RADIATION DOSE TRACKING
FROM A QUALITY IMPROVEMENT PERSPECTIVE

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Outline

- Background
- Reasons for dose tracking
- Critical analysis
- Alternatives

Shared objective:

Radiation protection
I.e., Provide needed information using radiation doses that are as low as reasonably achievable (ALARA).

Question at Hand

Question:

Should longitudinal patient-specific dose tracking systems be broadly established?

Position of the ACR Quality and Safety Commission:

No, for a number of reasons:

- Provides no benefit (individual or population)
- May cause harm
- Imposes significant expense

Critical Question to Determine Appropriateness

“How will the information from this exam change the clinical management?”

QI Perspective:

The only purpose of looking backwards is to improve care going forward.

Theory of improvement:

Theoretical **causal relationship** between **specified interventions** and a **desired outcome**.

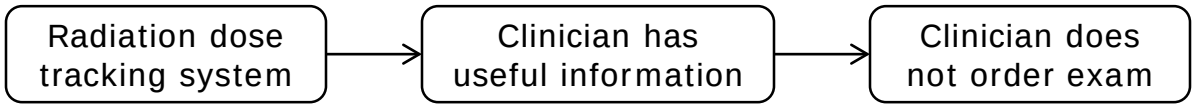
Theory of improvement for dose tracking:

"Tracking of radiological procedures of an individual patient is useful for individual patient protection as it provides clinical information that can avoid performing another radiological examination for that patient."

Specified intervention: Dose tracking system

Desired outcome: Not stated. Implied desired outcome: Decreased inappropriate dose

Causal relationship between intervention and outcome:



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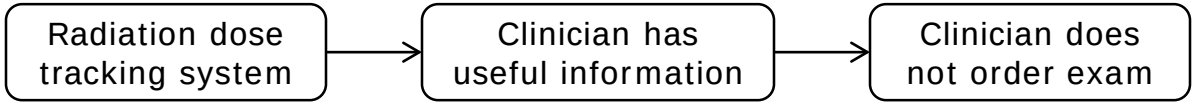

Assumption:

- Radiation dose tracking system provides *useful clinical information*
  - *Useful clinical information?* Prior exam is available for review
    - Analysis: Usefulness is in the prior exam, not knowledge of radiation dose
    - For almost any clinical question, the benefit outweighs the dose
  - *Useful clinical information?* Patient has already received high radiation doses
    - Analysis: Sunk cost fallacy
    - Would be inappropriate for the clinician to not order the exam
    - In fact, those who have received many prior studies generally have *greater* need for the next study

Other Reasons Cited for Radiation Dose Tracking

- **CT radiation exposure adds incrementally to baseline cancer risks in populations; we should therefore monitor radiation dose**
  - Longitudinal, patient-specific radiation dose tracking is not an effective strategy for minimizing unnecessary radiation exposure
    - Cumulative, population doses are the aggregate of microdecisions
    - To solve the problem, attack the problem directly:
      - Institutional protocol management and exam appropriateness
    - Focus on minimal dose to answer the clinical question (especially image quality)

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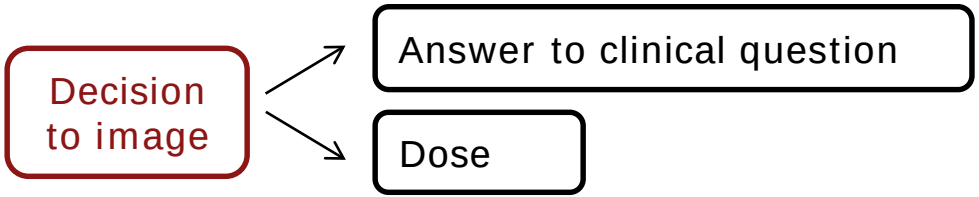
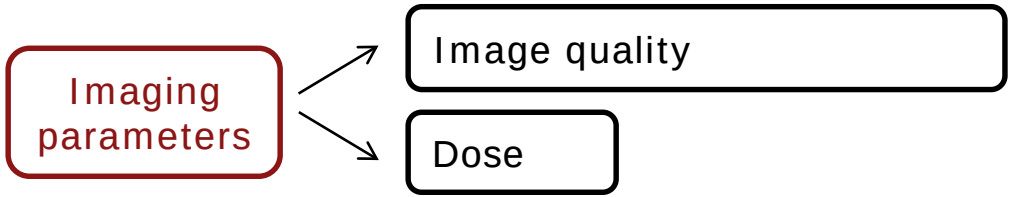
Strategies for Minimizing Unnecessary Dose

