change in this particular organization too had its challenges. Creating new improvement ideas for routine procedures had to be approved by multiple stakeholders. These procedure changes affected multiple people in different areas of the

company. When taking on this project we understood there would be difficulties because of RA's multiple lines of communication, however, we did not expect the experience to be so tough.

Reducing the amount of no-shows has been a problem that RA has addressed before which resulted in unsatisfying results. When we came aboard to help them with this problem, RA was initially excited to work on this problem but some of the stakeholders were not eager to work on this issue as they felt it had already been exhausted by it in the past. Due to this previous overworked nature, communication with various company stakeholders was difficult and oftentimes took longer than we anticipated. It was truly a growing experience to be able to work with people in industry.

Our team learned that in the future we need to fully understand and identify the complete process of making changes in any company. When our group started this project, we believed our solutions were to be verified and consulted with one stakeholder. We worked closely with this stakeholder and communicated with them constantly. As the project progressed, we found our ideas for improvement needed to be verified by multiple stakeholders.

Understanding our stakeholders and how to interact with them was one of our main takeaways for our project. If we could do the project over again, we would spend more time understanding each of our stakeholders roles in the company. Not only this, but learning what form of communication was best for each shareholder would have helped us when coordinating with them. Although working with RA was no easy task, nonetheless, we provided solutions and future recommendations to reduce their no-show rate.

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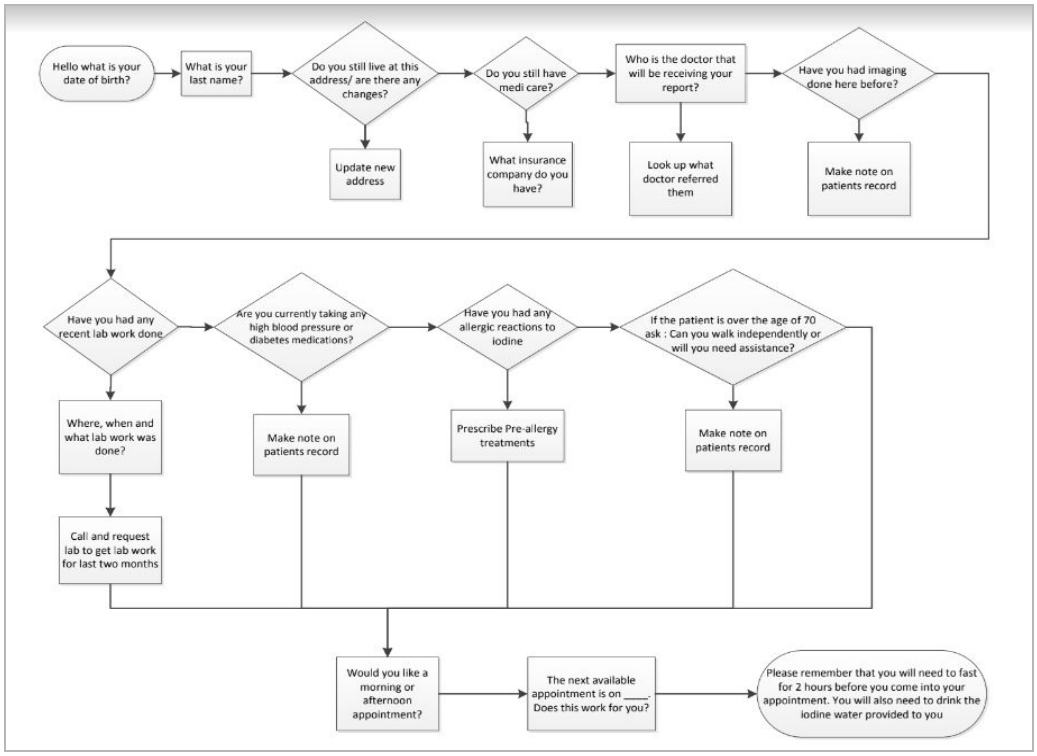
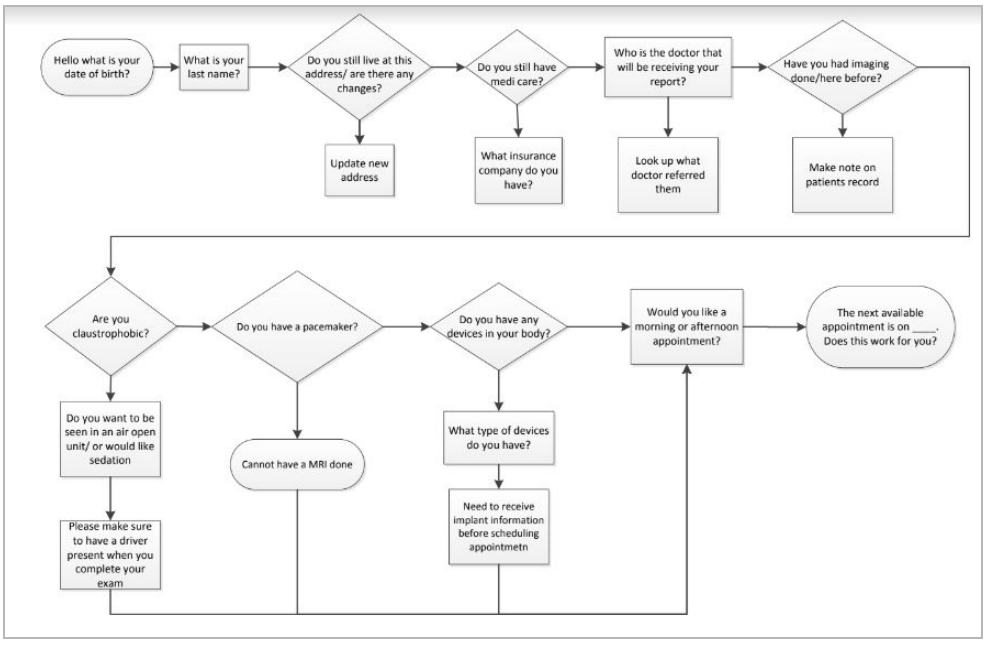
IX. Appendix

