The Ottawa Hospital | L'Hôpital d'Ottawa

Implementation of An Incident Learning System in a Multidisciplinary Environment: a Leadership Opportunity for Medical Physicists

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Learning Objectives

To understand:

1. The value of a comprehensive incident learning system
2. The barriers that must be overcome to effectively implement such a system
3. Why the physicist plays a vital role in error management

System Safety

- **Unsafe Systems** – mountain climbing, some surgery, etc.
  - Risk of failure inherent in activity & accepted
- **Safer Systems** – road traffic, some healthcare
  - Safety improvement through standardisation
  - QA monitoring, staff training, procedures, etc.
- **Safe Systems** – food supply, charter airlines
  - Safety from top management commitment
  - Written safety policy, safety resources available
- **Ultra-safe Systems** – scheduled airlines, nuclear power
  - Safety supervision, automatic monitoring of process, automatic execution of routine tasks, etc.

The Field guide to Understanding Human Error, Sidney Dekker, Ashgate 2006

Approaches to Error Management

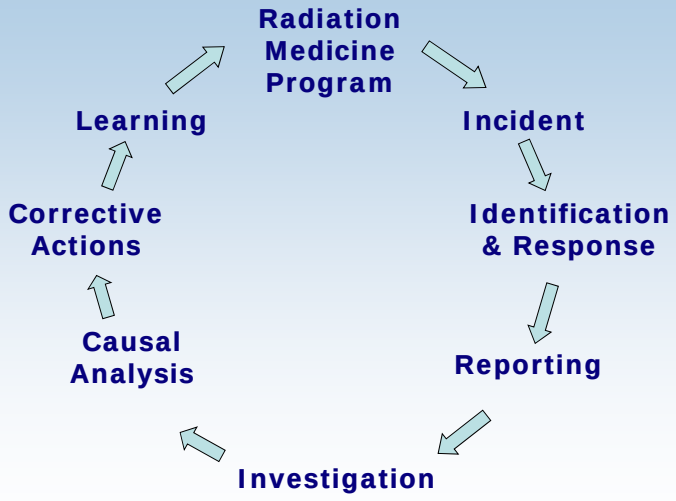
- **Incident Learning Systems** are used reactively to analyze incidents that have occurred or proactively to analyze potential incidents (near misses)
- **Failure Modes and Effects Analyses (FMEA) and Fault Tree Analyses** are used prospectively to analyze systems for weaknesses

Outline

Incident Learning

- What is it?
- Why should we do it?
- How do we do it?

Incident Learning System



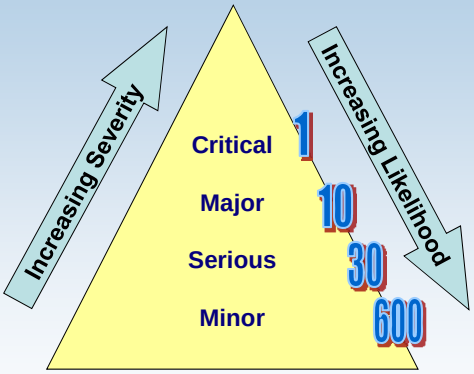
Adapted from the Tom Baker Cancer Centre, Calgary, funded by the Alberta Heritage Foundation for Medical Research

Definitions

- **Incident**: An unwanted or unexpected *change* from a normal system behaviour that causes or has the potential to cause an adverse effect to persons or equipment
- **Potential Incident** ("near miss"): An incident that causes no harm but signals a *potential weakness* in the health care system

1. The management of radiation treatment error through incident learning. Clark BG, Brown RJ, Ploquin JL, et al.: Radiother Oncol 95 (2010) 344-349
2. A Reference Guide for Learning from Incidents in Radiation Treatment 2006: Cooke DL, Dubetz M, Rahim H, et al. http://www.ihe.ca/documents/hta/HTA-FR22.pdf

Potential Incidents



Bird FE and Germain GL, 1986
Practical Loss Control Leadership
Institute Publishing, Loganville, GA

