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The Effect of non-Pharmaceutical Sedation on Improving MRI Study Completion Rates and No-Show Rates

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Abstract

Purpose—MR is a high-cost imaging modality, and an optimized encounter ideally provides high quality care, patient satisfaction and capacity utilization. Our purpose was to assess the effectiveness of team training and its impact on patient show-up and completion rates for their MRI examinations.

Methods—A total of 97,712 patient visits from 3 tertiary academic medical centers over one-year intervals were evaluated, totaling 49,733 visits at baseline and 47,979 after training. Each centers' MRI team received team training skill training including advanced communication and team training techniques training. This training included onsite instruction including case simulation with scenarios requiring appropriate behavioral and communicative interventions. Orientation and training also utilized customized online tools, and proctoring. The study completion rate and patient show-up rate during consecutive year-long intervals before and after team training were compared to assess its effectiveness. Two-sided Chi-Square tests for proportions using were applied at a 0.05 significance level.

Results—Despite differing no-show rates (5–22.2%) and study incompletions rates (0.7–3.7%) at the three academic centers, the combined patients' data showed significant ($p < 0.0001$) improvement in the patients' no-show rates (combined decreases from 11.2% to 8.7%) and incompleteness rates (combined decreases from 2.3 to 1.4%).

Conclusion—Our preliminary results suggest training of imaging team can improve the no-show and incompleteness rates of the MRI service, positively affecting throughput and utilization. Team

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training can be readily implemented and may help address the needs of the current cost-conscious and consumer sensitive healthcare environment.

Keywords

Claustrophobia; MRI; patient motion; no-show rate; completion rate; cancellations; team training; anxiety

INTRODUCTION

Claustrophobia and patient motion contribute to adverse patient experiences, affect diagnostic accuracy and imaging quality, throughput, and the financial impact of MRI operations (1). Claustrophobic patients may initially cancel or fail to show up for their appointment (no-show) as a result of their anxiety, they may be unable to hold still during their study if they do appear, and they may even ask to terminate their study before completion (incomplete study) once their study has been initiated. Incomplete study rates vary from an average of 2.3% (2) to as high as 25–39% in selected anxious populations, even when larger bore claustrophobia-friendly open scanners are used (3). No-shows and incompletions result in ineffective utilization and financial losses (4, 5). Word of mouth from dissatisfied patients may also potentially dissuade friends and family members as future patients (6, 7).

We sought to investigate the efficacy of a simple and low cost approach delivering team training to the supporting staff of MR centers, comparing both incompleteness and no-show rates including one year of data preceding and one year of data following training. Three large medical centers were included in this study.

MATERIALS AND METHODS

A communication and team training program labeled “Comfort Talk®” was implemented at three separate academic medical centers. Site 1 is a 451-bed urban tertiary care center, site 2 is a 496-bed safety-net disproportionate share urban tertiary care center, and site 3 is a 976-bed tertiary care center. All study sites exclusively utilized conventional cylindrical MRI scanners at the time of the study. No large bore or open MR scanners were used. During the study interval, no major changes in personnel staffing models or physical magnet installations occurred at any of the sites.

The trial was IRB-approved, was HIPPA compliant, and was supported by an NIH/NCCAM Small Business Innovation in Research Grant. All study data and information was controlled by the authors at the academic sites.

Team Training Program

Training focused on teaching MRI personnel how to effectively establish rapport with patients, guide patients with team training suggestions and phrases, and reframe their distressing thoughts. These techniques, based on a training book (8), were designed to avoid overburdening or adversely affecting staff, adversely affecting staff workload, or decreasing patient throughput (9–13).

Team training included 2 on-site workshops for the trainees separated by several weeks. Each of these two workshops consisted of 8-hour programs. Teaching included lectures, videos, and live demonstrations. Trainees underwent small group exercises, experienced self-hypnotic relaxation, were given practice in scenario visualization, and when and how to implement script utilization. After successful completion of the initial training, on-site coaching implemented during actual clinical scanning followed for 2 additional days.

