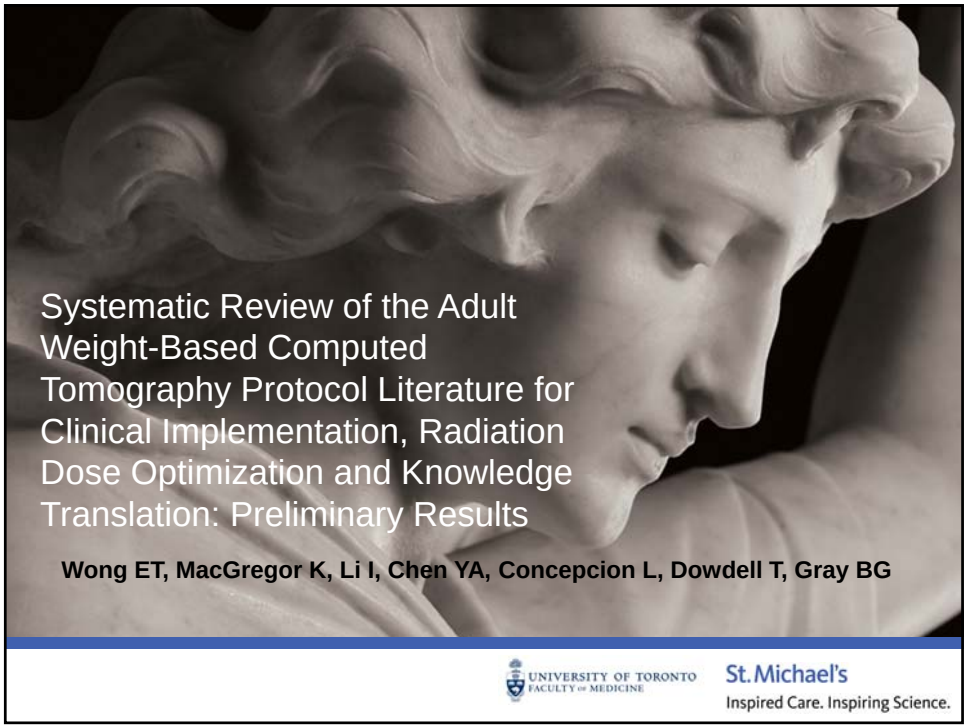




## Our Institutional Experience (1 of 2)

In 2015, we performed an institutional review of our radiation dose index statistical distribution which demonstrated the need to optimize our CT body (chest, abdomen, pelvis) protocols based on patient size.

A subsequent “scoping” search of the adult weight-based CT protocol (WBP) literature returned many studies which demonstrated effective radiation dose reduction with WBPs.

However, very few studies identified could be defined as quality improvement (QI), in which the local contextual elements and processes associated with implementation of the WBPs were described.

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## Our Institutional Experience (2 of 2)

Therefore, we decided to perform a systematic review of the adult WBP medical literature to examine the availability of QI studies as defined by Baily et al. in their 2006 Hastings Center report:

"Systematic, data-guided activities designed to bring about immediate, positive changes in the delivery of health care…"
Hastings Cent Rep 2006;36:S1-S40.

This definition was also used by Larson et al. in *Guide to Effective Quality Improvement Reporting in Radiology.*
Radiology 2014;271:561-73.



Systematic Review of the Adult Weight-Based Computed Tomography Protocol Literature for Clinical Implementation, Radiation Dose Optimization and Knowledge Translation

## Recent Guidelines

The American Association of Physicists in Medicine (AAPM) CT Protocol Management and Review Practice Guidelines published in 2013 states that:

*"…acquisition parameters [for CT] should be adjusted for patient size."*

The AAPM also developed weight-based reference CT dose index values for common CT protocols; these are available for small (50-70 kg), average (70-90 kg) and large (90-120 kg) patients.

