

# Reduction of Brachytherapy Treatment Cancellation Rates by Systematic Team Approach

Tony Eng, M.D.<sup>1,2,\*</sup>, Vanessa Magel, R.N.<sup>2</sup>

<sup>1</sup>Department of Radiation Oncology, University of Texas Health Science Center at San Antonio

<sup>2</sup>The Cancer Therapy and Research Center San Antonio, TX 78229

\*Corresponding Author: [eng@uthscsa.edu](mailto:eng@uthscsa.edu)

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**Abstract** Brachytherapy is one of the key components for cervical cancer therapy. Cancellation of brachytherapy leads to prolongation of therapy time which has been shown to decrease cancer control. Therefore, any cancellation of brachytherapy will affect patient survival or cure. In this study, we looked into brachytherapy cancellation rates and identified the top three causes. We then incorporated proper systematic interventions to include reminder calls and patient education. The monthly pre-intervention brachytherapy cancellation rates were 17-42%. The post-intervention rates gradually decreased from 44% to 0% within 3 months of implementing changes. The impact sustained throughout the project duration. The treatment delay rate (treatment duration >63 days) was 57% pre-intervention compared with 44% post-intervention. Cancellation and patient treatment delay rates were substantially improved by our simple systematic interventions. This project still requires continued efforts and longer follow up to show sustained clinical impacts.

**Keywords** Brachytherapy, Cancellation Rates, Systematic Team Approach

## 1. Introduction

This project was conducted in the Department of Radiation Oncology, University of Texas Health Science Center at San Antonio/ Cancer Therapy and Research Center (UTHSCSA/CTRC). We had observed the need to solve the problem of relatively high and erratic tandem & ovoids (T&O) intracavitary brachytherapy cancellation rates. T&O brachytherapy (as opposed to teletherapy) is a form of contact (internal) radiation therapy performed in the operating room (OR) and is one of the key components for cervical cancer therapy. As cervical cancer can be cured with radiation therapy, one of the important prognostic factors is overall treatment time. The prolonged duration of treatment from the first external beam treatment (teletherapy) to the

last T&O brachytherapy has shown to decrease cancer control rates up to 10-15%, when the patient's radiation treatment is delayed beyond 9 weeks (1-4). Therefore, any cancellation of T&O brachytherapy leading to a delay in radiation therapy will ultimately affect patient survival or cure. The goal of this project was to find the causes of T&O brachytherapy treatment cancellation, implement corrective actions, and ensure sustainable intervention and improvement.

Our primary aim was to reduce the rates of T&O treatment cancellation at the UTHSCSA/CTRC Radiation Oncology Clinic by at least 10% (or absolute 10% improvement) in the next 6 months (December to May 2010). Our secondary aim was to reduce treatment delays by 10% (treatment duration less than 9 weeks or <63 days).

## 2. Methods & Materials

I solicited the nurse manager, as my partner to make this project possible. She was in charge of patient coordinators, patient education, staff nurses and medical assistants. Our chief administrator was a key team member, who provided administrative support, tackled unexpected problems, and served as the immediate team facilitator. As another key member of the team, our chief nurse for the ambulatory surgery center (ASC) coordinated OR scheduling for T&O brachytherapy procedures, provided additional OR resources and nursing support. We believe this project would lead to quality patient care, improved clinic efficiency, reduction of manpower, less waste of resources and good return on investment (ROI), which are our fundamental organizational goals.

We collected our base data on the monthly T&O brachytherapy cancellation rates for the past 6 months and compared these with the post-intervention data set. We analyzed the impact on the frequency of patient treatment delays on those who completed the entire course of radiation therapy. We compared the number of patients whose treatments were delayed before with that after implementation of intervention.

### 3. Use of Quality Tools

After our team was formed and organized with well-defined roles and responsibilities, we summarized our patient consultation and radiation treatment process in a flowchart. Briefly, the patient is seen for radiation therapy consultation, and a decision is made to proceed with treatment planning for external beam radiation therapy with concurrent systemic chemotherapy for 5 weeks. After 5-7 days of break, the patient is scheduled for T&O brachytherapy for 5-6 treatments delivered twice-a-week.