- Two elements:
  - Use imaging when appropriate (justification)



  - Use the optimal radiation dose (optimization)



- Focus on locus of control: practice/institution

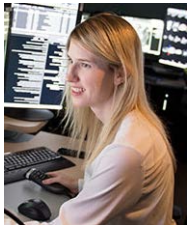
Appropriateness of Imaging

- Strategies to address appropriateness:
  - Peer-reviewed literature
  - Evidence-based appropriateness criteria
  - Clinical decision support in ordering workflow
  - Awareness campaigns (Image Gently / Image Wisely)
  - Local QI initiatives
  - Consultations between radiologists and ordering providers
  - Minimizing conflicting incentives
  - Make prior imaging easily available

image gently®

IMAGE WISELY®
Radiation Safety in Adult Medical Imaging

2021 ACR Appropriateness Criteria®



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Optimal Radiation Doses

AJR FOCUS ON:

Toward Large-Scale Process Control to Enable Consistent CT Radiation Dose Optimization

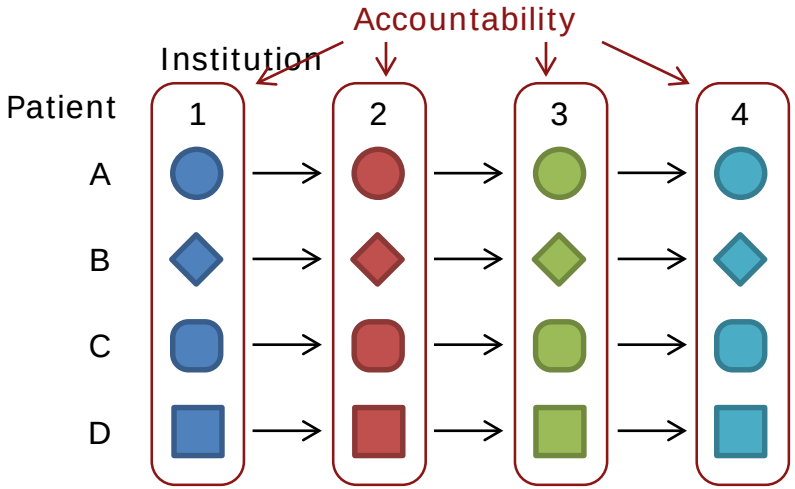
David B. Larson[1]
Keith J. Strauss[2]
Daniel J. Podberesky[3]

OBJECTIVE. This article reviews the concepts of CT radiation dose optimization and process control, discusses how to achieve optimization and how to verify that it is consistently accomplished, and proposes strategies to move toward large-scale application.
CONCLUSION. CT dose optimization is achieved when the least amount of radiation necessary is used to achieve adequate image quality. The key to consistent optimization is minimization of unnecessary variation. This minimization is accomplished through local process control mechanisms.