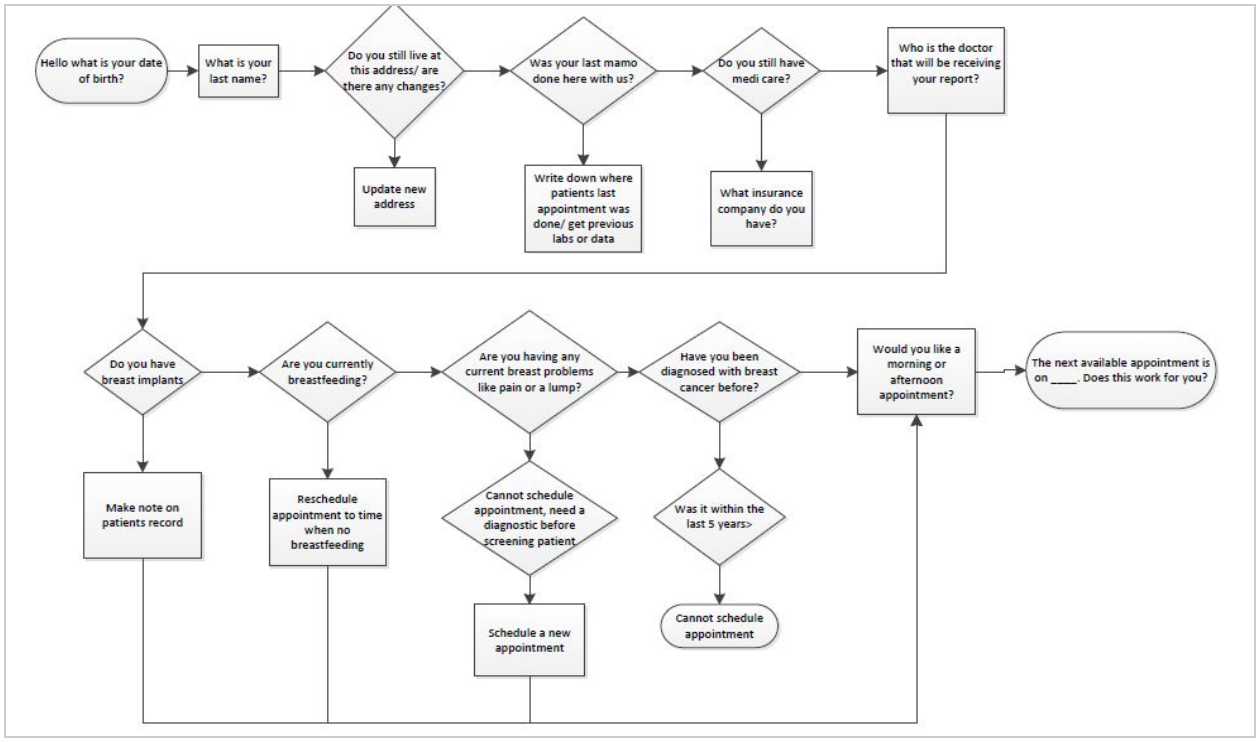
Appendix A: Computed Tomography workstream example