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## Recent Guidelines

The Joint Commission recently implemented diagnostic imaging requirements for accredited providers which include adoption of:

*"…diagnostic CT imaging protocols based on current standards of practice, which address key criteria including…patient size and body habitus, and the expected radiation dose index range."*



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## Advanced CT Dose Reduction Techniques

Common methods available

- Automatic exposure control
- Iterative reconstruction techniques
- Manual size-based adjustment of acquisition parameters such as tube voltage (kV) and tube current (mA)
- And now, automatic tube voltage selection

Image from www.auntminnie.com

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Image from www.auntminnie.com



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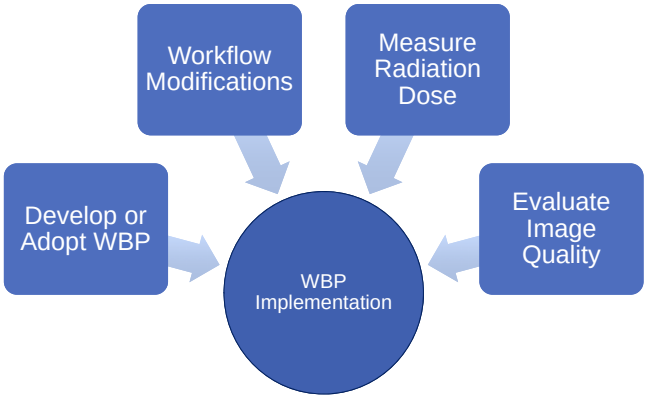
## WBP Implementation as Quality Improvement

The process of WBP implementation is complex and requires several steps.




**Slide 8**

**MK(M4** Like this diagram very much, save for paper.
Marie Kathleen (Kate) MacGregor, 10/25/2016

Systematic Review of the Adult Weight-Based Computed Tomography Protocol Literature for Clinical Implementation, Radiation Dose Optimization and Knowledge Translation

## Objective

To review the adult WBP literature and identify QI studies that could guide implementation of these CT protocols into clinical practice for the optimization of radiation dose.

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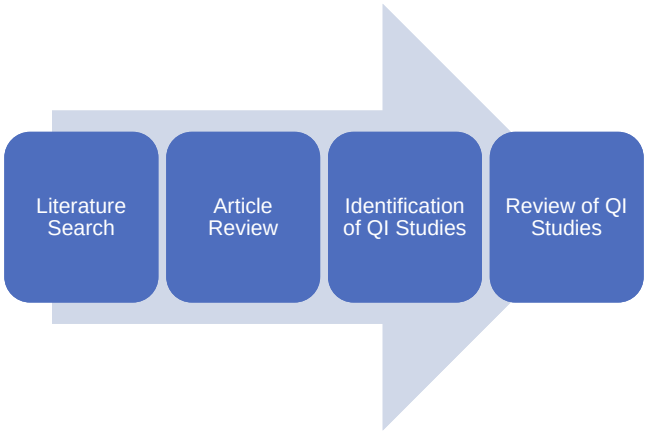
## Methods

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## Search Strategy

- Identified key words from selected sample articles on adult WBPs with radiation dose metric outcomes
- Performed "scoping review" of PubMed database
- Systematic search of EBM, EMBASE, Medline/OVID, PubMed, Scopus and Web of Science databases with library Information Specialist
- "Handsearch" of websites and "snowball search" of references from included studies.

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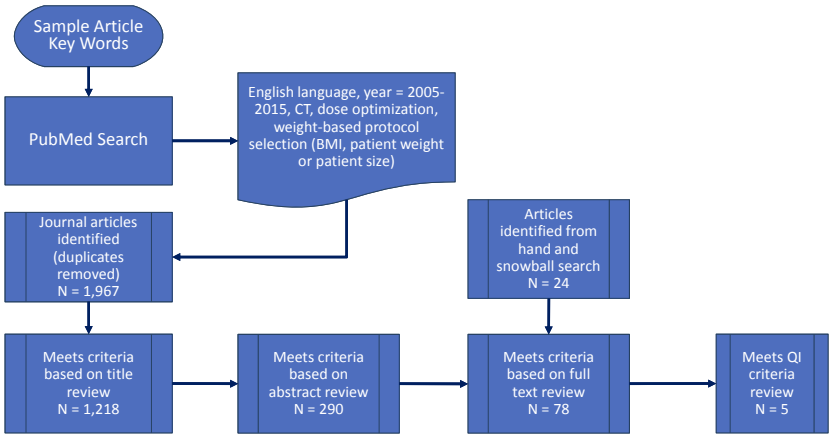
## Search Results




Please note that numbers are preliminary.

