QUALITY IMPROVEMENT ON A GLOBAL LEVEL- HOW CAN THIS TASK BE ACCOMPLISHED?

Marilyn J. Goske MD
Chair, Alliance for Radiation Safety in Pediatric Imaging
Corning Benton Endowed Chair for Radiology Education
Professor of Radiology
Cincinnati Children's Hospital Medical Center

- Quality Improvement on a global level- how can this task be accomplished?
- The purpose of this talk is to review successful strategies that have promoted large scale quality improvement. While there is an increasing body of work that discussed practice quality improvement at a facility level, how can this knowledge be leveraged for quality improvement on a much larger scale in medical physics? This talk will review successful strategies and discuss how these strategies can be applied to the medical physicist community for the purpose of optimizing radiation dose and improving care of children worldwide

Goal

- At the end of the talk, the participant will understand strategies to improve quality in radiology practice and how this can be applied to the world community

Objectives

- Review an example of large scale quality improvement
- Define the steps of the PQI cycle
- Discuss the QMP role as part of team
- Provide example of PQI at a local and international level
- Use of Image Gently resources for PQI

Objectives

- Review an example of large scale quality improvement
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The Small Book About Large System Change

Sir John Oldham

Foreword by
Dr. Donald M Berwick

Caspian Sea
North Atlantic Ocean
Londinium
Black Sea
Trapezius
Byzantium
Rome
Thessalonika
Athens
Antioch
Carthage
Mediterranean Sea
Jerusalem
Cyrene
Alexandria
Tripoli
Thebes
Red Sea
Roman Empire
0 250 500 Miles

Actions to achieve large system improvement
Roman Empire 100 AD

- Systematic transfer of knowledge
- Creation of an environment that facilitated the uptake of ideas
- Unified policy framework and infrastructure for spread –adapted locally
- Create an army to spread change

What is the justification for practice quality improvement ?

Why do we care about Practice Quality Improvement (PQI) ?

- In 1999, the Institute of Medicine (IOM), a scientific advisory group, issued a report called *To Err is Human: Building a Safe Health System**

- It stated that medical error was a significant cause of morbidity and mortality in the Unites States (US)

- Medical error is a more common cause of death in the U.S. than breast cancer or motor vehicle accidents!

It is estimated that up to 98,000 U.S. citizens die each year from medical error.

*Corrigan JM, Kohn LT, Donalsons, MS, eds. *To Err is Huma*
Building a Safe Health System, Institute of Medicine

Quality and safety in radiology

" First, do no harm"

After the Hippocratic oath

Medical error in radiology

THE RADIATION BOOM

After Stroke Scans, Patients Face Serious Health Risks

By WALT BOGDANICH
Published: July 31, 2010

When Alain Reyes's hair suddenly fell out in a freakish band circling his head, he was not the only one worried about his health. His co-workers at a shipping

New York Times July 31, 2010

Medical error in radiology

Oct 30, 2008 9:19 pm US/Pacific

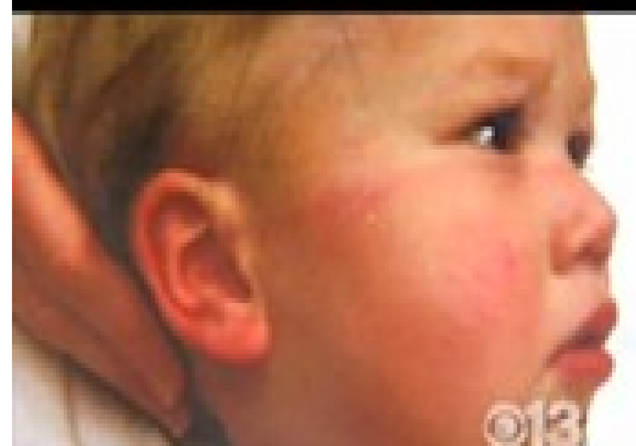
CBS13 Investigates: Radiation Overexposure

Radiation Overexposure Involving A 2-Year-Old Child

Reporting
Sam Shane

ARCATA (CBS13) — Inside the tiny frame of two-year-old Jacoby Roth no one really knows for sure what's going on.