Topics on the first training day included the scientific background, how to establish rapid rapport particularly with distressed individuals; in addition to developing greater sensitivity to one's own and patient's preferred mode of communication. The latter involves adaptation to the patient's sensory preferences, such as responding in kind to patients who prefer to express themselves in visual terms with statements such as "I see" rather than saying "I hear you" even if that were the healthcare professional preferred mode of communication. The first day of training also included adapting to the patient's body position such as focusing on either bending over to a supine patient or elevating the MRI gantry early on to be more at eye-level with the patient; avoiding negative suggestions such as providing a "call button" instead of a "panic button", use of "hypnoidal" and permissive language" such as suggesting to an obese patient "every time you feel the equipment touching you use that as a signal to relax even further" rather than stating "don't worry about it getting to tight in the machine, just don't breathe that hard". Word choice awareness and exercises directed at selecting appropriate words and phrases to maximize patient relaxation and comfort. Of the three centers, one institution drew primarily from an Asian immigrant community, one included a disproportionately high share of underrepresented minority patients, and one institution included primarily middle-class patients; this heterogeneity in population suggested the value of sensitivity to cultural variations in patient engagement. As such the teams elaborated behavior and wording of what to do with recurrent site-specific challenges. Teams chose scenarios such as how to manage inebriated patients referred from the emergency room on a Friday night who may be resistant to getting on the scanner; how to comfort a patient with a stereotactic head frame, or how to proceed with a patient refusing to exchange their exercise clothing for an MRI-safe gown. Furthermore, use of a clinically tested script was practiced as a blueprint for basic pain and anxiety management methods and phrasing.

An online training support module included copies of the training materials in addition to handouts and references. The modules provided for printing or electronic display on mobile devices of reference script phrases on site-neutral stock cards. The training support module also provided site-specific language and behavior suggestion cards including recommended tools for recurring challenging situations elaborated in class in (Fig. 1); short coaching videos; a frequently-asked-question module, and a web-based interactive word-choice practice tool.

For several weeks following initial classroom training, trainees underwent clinical skills practice and training through an online training support portal before their second on-site 8-hour workshop.

The second 8-hour onsite workshop served to discuss and reinforce what trainees had learned from both the first on-site workshop and their several weeks' online practice, while simultaneously exposing them to additional topics. The additional didactic topics covered included advanced anxiety management techniques, approaches to difficult cases and resistant patients, and practice implementation considerations for clinical practice. The additional exercises in the second session were directed at understanding and managing attitudes and include video review of various advanced techniques, a microteaching exercise where trainees could practice a scenario with subsequent self analysis by video review of the interaction with additional peer commentaries enhanced by the constructive delivery of detailed and solution-oriented feedback (9). This training phase also included a Big Assumption Exercise intended to help trainees adapt to the new communication and engagement changes they are facing with patients (14). The Big Assumption Exercise is a tool developed by Kegan and Laskow to overcome immunity to change (14). The idea behind the exercise is that one commonly engages in behaviors and activities that prevent a person from doing what one really very much wants to do. As an example, one may clean up the garage, bake a cake, get lost in the internet, or do anything but writing that manuscript one genuinely wants to author, and unless one acknowledges the other activities as "competing commitments" and addresses them in accepting safe ways the original goal is not pursued. As such even teams and individuals who sincerely want to use their new skills may display counterproductive behaviors which cannot be resolved unless the hidden belief systems of the competing commitments are addressed to allow change to take place.

At Institution #1, staff training included 19 trainees encompassing all of the MRI technologists, nursing and front desk staff. At site 2, six volunteer and selected technologists from a total workforce of 12 were trained. At Institutions #1 and #2 staff was reimbursed by the Department for their time participating in the training, and was financially justified as time added to the workweek. At Institution #3 voluntary training was offered to the entire MRI team of 24 staff on weekends in February and March 2012. Ten of the 24 eligible technologist staff chose to participate and did not receive payment for their time engagement. An additional incentive provided to all sites was 16 hrs of American Society for Radiologic Technologists (ASRT) A+ continuing education credits (CEUs), and if trainees correctly answered 80 of 100 questions referring to the core training book, they would receive another 9 hours' credits of ASRT A+ CEUs.

Data Collection

One year of data was collected retrospectively to the baseline interval, and second year of data was collected following training. Data was gathered from hospitals' computer-based tracking and billing systems utilizing information technology specialists who were otherwise not associated with the study. Cancellations due to contraindications, such as metallic foreign bodies, were excluded from consideration for the purpose of this study.

No-shows are patients with scheduled exams who did not show up for their tests, with no-show rate calculated using the total number of scheduled cases as the denominator.