Optimal radiation dose:

Minimum radiation exposure to provide the needed information

- Strategies for dose optimization:
  - Local sites establish image quality targets with minimal dose
  - Hold local sites accountable for minimizing unnecessary variation
  - Require manufacturers to publish their dose control algorithms
- Note: Optimizing radiation dose happens at the practice/institutional level



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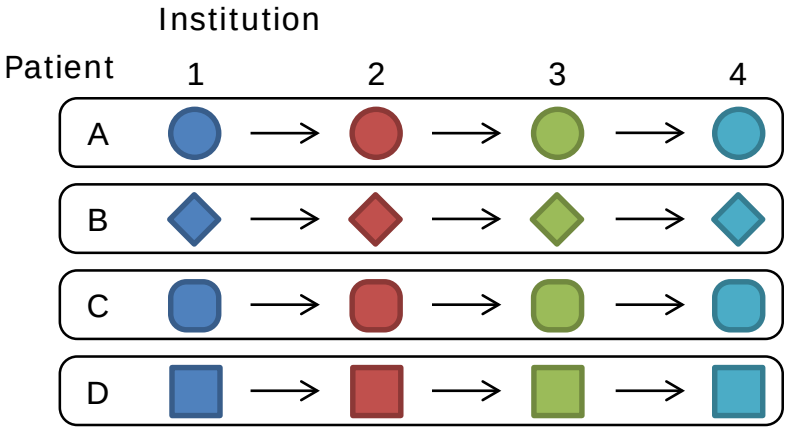

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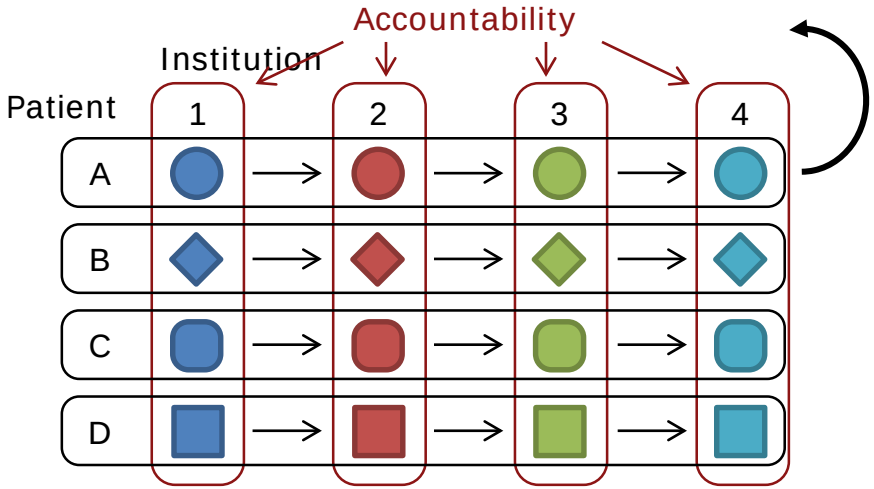


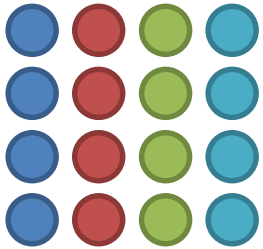
Size and Complexity of Patient-Specific Dose Tracking

- Efforts needed to implement at the macro level
  - Common definitions
  - Dose measurement standards
  - Automated dose assessment tools
  - Local data repositories
  - Updatable sharable or central data repositories
  - Universal identifiers
  - Privacy protection
  - Real-time data visualization applications
- Burden on local sites
- Expensive infrastructure to build/maintain
- Requires system-wide implementation: Cannot implement piecemeal
- Requires significant political will