"I just want him to be ok," says Carrie Roth, Jacoby's mother.



But Jacoby's mother Carrie, and his father Padre and Jacoby himself may very well live the rest of their lives not knowing.

The New York Times

X-Rays and Unshielded Infants

Piotr Redlinski for The New York Times

"I was mortified. Full, unabashed, total irradiation of a neonate. This poor, defenseless baby." Dr. Salvatore J. A. Sclafani, left, Chief of Radiology, SUNY Downstate Medical Center

By WALT BOGDANICH and KRISTINA REBELO
Published: February 27, 2011

It was well after midnight when Dr. Salvatore J. A. Sclafani finally hit the "send" button.

Soon, colleagues would awake to his e-mail, expressing his anguish and shame over the discovery that the tiniest, most vulnerable of all patients — premature babies — had been over-radiated in the department he ran at State University of New York Downstate Medical Center in Brooklyn.

A day earlier, Dr. Sclafani noticed that a newborn had been irradiated from head to toe — with no gonadal shielding — even though only a simple chest X-ray had been ordered.

The Radiation Boom

Articles in this series are examining issues arising from the increasing use of medical radiation and the new technologies that deliver it.

Previous Articles in the Series »

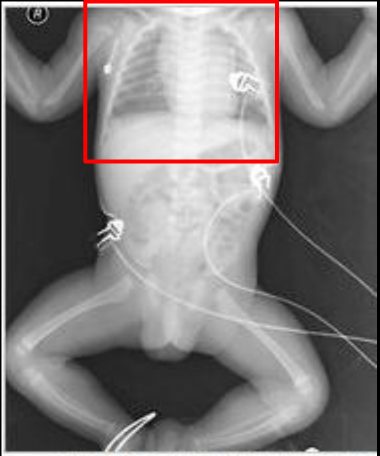
Multimedia

on of a neonate! Every film,
poor defenseless baby.

to express my dissatisfaction
he blame onto the supervisors
d that includes you and me"

all my residents.....you too.

RECOMMEND
TWITTER
COMMENTS (137)
SIGN IN TO E-MAIL
PRINT
SINGLE PAGE
REPRINTS
SHARE



Reproduced by permission of Springe
Science+Business Media--Forensic Aspects
of Pediatric Fractures: Differentiatin
Accidental Trauma from Child Abuse, by Ro
A. C., Robben, Simon G. F., Rijn, Rick R
1st Edition, 2010, Chapter 8: 171-188, Fig. 3

This reproduction of a "babygram" — a full-body X-ray of an infant — is from an article on detecting child abuse that appeared in a medical journal. Babygrams have long been out of favor because of radiation dangers; the article describes their use as "a serious flaw." At SUNY Downstate Medical Center in Brooklyn, technologists took babygrams of premature infants even though only chest X-rays had been ordered. The State Health Department is now investigating.

February 28, 2011

Goals of PQI

- Improve quality of care for patients
- Reduce error
- Minimize medical legal risk
- Save money

Objectives

- Review an example of large scale quality improvement
- Define the steps of the PQI cycle
- Discuss the QMP role as part of team
- Provide example of PQI at a local and international level
- Use of Image Gently resources for PQI

What is Practice Quality Improvement?

"*Ongoing, organization-wide framework to monitor all aspects of an organization's activities for the purpose of continuous improvement.*"

Applegate KE. Continuous Quality Improvement for Radiologists

Acad Radiol 2004;11:155-161

The American College of Radiology summarizes PQI as:

PQI is a path to establish best practices, determine variations in practice, and standardize these practices to minimize error

Hillman BJ, Amis ES, Neiman HL, et al. The future quality and safety of medical imaging: proceedings of the Third Annual ACR Forum. J Am Coll Radiol 2004;1:33-9.

The United Kingdom Health Foundation stresses the following key principles

The dimensions of quality

Safe
Avoiding harm to patients from care that is intended to help them.