Then we looked into the T&O brachytherapy cancellation rates and collected baseline data. We created the base data control chart (Figure 1) which shows a mean cancellation

rate of 27%. We also reviewed the number of patients whose treatments had been delayed. We had brainstorming team and small frequent impromptu meets to identify the causes of and potential solutions to the problem. We created a fishbone diagram (Figure 2). We discussed some of the common root causes, did an affinity sort collectively, and came up with major causes of T&O brachytherapy cancellations in order of frequency. A Pareto diagram was generated (Figure 3), which helped us to identify that patient factor, facility system and scheduling were the top three causes that were roughly responsible for 80% of T&O brachytherapy cancellations (see arrow in Fig 3).

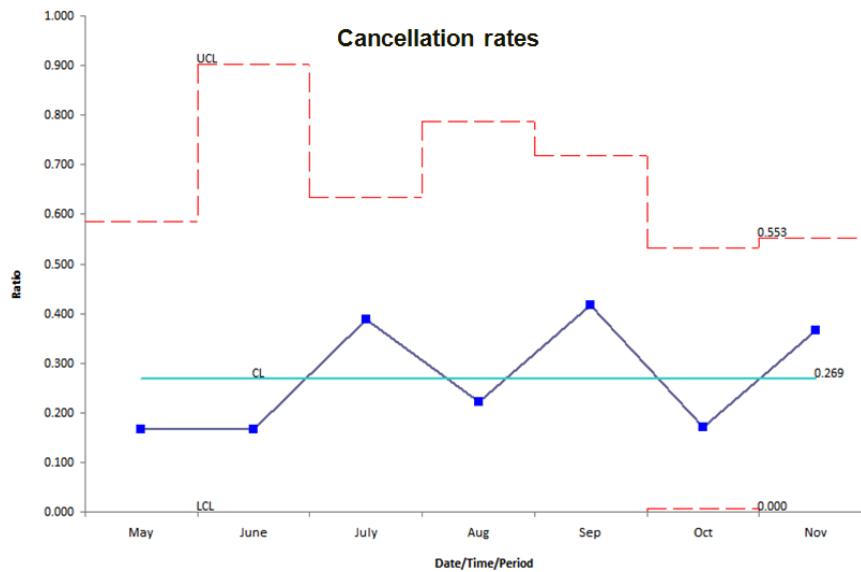


Figure 1. Pre-intervention cancellation rates

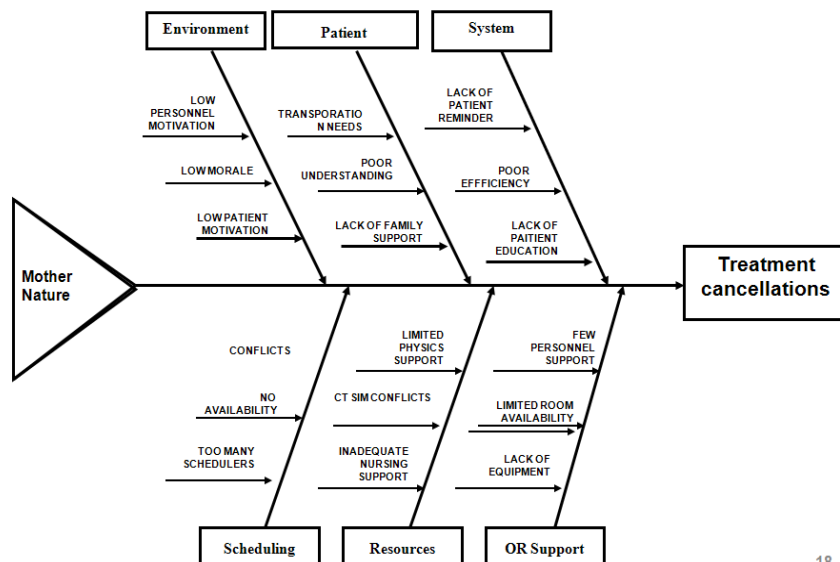


Figure 2. Cause & effect analysis

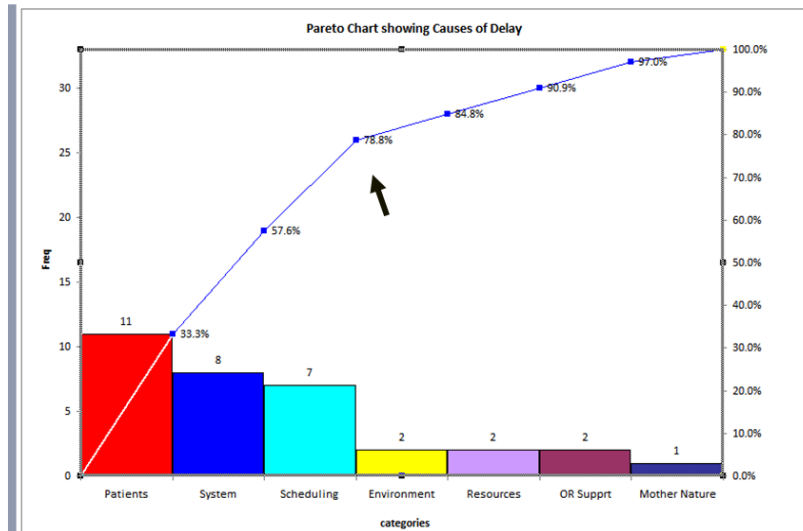


Figure 3. Cancellations Factors vs. Frequency

### 4. Interventions

The overall improvement plan was to make two sequential reminder calls, add patient education program regarding the importance of T&O brachytherapy in curing cervical cancer, give written information and instructions for T&O brachytherapy, arrange pre-op meeting with ASC, promote patient motivation, and improve communication by encouraging more questions. We implemented these changes by creating a timeline (Figure 4) so that these processes could be incorporated gradually within 2-3 months while collecting post-intervention data and analyzing the effectiveness. We wrote the patient information in layman