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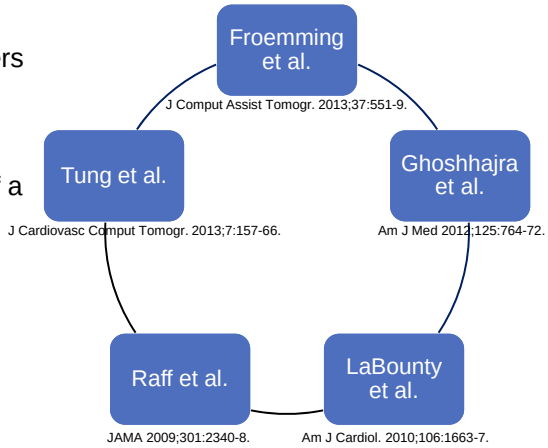
## Identification of Quality Improvement Studies

Three radiologist reviewers (ETW, AC, BGG) determined whether the previously screened articles met the criteria of a QI study as defined by Baily et al.

Of the 78 articles which met search criteria, 5 (6.4%) were identified as QI studies.








## Review of the Quality Improvement Studies

Our goal was to assess whether the selected QI studies contained sufficient information to guide effective implementation of the described intervention.

Checklists were developed from the SQUIRE 2.0 guidelines and the *Guide to Effective Quality Improvement Reporting in Radiology* published by Larson et al.

The QI studies were scored “yes” or “no” for each checklist point by the three reviewers independently and differences were resolved by consensus.

## SQUIRE 2.0 Guidelines

The Revised Standards for Quality Improvement Reporting Excellence guidelines are a reporting framework for systems-level work aimed at improving quality, safety and value in healthcare.

Sample from the checklist derived from the SQUIRE 2.0 guidelines.


Squire 2

Article Reviewer Name

Title

1. Indicates that the manuscript concerns an initiative to improve healthcare (broadly defined to include the quality, safety, effectiveness, patient-centeredness, timeliness, cost, efficiency, and equity of healthcare) Yes No If N/A, why:

Abstract

2. Provides adequate information to aid searching and indexing Yes No If N/A, why:
3. Summarizes all key information from various sections of the text using the abstract format of the intended publication or a structured summary such as: background, local problem, methods, interventions, results, conclusions Yes No If N/A, why:

Introduction — Problem Description

4. Describes nature and significance of the local problem Yes No If N/A, why:

Available Knowledge

5. Summarizes what is currently known about the problem, including relevant previous studies Yes No If N/A, why:

Rationale

6. Describes informal or formal frameworks, models, concepts, and/or theories used to explain the problem, any reasons or assumptions that were used to develop the intervention(s), and reasons why the intervention(s) was expected to work Yes No If N/A, why:

Specific Aims

7. Describes purpose of the project and of this report Yes No If N/A, why:

Methods — Context

8. Describes contextual elements considered important at the outset of introducing the intervention(s) Yes No If N/A, why:

Intervention

9. Describes the intervention(s) in sufficient detail that others could reproduce it Yes No If N/A, why:
10. Describes specifics of the team involved in the work Yes No If N/A, why:

Study of Intervention

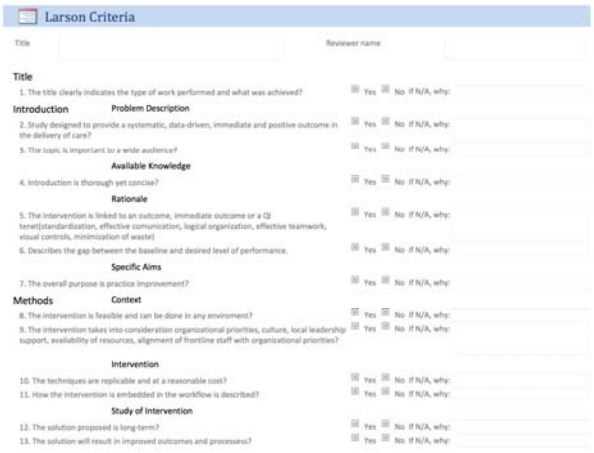




## *Guide to Effective Quality Improvement Reporting in Radiology*

Sample from the checklist derived from Larson et al.