Equitable
Providing care that does not vary in quality because of a person's characteristics.

Courtesy of UK Health Foundation:
http://www.health.org.uk/public/cms/75/76/313/594/Quality_improvement_made_simple.pdf
Used with permission

Quality can be difficult to assess in a complex medical system

Break the process into simple steps or *metrics*

- a standard of measurement

- a reference point against which other things can be measured

www.thefreedictionary.com/metric

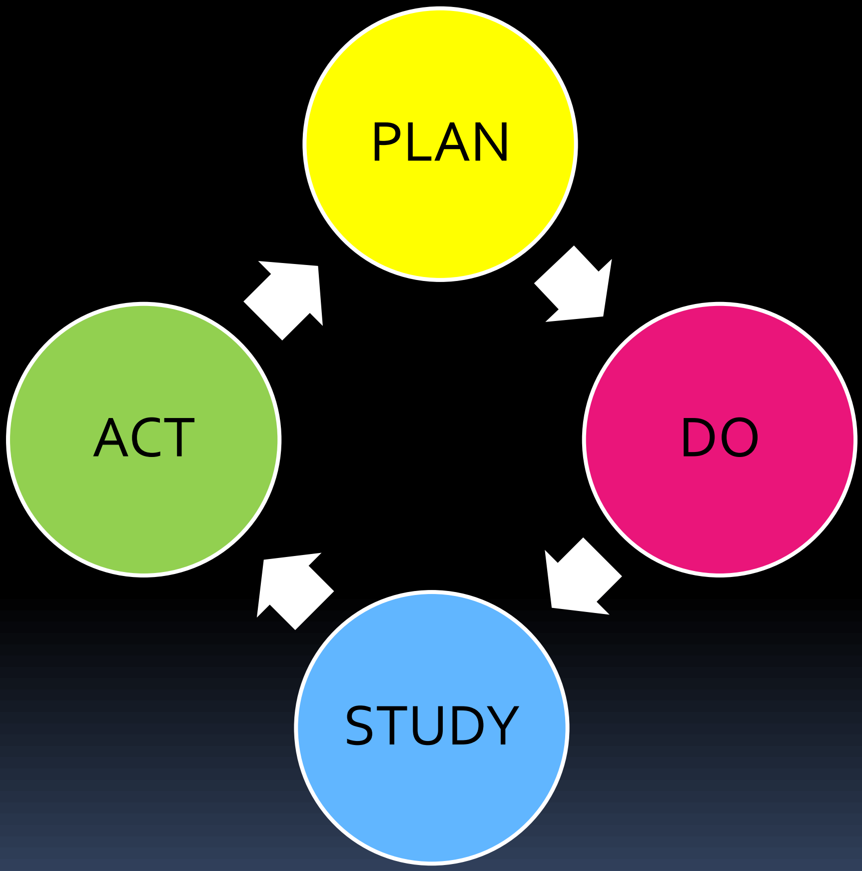
Important components of PQI

- Focus on the patient
- Break down the process into steps
- Understand variation that may lead to error
- Test on a small scale before implementing
- Teamwork

Implementing practice quality improvement

PLAN DO STUDY ACT (PDSA) is an improvement method that includes 4 steps:

1. Plan a test
2. Do the test
3. Study the outcomes of the test
4. Act on knowledge gained from the test



PQI project: Reduce variation

A goal of PQI in pediatric CT is to reduce the variation for CT scans of the same body part for patients of the same body size.

While a facility has protocols for patient of the same age, weight or size (the preferred method), what process is in place to ensure that this happens? Monitoring variation through the use of a chart may be helpful.