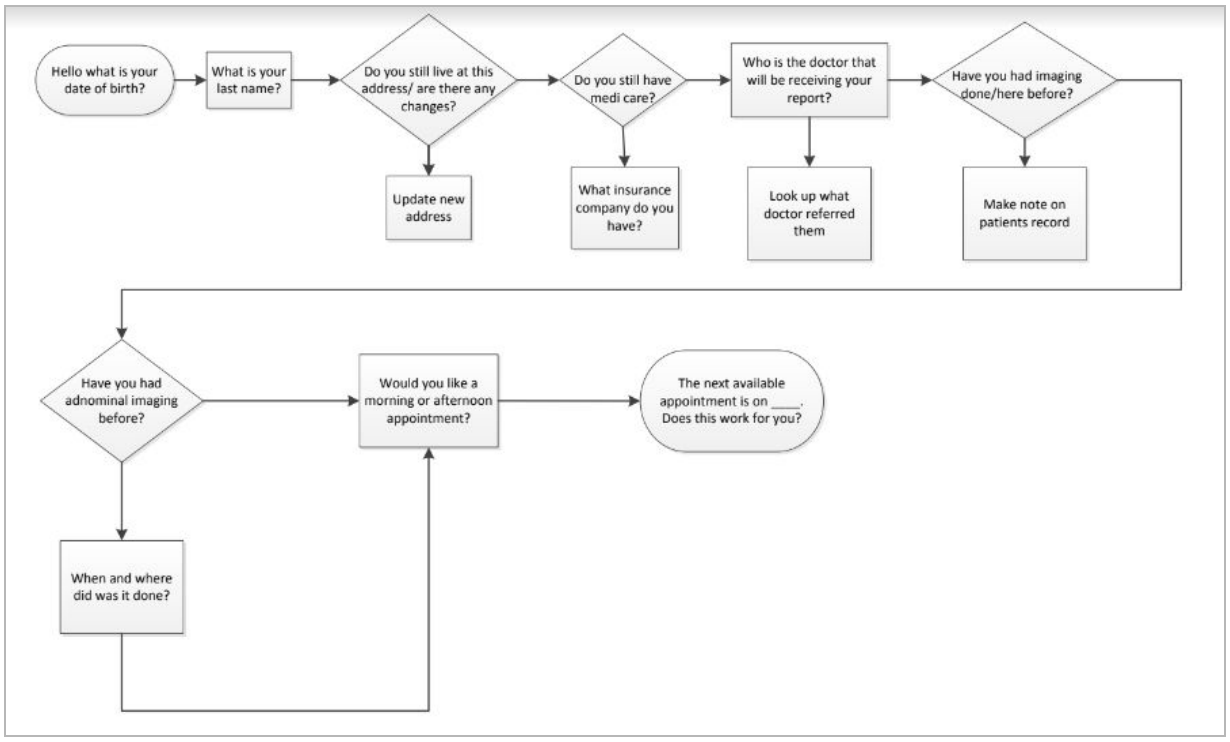
Appendix B: Magnetic Resonance Imaging workstream example