Incomplete studies listed reasons such as "claustrophobia," "can't tolerate," "too sick" (mainly patients unable to lie flat for extended time), "uncooperative," and "refused". Each

patient visit was counted as one encounter regardless of the number of body regions examined. The incompleteness rate was calculated using the total number of patients showing up (scheduled patients minus no-shows) as the denominator.

Statistical Analysis

Total subjects, no-show subjects and incomplete subjects were assessed for the pre- and post-training intervals, and their corresponding percentages were compared using a Chi-Square test for proportions with two-sided tests.

RESULTS

A total of 97,712 patient visits were evaluated, totaling 49,733 visits at baseline and 47,979 after training (Table 1). Despite differing no-show rates (5–22.2%) and study incompleteness rates (0.8–3.7%), the combined patients' data showed significant ($p < 0.0001$) improvement in the patients' no-show rates (decreases from 11.2% to 8.7%) and incompleteness rates (from 2.3 to 1.4%) following Comfort Talk training.

Overall the total number of completed patient visits for all 3 academic centers was relatively stable from the pre to post-training periods despite variations among different institutions. Given the benefit of reduced no-show and incompleteness rates after training, Institution #2 was able to accommodate 1,343 more patient visits following training. In contrast, Institutions #1 and #3 saw a decrease of total patient visits post-training attributed by the institution to increasingly complex, time-intensive, and multi-slot imaging protocols and imaging more challenging patients.

In the post-training period, Institution #1 implemented a policy of combining multiple MR studies in a single subject visit, resulting in longer imaging time per visit. More complex studies such as MR-enterography and whole-body high-resolution MR angiograms also added increasing imaging time per patient. Following training, more challenging patients considered for MR examination included sicker patients, a larger number of ICU patients who were more difficult to transport into and out of scanner and set up for scanning thereby prolonging the study time. Institution #3 initiated and established a new time consuming functional imaging program, new lengthy MR protocols for peritoneal metastases, cardiac patients with pacemakers, and obese cardiac insufficiency patients fitting into double slot-times all reducing total visit capacity.

Fig. 2 demonstrates the time course of incompleteness rates at Institution #3 with a clear and sustained reduction in the incompleteness rates coinciding with team training.

DISCUSSION

Based upon our data of 97,712 visits at 3 large academic centers, there was a significant improvement in the percentage of scheduled patients showing up and completing their examinations following training of the MR teams. Even though this was not a randomized trial and thus a cause and effect relationship cannot be proven, the clear and sustained drop

in incompleteness rates coinciding with the training is suggestive of training having had an effect.

The techniques we taught the MRI teams for anxiety and pain management had been reported to be effective in achieving these goals in other parts of the radiology department (10–14). The improvement in the incompleteness rate among patients who otherwise wouldn't have started or completed their examinations because of anxiety or discomfort thus fell within the hypothesized benefits of team training.

The improvement in the no-show rate after training was surprising. No-show tendency has been associated with younger age, lower socioeconomic status, state-medical assistance or lack of insurance, and a prior history of failure to keep appointments (15–18). Varying and discrete patient demographics and sociocultural environments may explain the wide range in initial no-show rates (5% and 22.1%) as well as the varying potential post-training effects on no-show rates among institutions, given the differences between a safety net hospital, and one that caters to principally working and middle class patients. In a study on reasons for no-shows in an urban university-affiliated family practice center, the majority of patients had missed more than 1 appointment (median, 4) and done so mainly because of financial constraints, anticipatory anxiety, concern about discomfort, and fear of the unknown or concerns about receiving bad news (18). Perceived disrespect of the staff and healthcare system as well as lack of understanding of the scheduling system were other important reasons explaining such failures to keep appointments. Ability to find transport or time-off ranked surprisingly low as causes for no-shows. One may speculate that anxious or concerned patients who are guided through a successful experience at their initial visit are more willing to show up for subsequent examinations rather than becoming “repeat offenders.”

The team training technique formally directed the staff's attention to the patients' psychological and communication needs through a method-based educational approach. This group effort takes place by learning simultaneously with professional peers intended to create a unified team culture, while being provided tools and resources to support this reorientation. In large part, this training becomes a focused customer-service exercise directed at specifically expressing respect and rapport as well as decreasing patient anxiety and discomfort. It is conceivable that this approach already provides a more engaging initial scheduling interaction for patients who otherwise would be at higher risk of appointment failure. Supporting the theory of team training training's potential contributions to the patient experience, MRI staff with team training in one study demonstrated up to 80 percentile points increases in their nationally benchmarked Press-Ganey Patient Satisfaction scores (26), possibly contributing to improved show-up rates and even increased referral numbers such as shown with Institution #2.