PLAN the test
Example:

- Identify a problem: wide variability in image quality in 2008
- Verify problem exists based on data from previous scans
- Create a corrective plan of action
- Establish a goal of 95% compliance

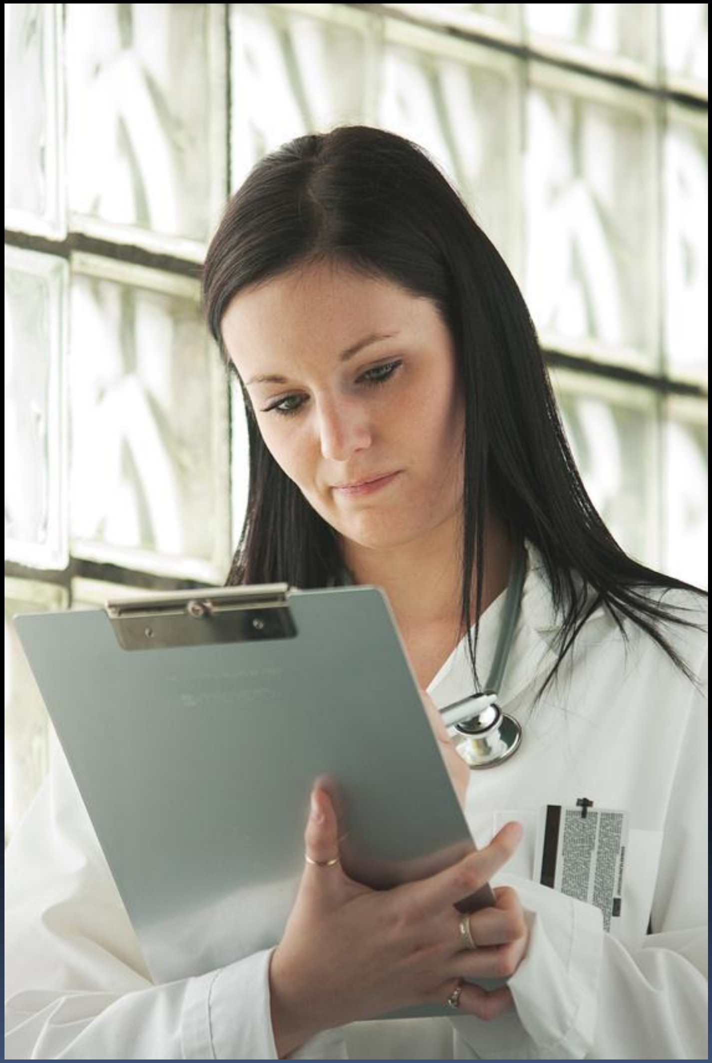
Baseline scan

Follow-up is 2X dose !

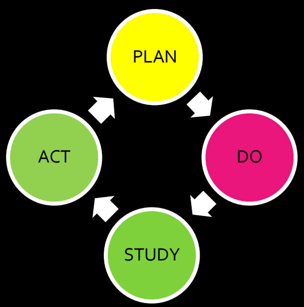
Follow-up a month later

DO the test

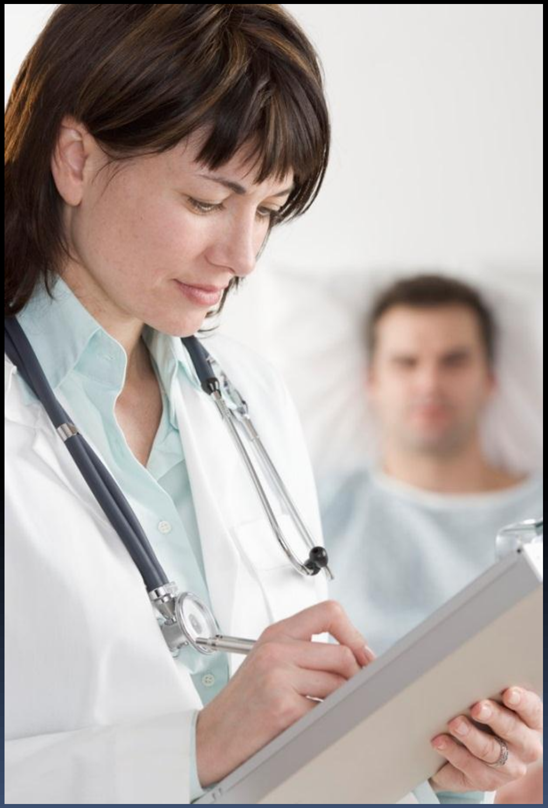
- Developed an intervention to ensure that CT scans are performed reliably and with minimal variation based on patient body size
- Test on small scale
- Re-test on a larger scale



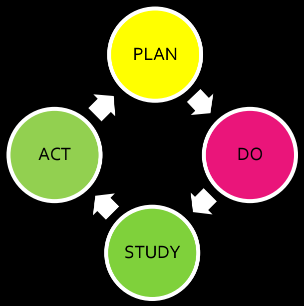
STUDY the test



- Is the subjective image quality the same for a patient of the same size for the same scan indication ?
- What is the variation ?