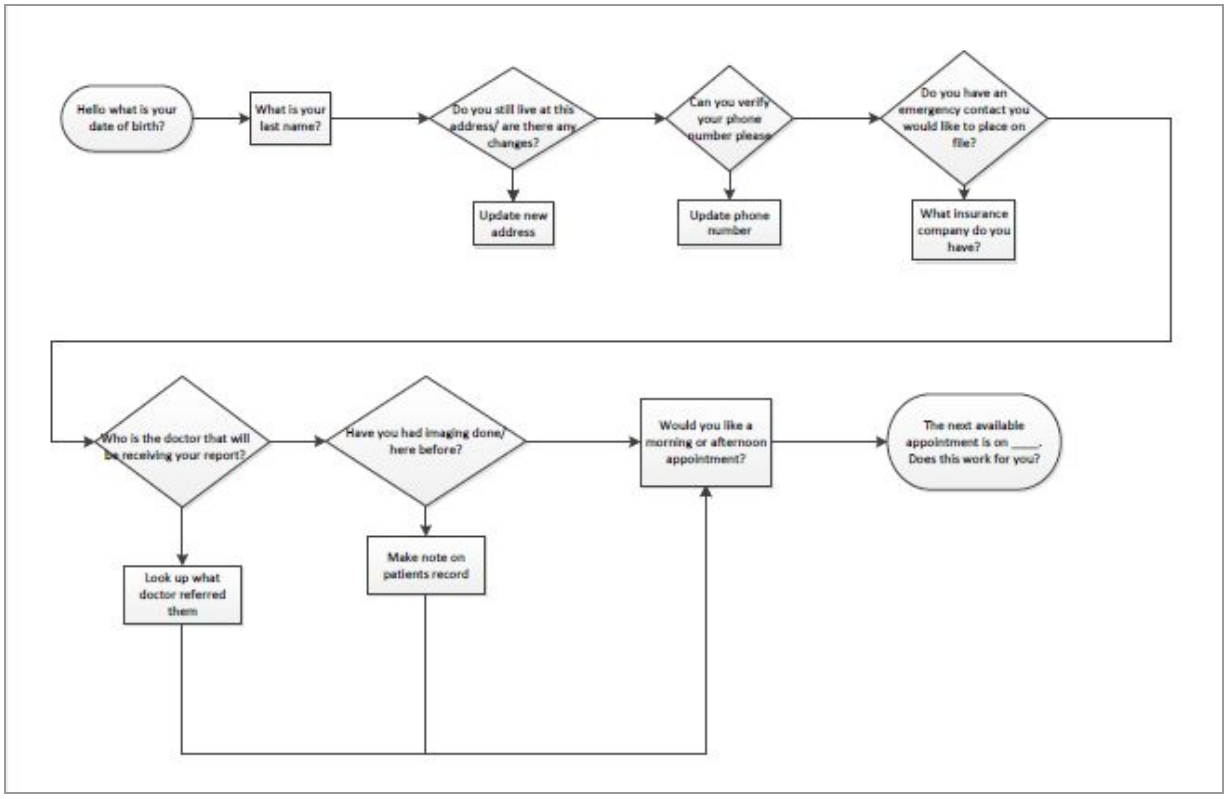
Appendix C: Mammogram workstream example



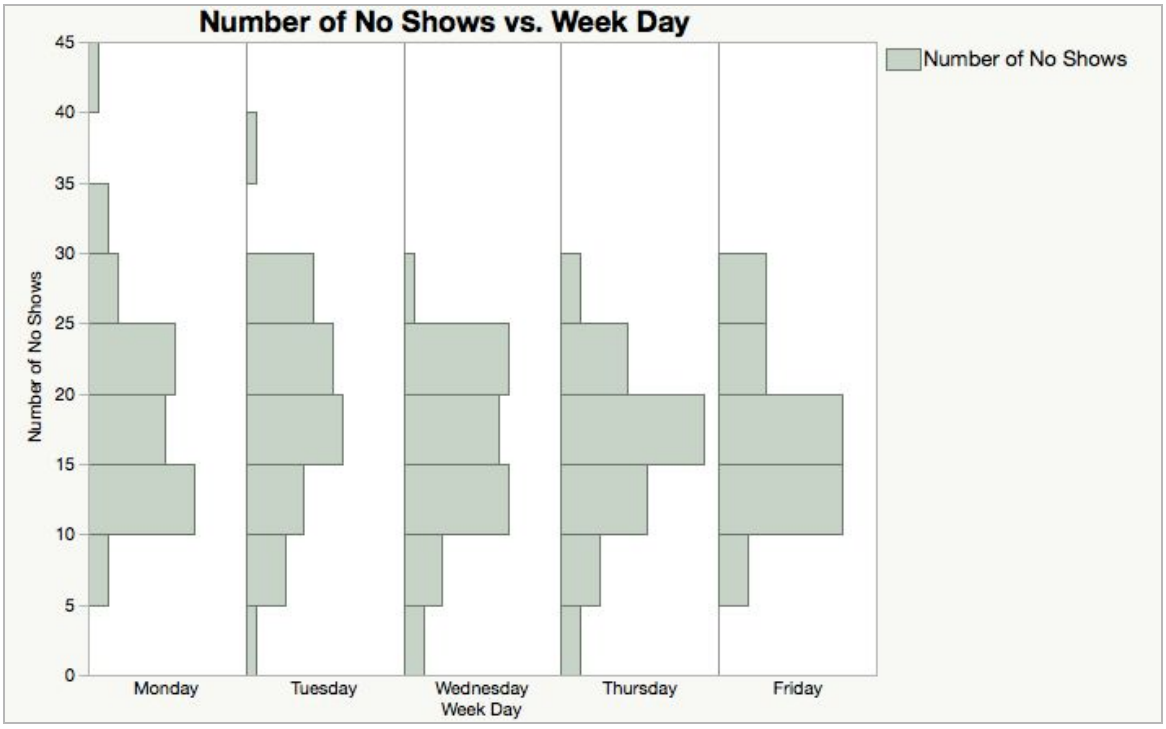
Appendix D: Fluoroscopy workstream example