terms and the chief nurse and her staff conducted patient education sessions. Both the radiation oncology and ASC nursing staff made separate reminder calls 2-3 days and 1 day (2 calls) before T&O brachytherapy procedure, respectively. Both the physicians and nursing staff promoted patient motivation and encouraged questions from patients. We felt that arranging patients to meet with ASC nursing staff pre-operatively was innovative. It appeared to have decreased patient’s apprehension about this “internal” radiation therapy, T&O brachytherapy.

### 5. Results

The base data on 134 scheduled procedures (28 patients) from May to November 2009 showed the monthly T&O brachytherapy cancellation rates ranged 17-42% with a mean of 27%. Post-intervention data on 77 scheduled cases (10

patients) showed a corresponding decrease in T&O brachytherapy cancellation rates from 44% down to zero within 3 months of implementing changes (the improvement was statistically significant). The impact sustained through project graduation date in May 2010 with a mean cancellation rate of 15% (Figure 5). Update in September 2010 with 37 scheduled procedures (8 patients) demonstrated sustained 0 cancellation rates (Figure 6).

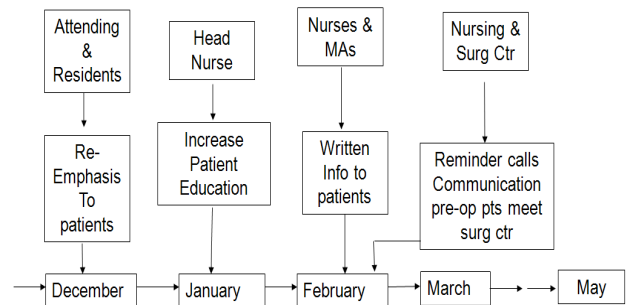


Figure 4. Intervention timeline: Step interventions

Treatment delays (treatment duration >63 days) were observed in 16 of the 28 (57%) patients who completed treatment prior to intervention compared with 8 of 18 (44%) patients who completed treatment after intervention. Most of these delays were in the early months when changes were being gradually implemented.

Financially, an estimated \$23,637 annualized cost savings over 8 months was achieved. See Table 1.