Investigation

- All incidents are investigated
- Composition of investigation team depends on severity of incident
- Priority for completion of investigation depends on severity of incident
- Assessment of impact, process domain and characteristics of the incident
- Investigation report includes causal analysis, recommends corrective actions, and assigns follow-up

Facility Management/Planning	Clinical Infrastructure	Clinical Process
1 Inadequate Human Resources 1.1 Inconsistent with prof. recommendations 1.2 Inconsistent with vendor specs 1.3 Inconsistent with regulations 1.4 No provision for increase in activities 1.5 Personnel availability **2 Inadequate Capital Resources** 2.1. Inadequate budget for equipment 2.2. Inadequate support/service contracts 2.3. Inadequate training support 2.4. Insufficient IT infrastructure 2.5. Inappropriate or inadequate equipment **3 Policies, Procedures, Regulations** 3.1. Relevant policy nonexistent 3.2. Policy not implemented 3.3. Policy inadequate 3.4. Policy not followed 3.5. External regulation not followed 3.6. Conflicting policies **4 Training** 4.1. Facility training inadequate 4.2. Vendor training inadequate 4.3. Training needs not identified 4.4. Inadequate assessment of staff competencies 4.5. Lack of continuing education **5 Communication** 5.1. Poor/incomplete/unclear/missing documentation 5.2. Inadequate communication patterns designed 5.3. Inappropriate or misdirected communication 5.4. Failure to request needed information 5.5. Medical records incorrect/incomplete/absent 5.6. Lack of timeliness 5.7. Verbal instruction inconsistent w documentation **6 Physical Environment** 6.1. Physical environment inadequate 6.2. Distracting environment 6.3. Interruptions 6.4. Conflicting demands/priorities **7 Leadership and External Issues** 7.1. Inadequate safety culture 7.2. Failure to remedy past known shortcomings 7.3. Environment not conducive to safety 7.4. Hostile work environment 7.5. Inadequate supervision 7.6. Lack of peer review 7.7. Leaders not fluent in the discipline 7.8. Outdated practices	**8 Materials/Tools/Equipment** 8.1. Availability 8.2. Defective 8.3. Used incorrectly 8.4. Inadequate assessment of material/tool/equipment for the task **9 Acceptance Testing & Commissioning** 9.1. Not following best-practice documents 9.2. Lack of independent review 9.3. Lack of review of pre-existing reports 9.4. Lack of effective documentation **10 Equipment Design and Construction** 10.1. Inadequate P&Ps for QA and QC 10.2. Inadequate hazard assessment 10.3. Inadequate design specification 10.4. Inadequate assessment of operational capabilities 10.5. Poor human factors engineering 10.6. Interoperability problems 10.7. Networking problems (IT) 10.8. Software operation failure 10.9. Poor construction (physical) **11 Equipment Maintenance** 11.1. Failure to report problems to vendor 11.2. Failure to follow vendor field change orders 11.3. Failure to provide adequate preventive maintenance 11.4. Failure by vendor to share failure/safety issues 11.5. Unavailability of local and field support **12 Environment (within the facility)** 12.1. Ergonomics (room layout, equipment setup) 12.2. Machine collision issues (room specific) 12.3. Environment (water, HVAC, electrical, gas) 12.4. IT infrastructure and networking issues 12.5. Delay in corrective actions for facility problems **13 External Factors (beyond Facility Control)** 13.1. Natural environment 13.2. Hazards	**14 Failure to detect a developing problem** 14.1. Environmental masking 14.2. Distraction 14.3. Loss of attention 14.4. Lack of information **15 Failure to interpret a developing problem** 15.1. Inadequate search 15.2. Missing information 15.3. Incorrect information 15.4. Expectation Bias **16 Failure to select the correct rule** 16.1. Incomplete or faulty rule 16.2. Old or invalid rule 16.3. Misapplication of a rule **17 Failure to develop an effective plan** 17.1. Information not seen or sought 17.2. Inappropriate assumptions 17.3. Failure to recognize a hazard 17.4. Information misinterpreted 17.5. Inadequate management of change 17.6. Inadequate assessment of needs & risks 17.7. Side effects not adequately considered 17.8. Mistaken options **18 Failure to execute the planned action** 18.1. Stereotype take-over/faulty triggering 18.2. Plan forgotten in progress 18.3. Plan misinterpreted 18.4. Plan too complicated (bounded reality) **19 Patient-Related Circumstances** 19.1. Misleading representation 19.2. Cognitive performance issues 19.3. Non-compliance 19.4. Language issues and comprehension 19.5. Patient condition, eg, physicial capabilities, inability to remain still **20 Human Behavior Involving Staff** 20.1. Unclear roles, responsibilities & accountabilities 20.2. Acting outside one's scope of practice 20.3. Slip causing physical error 20.4. Poor judgment 20.5. Language and comprehension issues 20.6. Intentional rules violation 20.7. Negligence **21 Other**