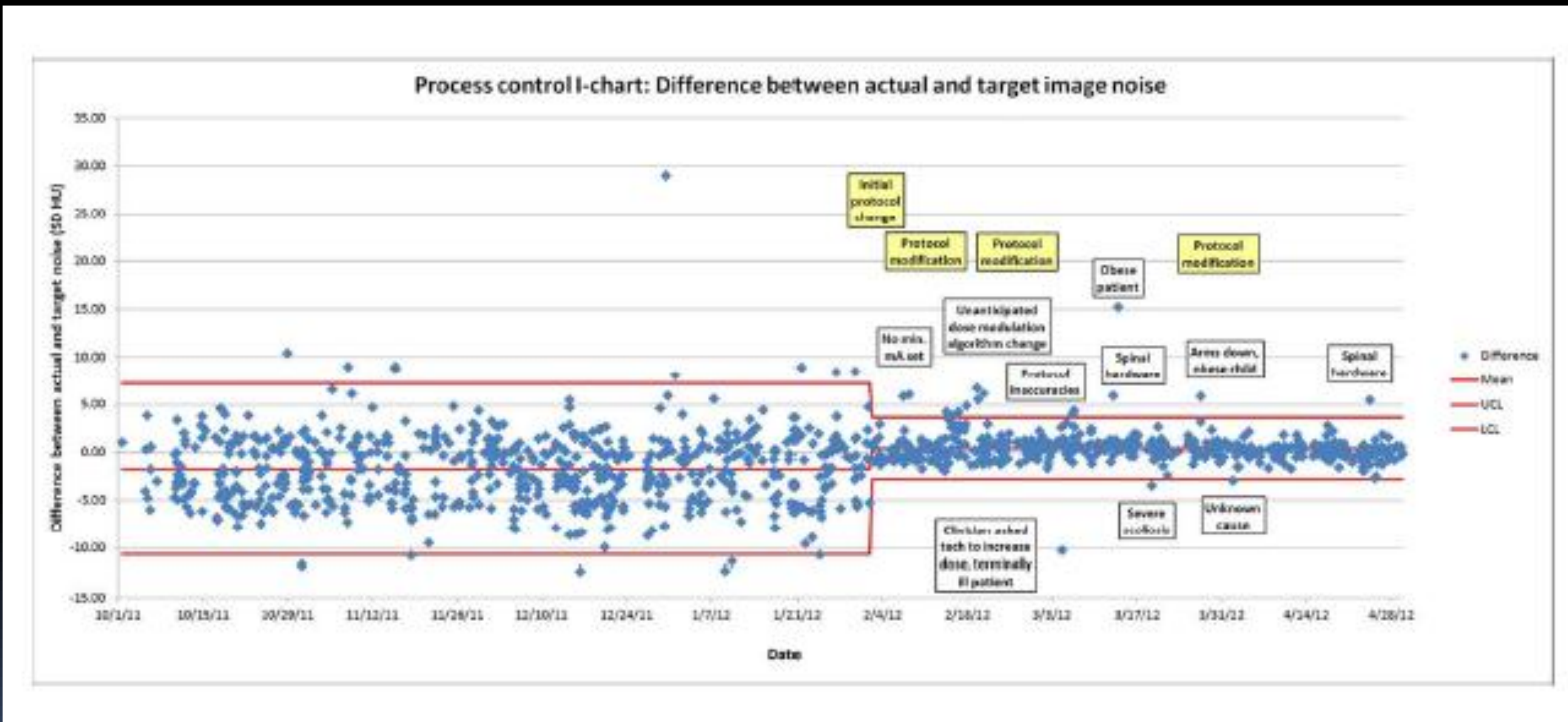


ACT on the results



- Evaluate for best practice best practice
- Check for outliers
- Data collection and feedback continue until 95 % compliance achieved