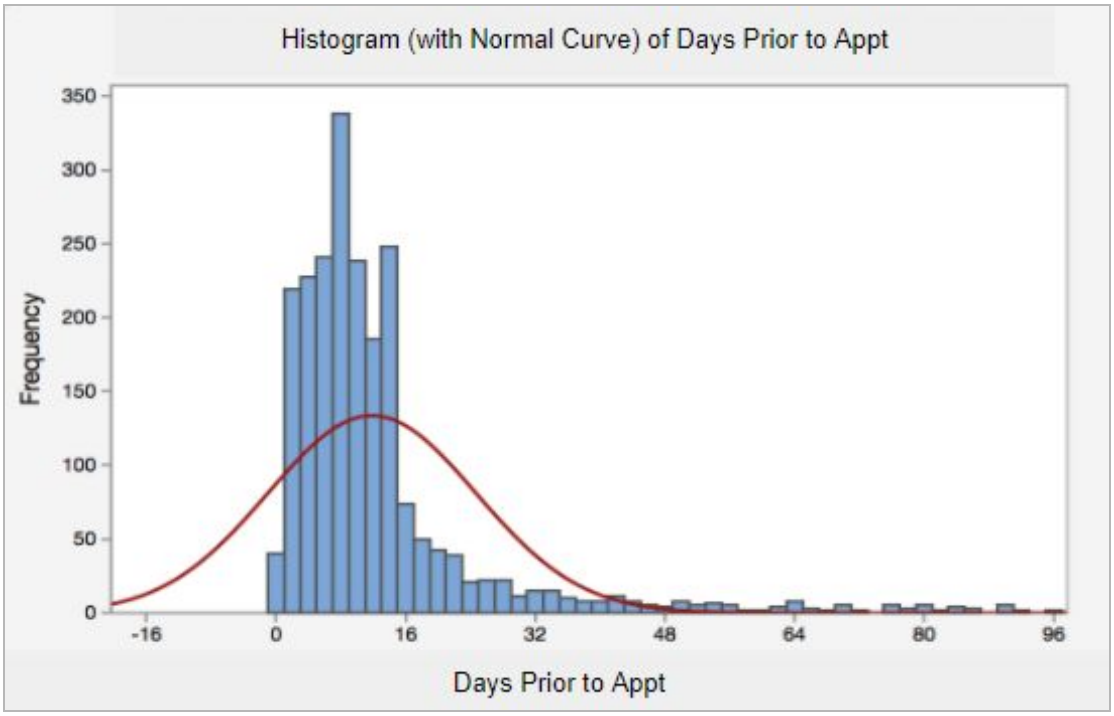
Appendix E: Ultrasound workstream example