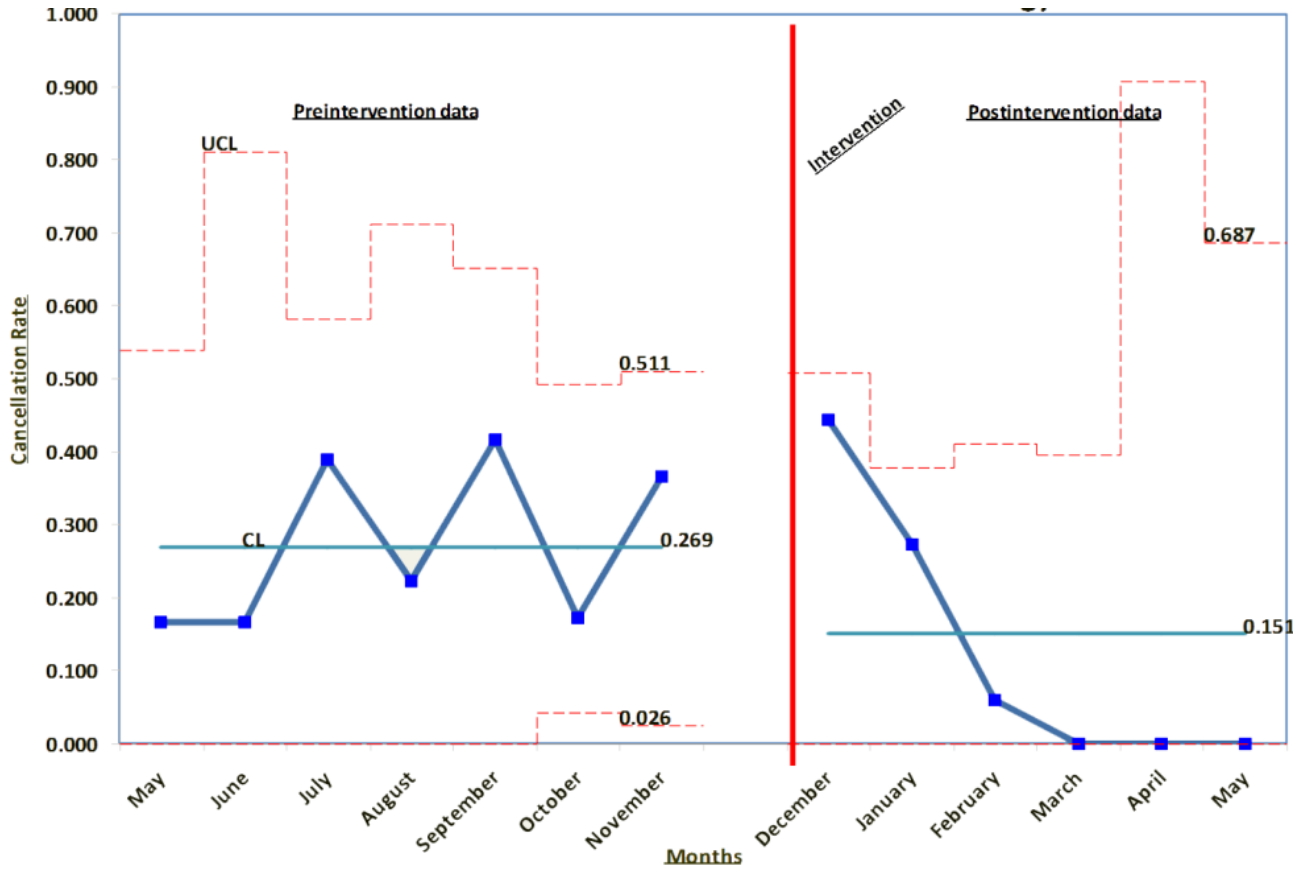


Figure 5. Comparison of pre- and post-intervention cancellation rates

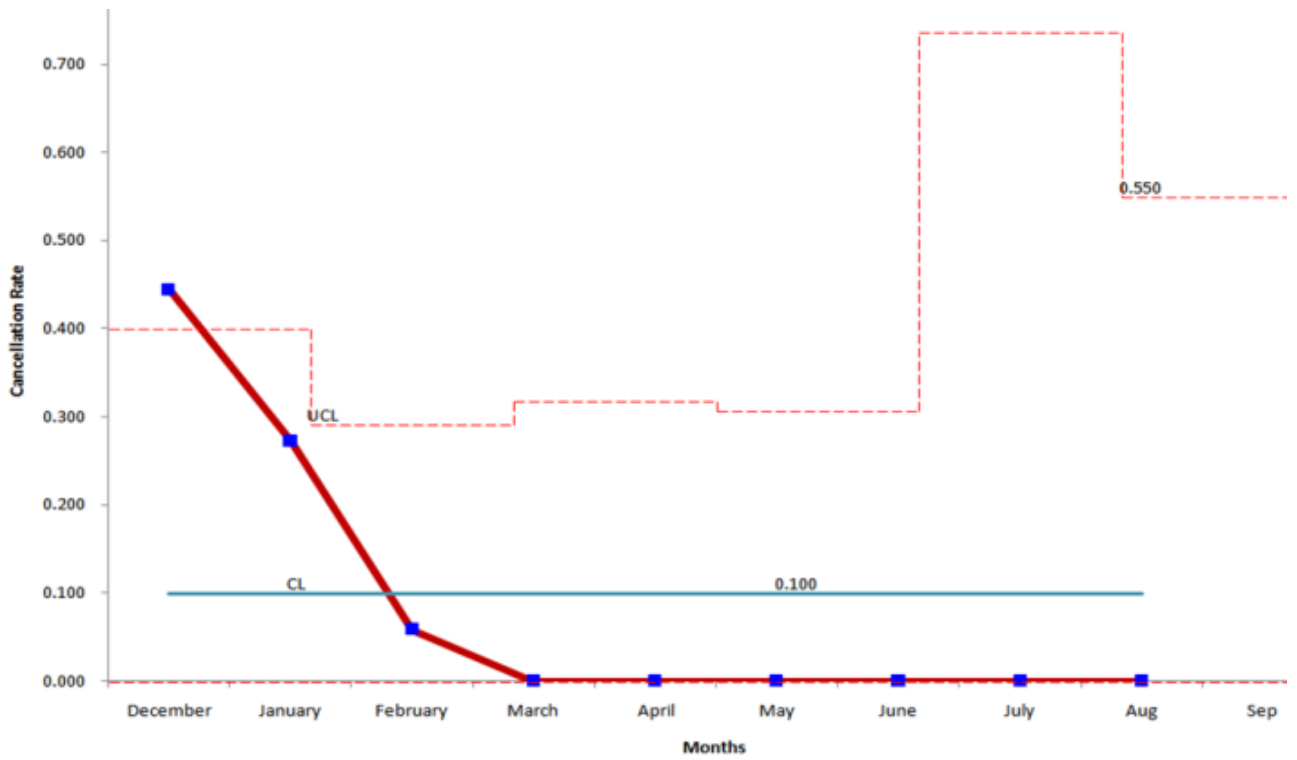


Figure 6. Sustained post-intervention on cancellation rates

**Table 1.** Estimated Return of Investment (ROI)\*

Step 1.	Estimate Labor Cost to Schedule the Procedure 10.6 hours of staff time \$489.24	
	<b>Title</b>	<b>Hours Per Cancelled Case</b>
	Rad RN	1.5
	MD	0.75
	Resident	1.0
	Patient Coordinator & Financial Clearance	4.0
	Radiation Therapist	0.5
	CT Technologist	0.25
	Physicist	0.5
	Medical Assistant	0.1
	ASC RN	2.0
	Total hours	10.6
	Total Labor Cost	\$ 489.24
Step 2a.	Multiply Cost of Labor times 40 cases (pre-intervention) Cancelled(May through Dec)-\$19,570	
Step 2b.	Multiply Cost of Labor times 7 cases (post-intervention) Cancelled(Jan through May)-\$3,811	
Step 3.	Determine the difference- \$15,758	
ROI.	\$15,758 direct cost savings over 8 month period due to decreasing cancellations and \$23,637 cost savings annualized	

\*Based on our internal booking estimates prepared by the department administrator.

## 6. Discussion

Among several prognostic factors for cervical cancer, prolonged treatment duration can adversely impact local pelvic control and survival (1-5) even in the setting of concurrent chemoradiotherapy(6), although the addition systemic chemotherapy may alleviate some of the negative effects of prolonged treatment duration on distant failures or survival (7). Huang and associates (8) used the extended LQ model to elucidate the mechanism of loss tumor control and treatment delay based on clinical data and MRI based 3D tumor volumetric regression data from 80 cervical cancer patients. They concluded that accelerated repopulation of tumor cells occurred in cervical cancer and had a relatively short onset time if the treatment course was protracted.

As prolongation of treatment time is detrimental to pelvic control and often associated with delay in starting brachytherapy due to various reasons, we have achieved our primary endpoint of lower cancelled appointment rates (down to zero), which led to an immediate reduction of manpower and waste of resources. We have also achieved our secondary endpoint of less treatment delays, which could lead to improved disease control and potentially patient survival. Such clinical benefits are priceless. Based on Song et al. data (6), the estimated reduction of local pelvic failure may be up to 17% at 3 years; however, it will take several years for these benefits to be realized in our study, which requires longer follow-up.