The average baseline incompleteness rate of 2.3% before team training in this study is concordant with previously reported data also measuring an average incompleteness rate of 2.3% (2). While a 2.3% incompleteness rate may be perceived as a small number, when extrapolating to the approximately 30 million scans performed annually in the US (15), a 2.3% incompleteness rate improvement reduces by 700,000 the number of studies either

delayed or not performed. Assuming a single exam per patient at a base-facility case cost of \$444 (1) within a range of charges between \$259–2,042 per case this low percentage already translates into an annual waste of 310 million dollars (19). Given ever-shrinking margins, even small reductions in the no-show and incompleteness rates could have considerable impact to the financial status, quality of care, and experience within individual departments.

Team training that includes nonpharmacologic analgesic and anxiolytic techniques are teachable, simple, and relatively inexpensive to implement when compared with many hardware or pharmaceutical solutions. Intravenous sedation has a failure rate of 6%, and inconveniences the patient by requiring fasting prior to sedation. Intravenous sedation also increases average manpower requirements such as an extra 27 minutes of patient management on average in the hands of dedicated MRI sedation nurses and an extra 47 minutes of patient management on average in the hands of inpatient nurses (20). Patients under sedation are not necessarily receptive to spoken requests such as breathing instructions, for additional consideration, particular hazards and risks concomitant with sedation and anesthesia in the MRI environment may include artificially blunted responses to discomfort or burn risks.

When considering decreases in incompleteness rates, we demonstrated an aggregate reduction in incompleteness rate from 2.3% to 1.4% after training. The post-training changes in incompleteness rates however varied widely among the institutions, with the greatest benefit at Institution #3 which had the highest baseline incompleteness rate of 3.7% and the greatest reduction of 59% to a post-training incompleteness rate of 1.5%. Institution #2 with a baseline incompleteness rate of 2.4% showed a trend towards lower rates, Institution #1 with an extremely low incompleteness rate of 0.8% did not show any improvement. A similar overall improvement in incompleteness rates of 38% (from 1.20% to 0.74%) has been reported after team training with advanced communication techniques in a community imaging setting with access to both closed and open bore MR scanners (20). In this referenced study the benefit in reducing incompleteness rates depended on the base rates before training. Anxious, claustrophobic, and obese patients were referred preferentially to an open scanner where patient selection resulted in higher baseline incompleteness rates of 3.4% despite better tolerance of the magnet design. At the open scanner a 58% reduction in incompleteness was achieved to a post-training level of 1.5%. It therefore seems that greatest benefit of team training in terms of incompleteness rates may be expected at sites with higher baseline incompleteness rates. Furthermore, the effect on no-shows can also be highly variable with less direct correlation to baseline rates as seen with incompleteness rates.

When team training decreases incompleteness and/or no-show rates, throughput can be improved with less magnet vacancy, a more predictable rate of examinations, and therefore a greater patient visit capacity as best demonstrated with Institution #2, a safety net hospital with relatively high baseline no-show and incompleteness rates. Institution #2 did not change the case mix or length of studies and was able to accommodate another 1,343 patients. Institutions #1 and #3 used capacity for combined or more time-extensive examinations. Combined body-part evaluations, high resolution studies, additive novel and whole-body MRIs are becoming increasingly common (22). Examination length remains an independent predictor contributing to increasing pain, anxiety, and dissatisfaction for patients undergoing

medical tests (10,23,24). Despite the predictive potential for increased incompleteness rates with lengthening examination times, the decreasing incompleteness rates in this study suggest that the increases in study length may have been effectively offset by use of team training, as has been otherwise previously demonstrated in reducing time-related stress (12,13,24,25).

When considering training cost versus reductions in incompleteness and assuming the lowest reimbursement rates of technical and professional fees in a model in which all trainees are paid by the institution for their time in training, the type of team training provided amortizes in approximately 4 months. This financial justification does not take into account changes in no-show rates or the impact on satisfaction rankings which are tied to fines and/or payments through the Centers for Medicare and Medicaid Services (26,27). Team training may also permit lengthier and more complicated examinations, such as at Institutions#1 and #3. Improved patient compliance has also otherwise been shown to decrease motion artifacts with its accompanying need for repeatedly imaging failed series, thereby adding on average \$115,000 of revenue per scanner per year (1).