Problem of Scale

Institutions

Patients



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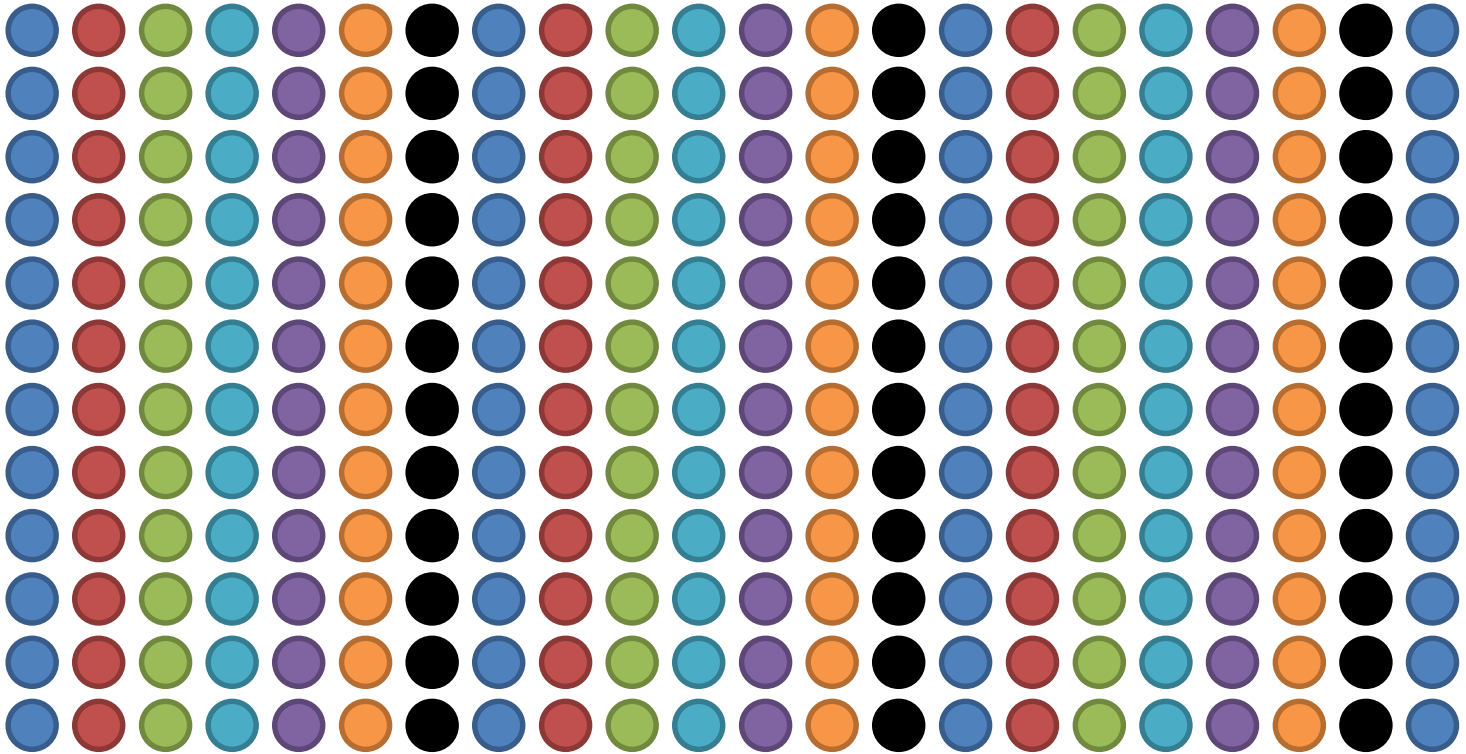