Action Hierarchy

Stronger Actions	•Architectural / physical plant changes •New device •Interlock •Process simplification •Standardisation •Leadership action
Intermediate Actions	•Redundancy •Staffing increase workload decrease •Software modifications •Distraction reduction •Checklist / cognitive aid •Eliminate look-alikes •Readback •Enhanced documentation
Weaker Actions	•Double checks •Warnings and labels •New procedure / policy •Training •Additional study

US National Centre for Patient Safety (NCPS)

Outline

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- What is it?
- **Why should we do it?**
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Radiotherapy Risk Profile

WHO Report, 2008

Analysis of incidents leading to significant adverse events to patients between 1976-2007

3125 patients affected by RT errors

- 55% planning
- 25% commissioning
- 10% treatment delivery
- 9% information transfer

Ottawa Program Summary

Annually:

- 70,000 External Beam Treatments
- ~4,000 New Patients
- ~4,700 Customised Treatment Plans

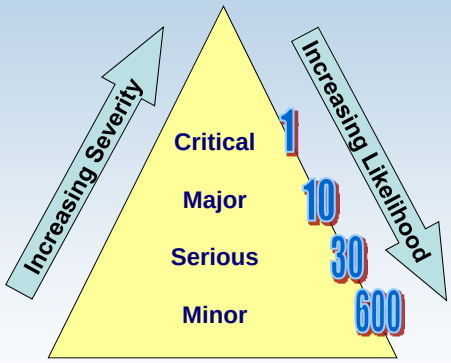
Treatment Technology:

- 12 External Beam Accelerators
  - 9 Conventional, 2 TomoTherapy, 1 CyberKnife
- 1 Orthovoltage Unit
- 1 HDR Brachytherapy Unit

Staffing

- 95 Radiation Therapists
- 18 Radiation Oncologists
- 18 Medical Physicists + 15 Technical Staff

Incident Severity



All Incidents

2007	2008	2009	2010	2011
1	0	1	0	0
9	4	1	1	1
44	21	26	9	15
604	661	433	406	269

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What Have We Learned?

Assigned Basic Cause (%)

Basic Cause Classification	2007	2008	2009	2010	2011
1 Standards/Procedures/Practices	**81.8**	**76.6**	**79.0**	**66.8**	**69.1**
2 Materials/Tools/Equipment	1.2	3.0	1.5	3.8	2.8
3 Design	2.0	0.9	0.4	1.9	2.1
4 Work Planning	2.9	3.0	**8.0**	**11.3**	**11.6**
5 Communication	**7.6**	**9.6**	**6.9**	**9.4**	**8.1**
6 Knowledge/Skill	3.2	3.6	3.3	**5.0**	**2.1**
7 Personal Capabilities	0.6	0.2	0.2	1.2	3.2
8 Personal Judgment	0.3	1.9	0.7	0.2	1.1
9 Natural Factors	0.3	0.3	-	0.2	-

Procedures

The Field Guide to Understanding Human Error

- Sidney Dekker, Ashgate 2006

- Procedures are resources for action
- Applying procedures successfully is a substantive, skillful, cognitive activity
- Procedures cannot guarantee safety. Safety comes from individuals being skillful at judging when and how they apply.
- Safety improvements come from organisations monitoring and understanding the gap between procedures and practice.