RESULTS: Reducing variation in image noise



Larson DB et al. System for verifiably optimizing CT radiation dose based on patient size and desired image quality, enabling large-scale quality control. Part 2. Clinical application. Radiology,. Published online before print June 19, 2013,
doi: 10.1148/radiol.13122321.With permission by the authorr.

Objectives

- Review an example of large scale quality improvement
- Define the steps of the PQI cycle
- Discuss the QMP role as part of team
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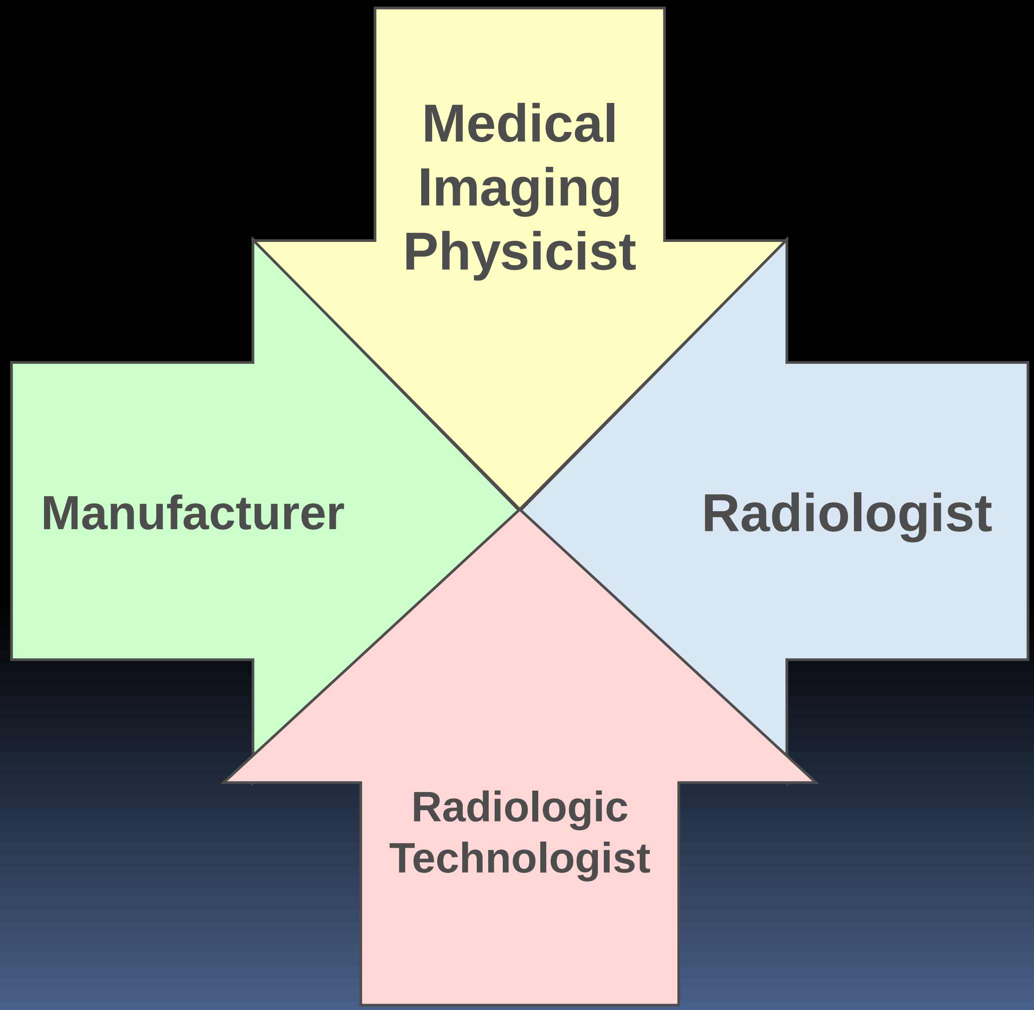
PQI takes team-work