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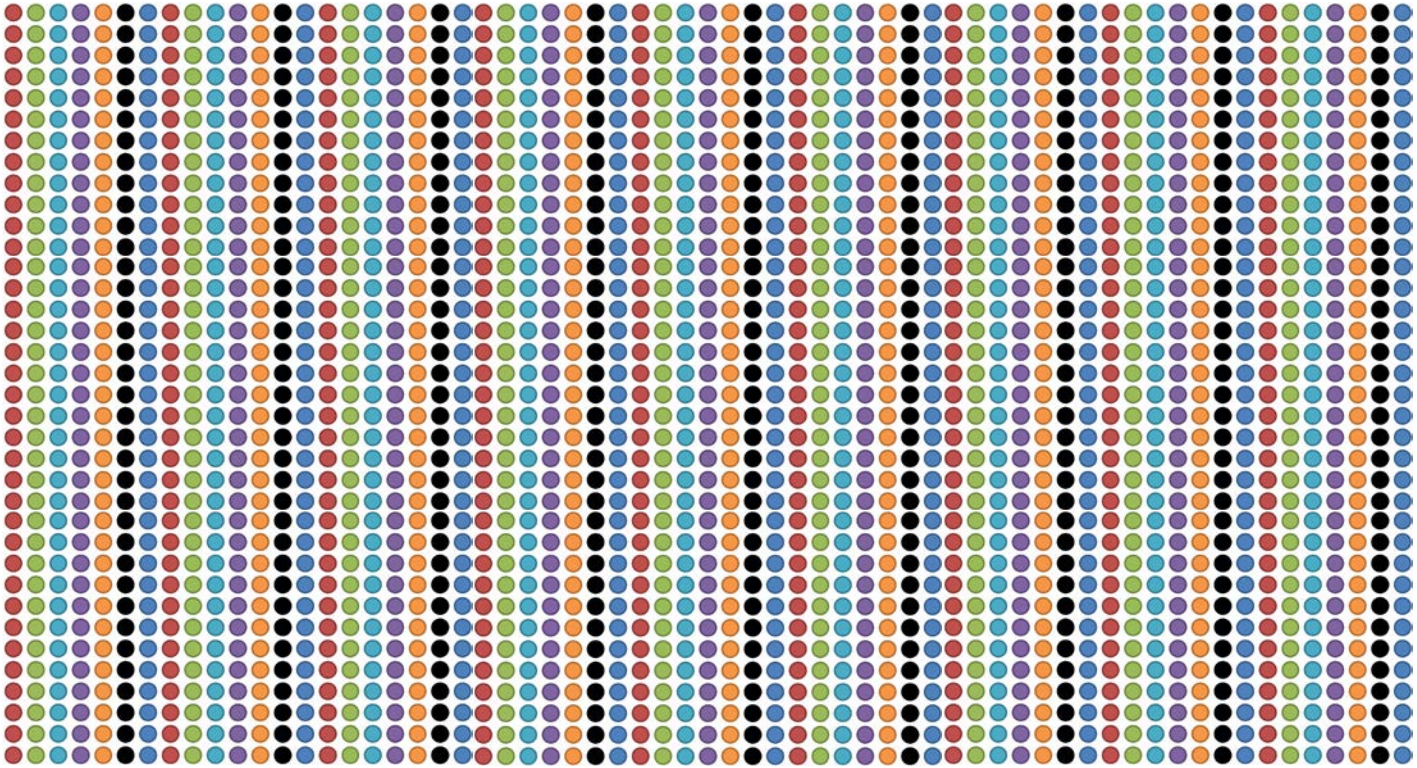