The significant decrease in cancellation rates will no doubt open up more treatment slots, increase our capacity to treat more patients, and improve the overall efficiency of clinic operations. Introduction of this project to and subsequent implementation in other facilities are anticipated as we have determined that this simple method was successful in our clinic.

Together with patient education and coordinated team effort, they form the backbone of our successful interventions. As patient's forgetfulness is one of the major factors of no-show, reminder calls are very effective remedy (9-10). Cancellation and patient treatment delay rates were substantially improved by our interventions. As our primary and secondary aims were achieved, we feel we had a good ROI. However, other uncontrolled factors, including unexpected hospitalizations, and rare occasions of unusual side effects in some patients can cause unavoidable treatment delays and skew the results as only a relatively small number of patients was involved in this study. Since our patients were mostly Hispanic, socioeconomic factors could conceivably affect the cancellation rates (11) and thus, outcome of this study. This project still requires continued efforts and longer follow up to gain further reduction of treatment delays and increase in ROI and clinical benefits. We plan to sustain our current interventions and continue to consider additional interventions and suggestions from our staff. We will continue data collection and analyses. We will see if we can also apply this method to other scheduled OR procedures to reduce cancellation rates.

## 7. Conclusions

Our primary aim to reduce the rates of T&O treatment cancellation at least 10% and secondary aim to reduce treatment delays by 10% were achieved by systematic implementation of interventions and focused team efforts. Overall, in aligning with our organizational goals, directly or indirectly, this project has led to improved patient care, efficient clinic operations, reduction of manpower, less waste of resources and good ROI. The ultimate clinical benefits include improved pelvic disease control.

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## REFERENCES

- [1] Perez CA, Grigsby PW, Castro-Vita H, et al. Carcinoma of the uterine cervix. I. Impact of prolongation of overall treatment time and timing of brachytherapy on outcome of radiation therapy. *Int J RadiatOncolBiolPhys* 1995;32(5):1275-88.
- [2] Lanciano RM, Pajak TF, Martz K, et al. The influence of treatment time on outcome for squamous cell cancer of the uterine cervix treated with radiation: a patterns-of-care study. *Int J RadiatOncolBiolPhys* 1993;25(3):391-7.
- [3] Girinsky T, Rey A, Roche B, et al. Overall treatment time in advanced cervical carcinomas: a critical parameter in treatment outcome. *Int J RadiatOncolBiolPhys* 1993;27(5):1051-6.
- [4] Fyles A, Keane TJ, Barton M, et al. The effect of treatment duration in the local control of cervix cancer. *RadiotherOncol* 1992;25(4):273-9.
- [5] Gasinska A, Fowler JF, Lind BK, et al. Influence of overall treatment time and radiobiological parameters on biologically effective doses in cervical cancer patients treated with radiation therapy alone. *ActaOncologica*. 2004;43(7):657-66.
- [6] Song S, Rudra S, Hasselle MD, et al. The effect of treatment time in locally advanced cervical cancer in the era of concurrent chemoradiotherapy. *Cancer* 2013;119(2):325-31.
- [7] Shaverdian N, Gondi V, Sklenar KL, et al. Effects of treatment duration during concomitant chemoradiation therapy for cervical cancer. *Int J RadiatOncolBiolPhys* 2013;86(3):562-8.
- [8] Huang Z, Mayr NA, Gao M, et al. Onset time of tumor repopulation for cervical cancer: first evidence from clinical data. *Int J RadiatOncolBiolPhys* 2012;84(2):478-84.
- [9] Taylor NF, Bottrell J, Lawler K, et al. Mobile telephone short message service reminders can reduce nonattendance in physical therapy outpatient clinics: a randomized controlled trial. *Arch Phys Med Rehabil* 2012;93(1):21-6.
- [10] Prasad S, Anand R. Use of mobile telephone short message service as a reminder: the effect on patient attendance. *Int Dent J* 2012;62(1):21-6.
- [11] Burkhart CG. Improving the rate of kept appointments at dermatology clinics. *J Am AcadfDermatol* 2001;44(2):313-4.