

**Processes and Tools for Re-thinking Linac QA**

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**Disclosures**

- ImageOwl, LLC
  - Stock
- *Quality and Safety in Radiotherapy*
  - Textbook royalties
- TreatSafely Foundation (non-profit organization)
  - Founding partner

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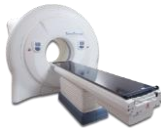
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### Impact on Quality Assurance

- TG-24 (1984)
  - Physical Aspects of Quality Assurance in Radiation Therapy
- TG-28 (1987)
  - Radiotherapy Portal Imaging Quality
- TG-40 (1994)
  - Comprehensive QA for Radiation Oncology
- TG-142 (2009)
  - Quality assurance of medical accelerators
- TG-114 (2011)
  - Verification of monitor unit calculations for non-IMRT clinical radiotherapy




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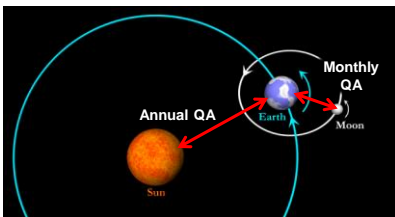
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### Testing Frequency




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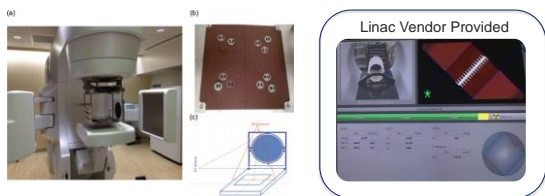
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Med Phys. 2015 Oct;42(10):5584-94. doi: 10.1118/1.4929550.

**Daily QA of linear accelerators using only EPID and OBI.**

Sun B<sup>1</sup>, Goddu SM<sup>1</sup>, Yaddanapudi S<sup>1</sup>, Noel C<sup>1</sup>, Li H<sup>1</sup>, Cai B<sup>1</sup>, Kavanagh J<sup>1</sup>, Mutic S<sup>1</sup>.

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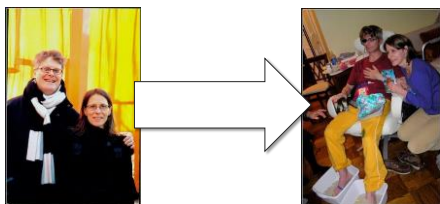
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<http://www.nytimes.com/2010/01/24/health/24radiation.html?hp-y>

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### Complex Systems

- Entities with several types of parts
  - Diverse, interdependent, connected, and adapting
- Characteristics of complex systems
  - Emergent properties
  - Capable of novel functions
  - Robustness
  - Unpredictable
  - Subject to large events




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### A Complex (Sociotechnical) System

- Radiotherapy



Unpredictable Large Event




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### Accidents and Safety

- Most errors reflect predictable human or process failings in the context of poorly designed systems
  - Accidents are not just a failure of equipment or process step
- Safety is an emergent property of a complex system
  - Safety is not a component that can be optimized or layered in
  - Hardware, software, or process can't be deemed as 'safe'

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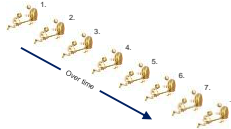
### Quality and Safety

Episodic-based



Is it correct, did I do it correctly?  
Each case is a go/no-go decision.

Process-based



Are people and equipment doing it right?  
How is the process performing?

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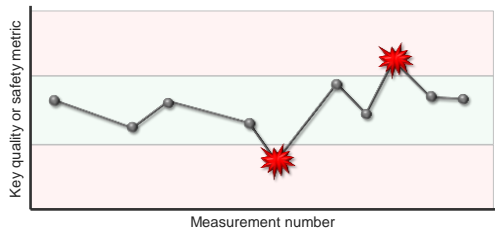
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### Statistics-Based Decision Strategy



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### EPID QA Enables System-Wide Learning

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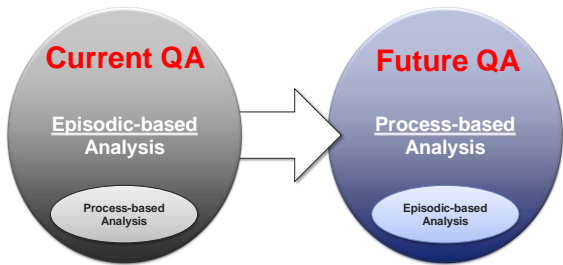
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### Summary

- EPID-based QA will change our QA paradigm
  - Automated data collection and analysis
- Focus will be on process analysis, not data collection
- Time for more impactful activities

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