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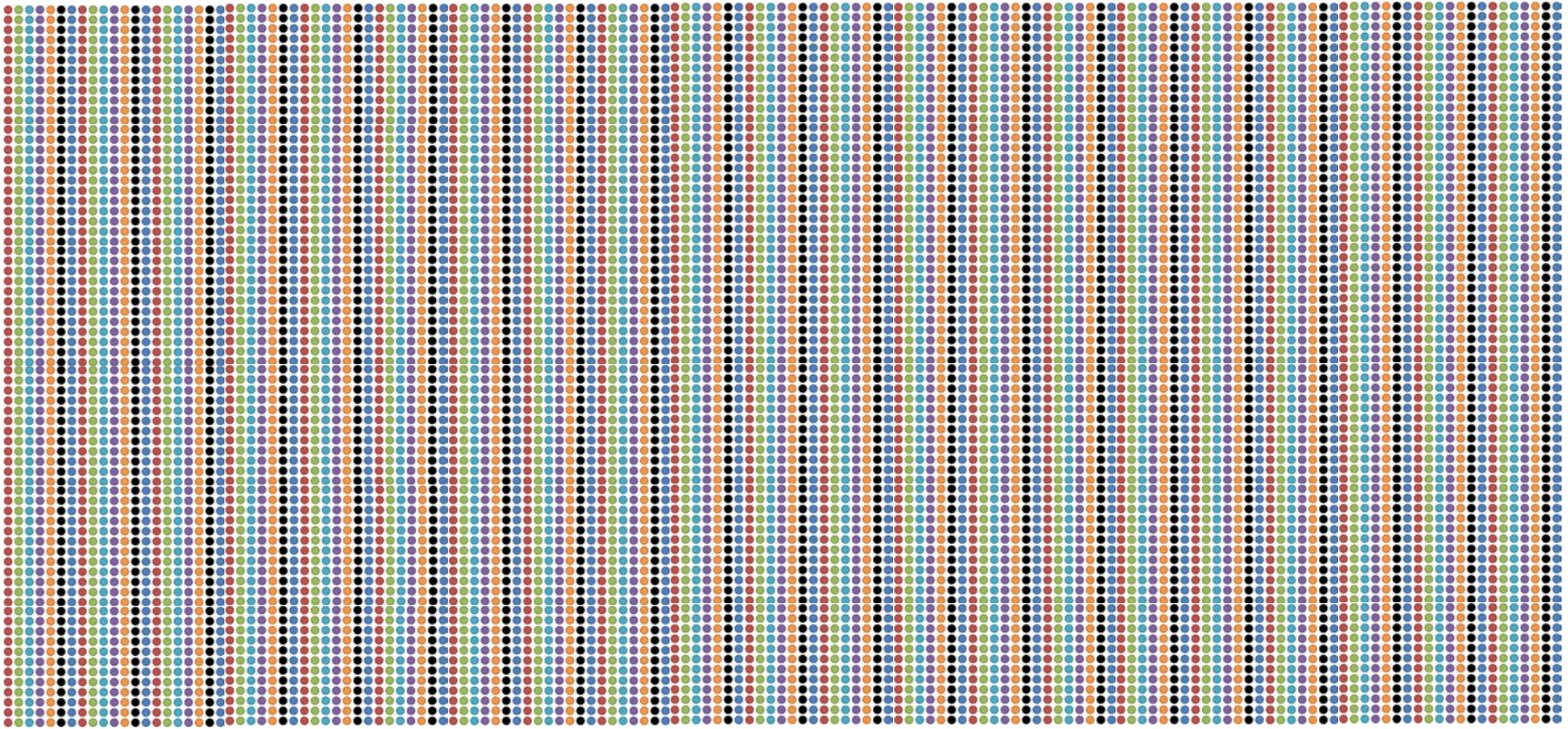

Summary

Problems with longitudinal patient-specific radiation dose tracking:

1. It has no significant benefit, either in theory or in practice
2. It can cause confusion, undue concern, and encourage inappropriate behavior
3. It imposes unnecessary local expense and burden, requires expensive infrastructure
4. Any benefit is indirect and incidental
5. It distracts from real problems, real solutions

Where to focus efforts instead:

1. Image exchange between institutions (prior exams)
2. Site-level dose optimization and consistency
3. Continued focus on imaging appropriateness
4. Manufacturers should be required to publish dose-controlling algorithms

Critical Question to Determine Appropriateness

“How will the information from this exam change the clinical management?”

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NATIONAL ACADEMY of MEDICINE

Tracking Radiation Exposures from Medical Diagnostic Procedures

GILBERT W. BEEBE WEBINAR SERIES

December 14, 2021, 10 AM – 12 PM (ET)

The use of medical diagnostic procedures has benefited the care of most patients. However, it is accompanied by growing concerns about the risks associated with diagnostic computed tomography (CT), fluoroscopy, and nuclear medicine imaging exams that utilize ionizing radiation. A number of initiatives in radiation safety in medicine aim to provide higher quality clinical management of patients and to ensure that reasonable steps are taken to keep the exposures as low as possible without compromising diagnostic efficacy. The idea of tracking radiation exposures from medical diagnostic procedures as a means of individual dose monitoring and risk assessment to patients has been debated over the years and more recently national and international

Critical Question to Determine Appropriateness

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