Radiology 2014;271:561-73.


Larson Criteria

Title Reviewer name

Title

1. The title clearly indicates the type of work performed and what was achieved? Yes No If N/A, why:

Introduction — Problem Description

2. Study designed to provide a systematic, data-driven, immediate and positive outcome in the delivery of care? Yes No If N/A, why:
3. The topic is important to a wide audience? Yes No If N/A, why:

Available Knowledge

4. Introduction is thorough yet concise? Yes No If N/A, why:

Rationale

5. The intervention is linked to an outcome, immediate outcome or a QI tenet(standardization, effective comunication, logical organization, effective teamwork, visual controls, minimization of waste) Yes No If N/A, why:
6. Describes the gap between the baseline and desired level of performance. Yes No If N/A, why:

Specific Aims

7. The overall purpose is practice improvement? Yes No If N/A, why:

Methods — Context

8. The intervention is feasible and can be done in any environment? Yes No If N/A, why:
9. The intervention takes into consideration organizational priorities, culture, local leadership support, availability of resources, alignment of frontline staff with organizational priorities? Yes No If N/A, why:

Intervention

10. The techniques are replicable and at a reasonable cost? Yes No If N/A, why:
11. How the intervention is embedded in the workflow is described? Yes No If N/A, why:

Study of Intervention

12. The solution proposed is long-term? Yes No If N/A, why:
13. The solution will result in improved outcomes and processes? Yes No If N/A, why:

## Review of the quality improvement studies with the SQUIRE 2.0 guidelines and criteria adopted from Larson et al.

Quality Improvement Study Review Criteria

| Domains | Froemming[39] | | Ghoshhajra[52] | | LaBounty[74] | | Raff[49] | | Tung[75] | | Question numbers from original checklists: Larson | Squire |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Appropriate Methods | 8/8 | 100% | 8/8 | 100% | 8/8 | 100% | 8/8 | 100% | 8/8 | 100% | 16,17,19,22,26 | 11,12,13 |
| Clarity/Style | 5/5 | 100% | 5/5 | 100% | 5/5 | 100% | 5/5 | 100% | 5/5 | 100% | 1,4 | 2,3,7 |
| Contextual Elements | 1/6 | 17% | 3/6 | 50% | 1/6 | 17% | 6/6 | 100% | 0/6 | 0% | 9,20,25 | 8,14,21 |
| Cost | 0/2 | 0% | 1/2 | 50% | 1/2 | 50% | 2/2 | 100% | 0/2 | 0% | | 31,40 |
| Details for Replication | 5/7 | 71% | 7/7 | 100% | 5/7 | 71% | 7/7 | 100% | 5/7 | 71% | | 9,10,15, 16,17,19, 20 |
| Feasible intervention | 4/5 | 80% | 5/5 | 100% | 4/5 | 80% | 5/5 | 100% | 3/5 | 60% | 8,10,12, 15,27 | |
| Impact of Findings | 2/6 | 33% | 5/6 | 83% | 5/6 | 83% | 6/6 | 100% | 3/6 | 50% | | 25,29,35, 37,38,39 |
| Improvement | 3/4 | 75% | 3/4 | 75% | 4/4 | 100% | 4/4 | 100% | 3/4 | 75% | 6,13,14, 24 | |
| Limitations | 3/5 | 60% | 5/5 | 100% | 3/5 | 60% | 5/5 | 100% | 3/5 | 60% | | 18,24,32, 33,34 |
| Problem | 3/4 | 75% | 4/4 | 100% | 3/4 | 75% | 4/4 | 100% | 4/4 | 100% | | 1,4,5,6 |
| QI Outcome | 5/11 | 45% | 8/11 | 73% | 8/11 | 73% | 11/11 | 100% | 11/11 | 100% | 2,3,5,7 | 22,23,26, 27,28,30,36 |
| QI Tools | 0/2 | 0% | 2/2 | 100% | 0/2 | 0% | 2/2 | 100% | 1/2 | 50% | 18,21 | |
| Workflow | 0/2 | 0% | 2/2 | 100% | 0/2 | 0% | 2/2 | 100% | 1/2 | 50% | 11,23 | |
| Total | 39/ 67 | 58% | 58/ 67 | 87% | 47/67 | 70% | 67/67 | 100% | 47/67 | 70% | Total questions=27 | Total questions=40 |

We found that only one study (Raff et al.) met 100% of the criteria. The others scores ranged from 58% to 87%, which suggests that there may be insufficient information contained in these articles for replication and implementation into clinical practice.