Limitations

Despite the positive results shown in our study, we acknowledge our study's limitations. There are three categories of limitations; first, in establishing causality of team training education to improved show-up and decreased incompleteness, this study design did not include prospective randomization and historical rather than concurrent controls were considered. Second, although all three institutions retrospectively commented about evolving imaging protocols and the increasing length of many studies over the study interval, we had not accommodated for gathering data regarding such changes in protocols, case-mix, or variations in slot lengths. Third, the range of involved staff and therefore training system and methods also varied somewhat among sites. We demonstrated variations in initial practices and the improvement each practice experienced with team training, we are therefore challenged at this time to prospectively extrapolate the expected economic impact for a single given practice. Lessons learned at one site may have also sequentially affected deployment and implementation at subsequent sites, since the three sites were sequentially trained. In order to accommodate for these specific issues, a randomized trial is being planned.

The issue of population heterogeneity and site-to-site differences in effectiveness as well as best timing and method of training will need to be more closely examined in future randomized trials. Image quality of completed examinations were not assessed as part of this study, there is therefore a lack of substantiation that all three institutions delivered similar and mutually acceptable imaging quality both before and after team training.

Conclusion

We postulate that positive effects on both MRI patient show-up and completion rates can be achieved effectively through utilizing team training techniques. Our results suggest that team training is particularly useful in centers with high no-show or high incompleteness rates. The improved effect on no-show rates although significant was unanticipated, additional investigation may clarify this relationship, including such contributions as increased staff

mindfulness to patient needs. Team training may have advantages over current standard methods used to address anxious or claustrophobic patients who either anticipate or are expected to have difficulty in holding still or complete studies, thereby improving capacity utilization while simultaneously creating a more methodical patient-centered perspective.

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Suggestion Cards *One-Minute Success Strategy Ideas*

Select Search Criteria below:

Strategy Idea will appear here:

AGE (consider maturity level)

- Adult (>12 years)
- Child (<12 years)

PHASE

- Rapport
- Relaxation
- Remedies

PATIENT CONDITION

- Calm
- Anxious
- Fearful
- Claustrophobic
- Hysterical
- Resistant
- Irritating
- Hurting
- Medically Unstable

GET CARD

Noise Integration

Say to patient:

Use all the sounds and noises in the room to deepen your own experience. *(Use natural noises matching the patient's imagery—e.g. a concert, sounds on a beach that blend into the surroundings, walking down a familiar street, driving a car, blending a smoothie, working with power tools, the gallop of aa horse, the sound of a snow mobile). And use only the suggestions that are helpful for you and let the rest just fade away.*

Search the Database

Type search key here

SEARCH

Figure 1. Sample of an electronic suggestion card, one of the provided webtools offered trainees. This example demonstrates a strategy idea helping the user specifically address noise integration. The user is offered specific and calming phraseology to advise the patient on how they should deal with the reality of a high-noise MRI environment using specific pleasant substitute examples intended to engage and relax the patient.