Breaking the rules: understanding non-compliance with policies and guidelines

- Carthey et al, BMJ 2011;343:d5283

Actual Clinical Incident Summary

Category	2007	2008	2009	2010	2011
Geographic miss	10	8	5	3	1
Incorrect shifts from setup point	5	4	1	6	7
Incorrect patient treated	2	-	-	-	-
Incorrect volume	1	-	1	-	1
Shielding incorrect	14	4	-	1	4
Incorrect parameter(s)	12	8	3	-	-
Patient positioning error	2	1	3	2	1
CT errors	8	11	4	6	4
Imaging errors	10	4	5	5	2
Bolus issues	14	3	3	2	10
Incorrect accessories	2	2	2	2	2
Incorrect dose/calculation error	5	4	4	2	1
Scheduling errors	2	2	3	1	6
Miscellaneous	-	3	0	-	-
Total	**86**	**54**	**36**	**30**	**39**

Program Changes 2007-2011

Technology

- CMS Focal, XiO, Monaco
- Elekta XVI CBCT
- BrainLAB ExacTrac
- CyberKnife

Techniques

- IGRT
- SBRT – lung, liver, spine
- Conventional IMRT
- VMAT
- New brachytherapy techniques

AND relocation of entire RT operation, commissioning of 5 accelerators, relocation of brachytherapy suite, etc....

Interventions Introduced

General

- changes in staffing levels to concentrate effort in more vulnerable parts of the process
- modification of the quality assurance processes to focus on weaknesses in the treatment preparation process

Human Factor Error Reduction

- reduction of transcription tasks including several achieved by virtue of software upgrades
- template standardization
- treatment table indexing
- first day treatment checklists

Policy and Procedure Changes

- verbalization of treatment parameters prior to treatment delivery
- laterality policy
- documentation of overrides

5 yrs ILS in Ottawa

- Substantial decrease in non-minor incidents
- Planning incidents are numerous, have either zero or minor impact but should be addressed
- **Treatment Delivery** is the most vulnerable point in our process
- Established a "just" environment
- ILS provides rapid feedback on new initiatives/technology
- Data used to maximise efficiency and recognise educational needs

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Error Management

Requires:

1. Recognition of inevitability of human error
2. Design & implementation of systems to reduce error-provoking tasks
3. Strengthening of defenses to limit effects of remaining errors

Reason J, Hobbs A. Managing Maintenance Error, 2003

NB: Human error is not a basic cause in our system!

ILS: Design Goals

An incident learning system that is

- Easy to use
- Free of "blame" or "stigma"
- Driven by continuous improvement in the SYSTEM (errors are normal)
- Key to the success of the learning process: **Leadership commitment & behaviour**

SAFETY IS A MANAGEMENT CHALLENGE, NOT A MEDICAL PROBLEM!

ILS Committee Members

- Head of Radiation Oncology
- Chief, Medical Physics
- Chief, Radiation Therapy
- 1 Senior Physicist/RSO
- 2 RT Supervisors
- 3 Planning Resource Therapists
- 3 Treatment Resource Therapists
- Administrative Assistant

Organisational Cultures

Pathological	Bureaucratic	Generative
Do not want to know	May not find out	Actively seek it
Messengers are "shot"	Messengers are listened to if they arrive	Messengers are trained and rewarded
Responsibility is shirked	Responsibility is compartmentalised	Responsibility is shared
Failure is punished or concealed	Failures lead to local repairs	Failures lead to far reaching reforms
New ideas are actively discouraged	New ideas often present problems	New ideas are welcomed

Reason, J: Managing the risks of organisational accidents

Summary

Incident Learning

- What? – Proactive measure to improve safety culture through the analysis of actual and potential events
- Why? – Physicists are responsible for the accuracy of dose delivered and have the technical and leadership skills
- How? – Multidisciplinary team effort, constant vigilance, non-judgmental

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