The vast majority of studies did not include intervention cost, QI tools used or workflow modifications required.

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Quality Improvement Study Review Criteria

| Domains | Froemming[39] | | Ghoshhajra[52] | | LaBounty[74] | | Raff[49] | | Tung[75] | | Question numbers from original checklists: Larson | Squire |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Appropriate Methods | 8/8 | 100% | 8/8 | 100% | 8/8 | 100% | 8/8 | 100% | 8/8 | 100% | 16,17,19,22,26 | 11,12,13 |
| Clarity/Style | 5/5 | 100% | 5/5 | 100% | 5/5 | 100% | 5/5 | 100% | 5/5 | 100% | 1,4 | 2,3,7 |
| Contextual Elements | 1/6 | 17% | 3/6 | 50% | 1/6 | 17% | 6/6 | 100% | 0/6 | 0% | 9,20,25 | 8,14,21 |
| Cost | 0/2 | 0% | 1/2 | 50% | 1/2 | 50% | 2/2 | 100% | 0/2 | 0% | | 31,40 |
| Details for Replication | 5/7 | 71% | 7/7 | 100% | 5/7 | 71% | 7/7 | 100% | 5/7 | 71% | | 9,10,15, 16,17,19, 20 |
| Feasible intervention | 4/5 | 80% | 5/5 | 100% | 4/5 | 80% | 5/5 | 100% | 3/5 | 60% | 8,10,12, 15,27 | |
| Impact of Findings | 2/6 | 33% | 5/6 | 83% | 5/6 | 83% | 6/6 | 100% | 3/6 | 50% | | 25,29,35, 37,38,39 |
| Improvement | 3/4 | 75% | 3/4 | 75% | 4/4 | 100% | 4/4 | 100% | 3/4 | 75% | 6,13,14, 24 | |
| Limitations | 3/5 | 60% | 5/5 | 100% | 3/5 | 60% | 5/5 | 100% | 3/5 | 60% | | 18,24,32, 33,34 |
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| QI Outcome | 5/11 | 45% | 8/11 | 73% | 8/11 | 73% | 11/11 | 100% | 11/11 | 100% | 2,3,5,7 | 22,23,26, 27,28,30,36 |
| QI Tools | 0/2 | 0% | 2/2 | 100% | 0/2 | 0% | 2/2 | 100% | 1/2 | 50% | 18,21 | |
| Workflow | 0/2 | 0% | 2/2 | 100% | 0/2 | 0% | 2/2 | 100% | 1/2 | 50% | 11,23 | |
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## Conclusions

There are very few articles in the radiology literature on adult WBP implementation that qualified as QI studies.

The majority of the articles identified as QI studies may lack the information necessary to replicate and implement the described WBPs.

We suggest that QI studies on WBPs include more information about the local context of implementation successes (or failures), associated costs, necessary workflow modifications and QI tools such as measurement/evaluation strategies.

If standards and guidelines require QI in areas of CT radiation dose management, then high-quality QI studies need to be encouraged through the scientific peer-review process.



Systematic Review of the Adult Weight-Based Computed Tomography Protocol Literature for Clinical Implementation, Radiation Dose Optimization and Knowledge Translation

## Limitations

We did not search the “grey literature” to identify WBPs or relevant QI methodologies. Therefore, certain WBPs such as those of the AAPM are not included.

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Data and conclusions are preliminary; this literature search has been extended through the first half of 2016.

Some of the articles we identified as QI studies may not have been written with a specific QI reporting framework in mind. This may explain the absence of certain information that should be included in QI studies.

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**Slide 20**

**MK(M6** Not sure what you are trying to say here.
Marie Kathleen (Kate) MacGregor, 10/25/2016

## Disclosures

No conflicts of interest to disclose.



Systematic Review of the Adult Weight-Based Computed Tomography Protocol Literature for Clinical Implementation, Radiation Dose Optimization and Knowledge Translation

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