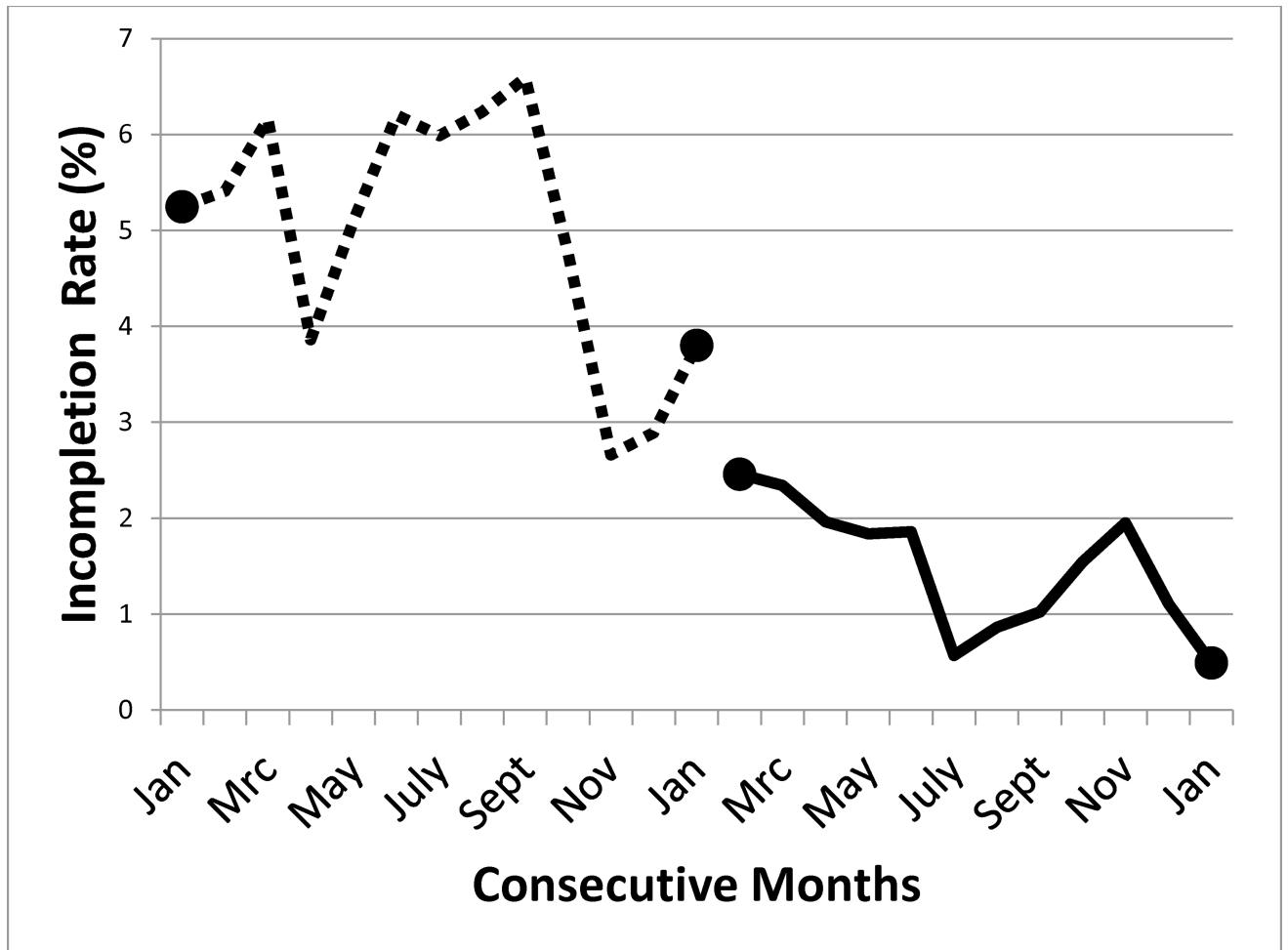


Figure 2.
Incompletion rates before (dotted line) and after team training (solid line)

Patient MRI no-show, incompleteness, and completion rates are demonstrated for consecutive twelve month intervals preceding and following team training at each of three academic radiology departments in aggregate, and individually for Institutions #1, #2 and #3.

Table 1

	Before Training		After Training		P value
	N	%	N	%	
Institutions 1-3 Combined					
All Patients scheduling appointment	49,733		47,979		
No-shows	5,593	11.2%	4,163	8.7%	P<0.0001
Showing up but unable to complete	1,014		634		
% of all showing-up patients		2.3%		1.4%	P<0.0001
Able to complete (% of all scheduled patients)	43,126	86.7%	43,182	90.0%	P<0.0001
Institution #1	N	%	N	%	
All Patients scheduling appointment	17,743		16,534		
No-shows	1,556	8.8%	1,585	9.6%	P=0.0093
Showing up but unable to complete	128		133		
% of all showing-up patients		0.7%		0.8%	P=0.3711
Able to complete (% of all scheduled patients)	16,059	90.5%	14,816	89.6%	P=0.0057
Institution #2					
All Patients scheduling appointment	14,212		14,813		
No-shows	3,148	22.1%	2,417	16.3%	P<0.0001
Showing up but unable to complete	265		254		
% of all showing-up patients		2.4%		2.0%	P=0.0793
Able to complete (% of all scheduled patients)	10,799	76.0%	12,142	82.0%	P<0.0001
Institution #3					
All Patients scheduling appointment	17,778		16,632		
No-shows	889	5.0%	161	1.0%	P<0.0001
Showing up but unable to complete	621		247		
% of all showing-up patients		3.7%		1.5%	P<0.0001
Able to complete (% of all scheduled patients)	16,268	91.5%	16,224	97.5%	P<0.0001