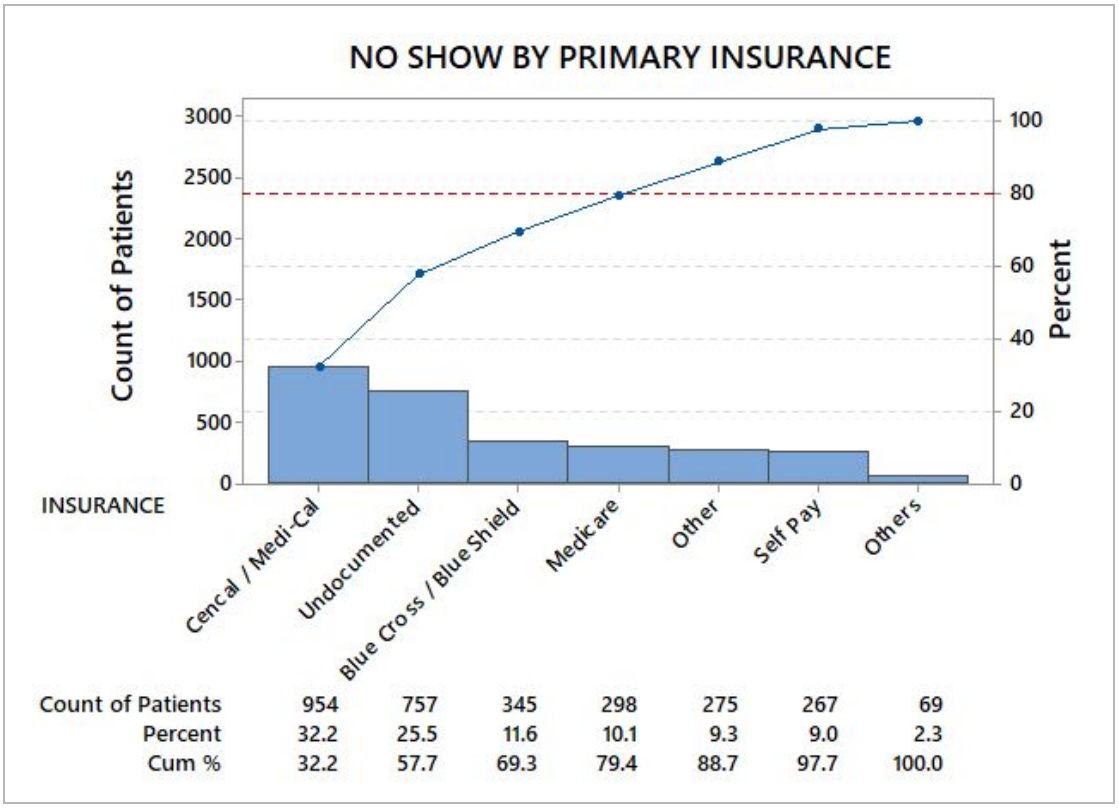
Appendix F: Oneway ANOVA for no-show trend by day of the week



Appendix G: Number of days in advance patient booked an appointment



Appendix H: No-show by a patient's primary insurance



Appendix I: Proposed Solutions

Solution	Reasoning
Offering ride services to every patient	- free ride services from a third party provider - RA should share the information with all patients just in case a patient did have a ride and lost it they then would remember the ride services available to them
Alternative signage	- many patients cannot find RA's location and oftentimes go to another center - instead of investing in an expensive, new sign they can use an identifier like a wacky wavy or inflatable archway
Customized appointment reminder calls	- patients know when they tend to forget about things, and can thus set their own reminder call for their upcoming appointment
Improve website	- create a "Ride Services" tab - it is currently not in a clear place/ easy to find -Spanish option for ESL patients
Offering snacks to patients who fast	- telling patients there will be snacks after their test while they are making an appointment is a positive reinforcement - for example, RA gives roses to patients who get Mammogram tests
Likelihood they'll come to the appointment	- asking patients to score on a scale of 1-7 the chance they will make their appointment will help to with "on-call" patients - some patients may be honest when answering and could potentially help RA define another way to track/ identify no-shows
Having "on-call" patients	- a way of double-booking using the likelihood scale - if a patient is really adamant about having a certain appointment time they could

	volunteer to wait to see if an appointment no-shows
Documenting missed appointment times	- keeping track will help in the future when analyzing missed appointments - could use most frequent times to test double-booking or “on-call” patients