MR-guided brachytherapy process for cervical cancer: identifying procedure time & opportunities for efficiencies

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Introduction

Integrating magnetic resonance imaging (MRI) to guide brachytherapy treatment in cervical cancer has recently been recommended as a standard. This increases the complexity of the treatment process and often causes inefficiency.

Objectives

- To describe the current MRI-guided brachytherapy process for the treatment of cervical cancer at PMH
- To use Lean Process methods to identify opportunities which may improve the efficiency of the current process

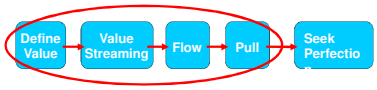
Materials & Methods

LEAN PROCESS
A quality management tool that is used to improve efficiency in a process by systematically eliminating wastes.

Value-added activities
work that adds value from the perspective of the patient

Waste (i.e. non-value-added activities)
repeated steps, rework, unnecessary motions, overproductions, waiting and transportation in the process

It has 4 main steps:



Define Value: interview for 10 key members of MR-guided brachytherapy team.

Value Streaming & Flow: Non-participant observation for eight (N=8) consecutive MR-guided BT for cervical cancer procedures were done. All activities for the procedure were first mapped out. Then, for each activity the time, description, location, number of staff involved and causes of any inefficiency were recorded.

Pull: Inefficiencies of the process were further categorized according to Lean value-added vs. non-value-added (i.e. wastes) activities. Finally, waste activities were further grouped using Taichi Ohno's 7 Wastes in Health Care.

Results

Define Value:
Interview summary from 10 team members

Ideal patient experience:
Efficient, painless treatment

Ideal provider experience:
Seamless process, when everything runs smoothly, no waiting

When your day works well, how does it look like?
Ideally finish as early as possible, but with current resources, 8am OR applicator insertion and 2pm Beam On Time is reasonable.
Total Duration: 6 hours

Where have you experienced the most delays?
Transportation to MR or MR availability
Staff (doctors') availability

Results

Flow:
Process Flow Diagram

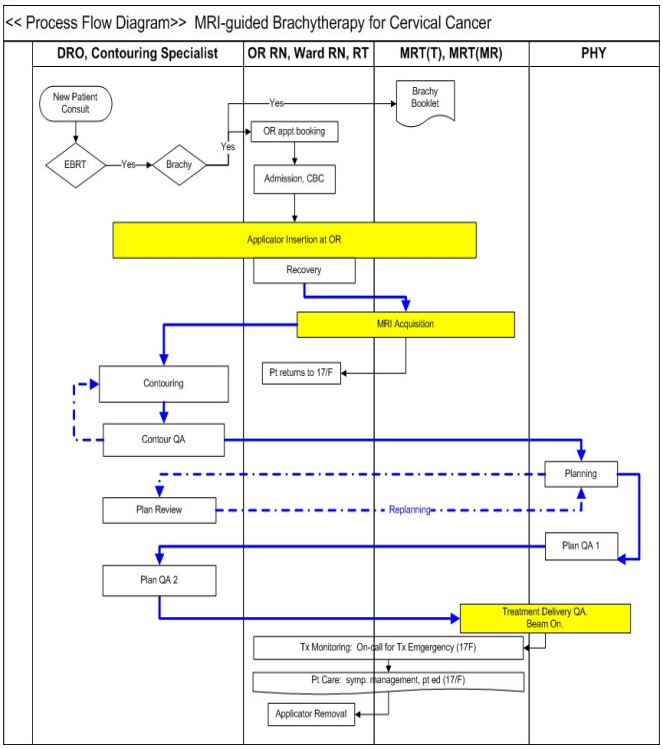


Figure 1: Progress Flow Diagram illustrating activities done by each health care professional during the MR-guided brachytherapy for cervical cancer process

DRO = Radiation Oncologist
RN = Registered Nurse
RT = Respiratory Therapist
MRT(T) = Medical Radiation Therapist
MRT(R) = Medical Radiation Technologist (MRI)
PHY = Medical Physicist

Value Streaming

Table 1: average time for each activity

Activity	Description	Average Time	Predicted Time MR-OR-BT
1	Applicator Insertion	61 mins	61 mins
2	Recovery	42 mins	
3	Transportation: Recovery → MRI	17 mins	
4	Awaiting: MRI availability	27 mins	
5	MRI Acquisition	27 mins	27 mins
6	MRI Image Data Transfer	(0-45 mins)	
7	Contouring	69 mins	69 mins
8	Hand-off: Contour → DRO	24 mins	
9	Contour QA, Verbal Rx	12 mins	12 mins
10	Hand-off: Contour → Planning	0 min	
11	Planning	72 mins	72 mins
12	Replanning	(0-95 mins)	
13	Plan QA 1: PHY	18 mins	
14	Plan QA 2: RO	17 mins	
15	Rx Approval RO	(0-59 mins)	
16	Treatment Delivery QA	46 mins	46 mins
17	Beam On	---	
	TOTAL DURATION	8.1 hrs	4.8 hrs

Pull

Table 2 (below): 7 Lean Wastes

	Lean Wastes	Observed Results
1	Waiting	•MRI availability •MR image data transfer •Staff member availability
2	Transportation	•Transferring patient from OR to MRI
3	Rework	•Planner spends time replanning
4	Motion	•Forgot OR equipment •Forgot treatment QA equipment
5	Overproduction	•Lack of standard process in communication among staff between recovery to MRI scanner
6	Processing	•Frequent communication and requests for updates regarding planning and plan QA progress·
7	Underdeveloped Talent	•Rationale for replanning not shared for subsequent procedures

Conclusions

The majority of time in the MR-guided brachytherpay process for cervical cancer was dedicated to value-added activities. On average, the team was performing at 8.1 hrs, although with the combined MR-OR brachytherapy suite, the procedure is predicted to be 4.8 hrs, translating to a 41% improvement in efficiency.

The most common waste was on waiting (for MR scanner and staff availability) and rework (replanning) in this process. The results of this study can be used to design and improve the current process at the study hospital.

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