AAPM REPORT NO. 42

THE ROLE OF THE CLINICAL MEDICAL PHYSICIST IN DIAGNOSTIC RADIOLOGY

DESCRIPTION OF THE ROLE OF THE CLINICAL MEDICAL PHYSICIST IN DIAGNOSTIC IMAGING

REPORT OF TASK GROUP 2
PROFESSIONAL INFORMATION AND CLINICAL RELATIONS COMMITTEE

Task Group Members

Joel E. Gray, Ph.D. (Chairman)
Gary T. Barnes, Ph.D.
Michael J. Bronskill, Ph.D.
Mary F. Fox, MS.
G. Donald Frey, Ph.D.
Arthur G. Haus
Mark T. Madsen, Ph.D.
William Pavlicek, Ph.D.
Stanley A. Reed, M.S.
Robert S. Wenstrup, Jr., Ph.D.

Consultants

Richard A. Geise, M.S.
Pei-jan Paul Lin, Ph.D.
Donald D. Tolbert, Ph.D.

This statement follows that entitled "The Role, Responsibilities, and Status of the Clinical Medical Physicist," issued by the AAPM in 1986 [1], and concentrates on the role and relationships of the clinical medical physicist practicing in diagnostic imaging.

January 1994

Responsibilities of the Clinical Medical Physicists

In diagnostic imaging, it is appropriate that the medical physicists participate in the planning for resource allocation for both diagnostic imaging and medical physics. Important contributions should be expected for:

1. Delineation of the Physical Aspects of Diagnostic Imaging Systems

- Specification of new equipment performance;
- Supervision of acceptance testing and performance verification;
- Supervision of calibration, preventive maintenance, repair of equipment and documentation of all relevant information;
- Development and maintenance of a quality management program for all imaging equipment to facilitate the production of images of optimum quality while minimizing radiation doses to patients;
- Responsibility for all instrumentation required for quality control, image quality, and patient exposure measurements;
- Determination of doses from radiological procedures;
- Assurance of the use of good radiological technique by the technologists, e.g., collimation, radiation protection, etc.

Program Information

Medical Physics Practice Quality Improvement Guidelines

M Yester[1]*, (1) UAB Medical Center, Birmingham, AL

SU-C-Salon EF-2 Sunday 1:30:00 PM - 3:30:00 PM Room: Salon EF

Michael Yester

Currently, a common initiative in many fields is quality improvement. This endeavor is especially prominent in the medical community with concerns of patient safety and reduction of medical errors. As part of its certification oversight, the American Board of Medical Specialties (ABMS) has made QI one of the four sections of its Maintenance of Certification (MOC) process. This is particularly relevant to those medical physicists with time limited ABR certificates or for other ABR Diplomates voluntarily enrolled in the MOC program. One of the key aspects of The ABR expectation for Practice Quality Improvement (PQI), Part IV of the ABR MOC program, is that Diplomates provide evidence of an ongoing program of improvement of practice either as an individual or within the system the individual is employed. For physicists, this may seem somewhat nebulous due to the many duties and responsibilities for quality in the clinical realm. For diagnostic physicists, this may seem even more undefined, especially for consultants.

As a beginning dialogue related to PQI, suggestions for projects appropriate for medical physicists are presented. Another method for fulfillment of the PQI section is participation in society based PQI programs. Such programs are under development within AAPM and formulations of a programs for physicists is presented.

Learning Objectives:
At the conclusion of the presentation, an individual will
1. Gain knowledge of the basic aspects of PQI as regards to project types, basic ingredients of projects.
2. Learn about examples of projects for demonstration of PQI for medical physicists.
3. Learn about the developments of society based program for PQI for Physicists within the AAPM.

Objectives

- Review an example of large scale quality improvement
- Define the steps of the PQI cycle
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PQI is a science

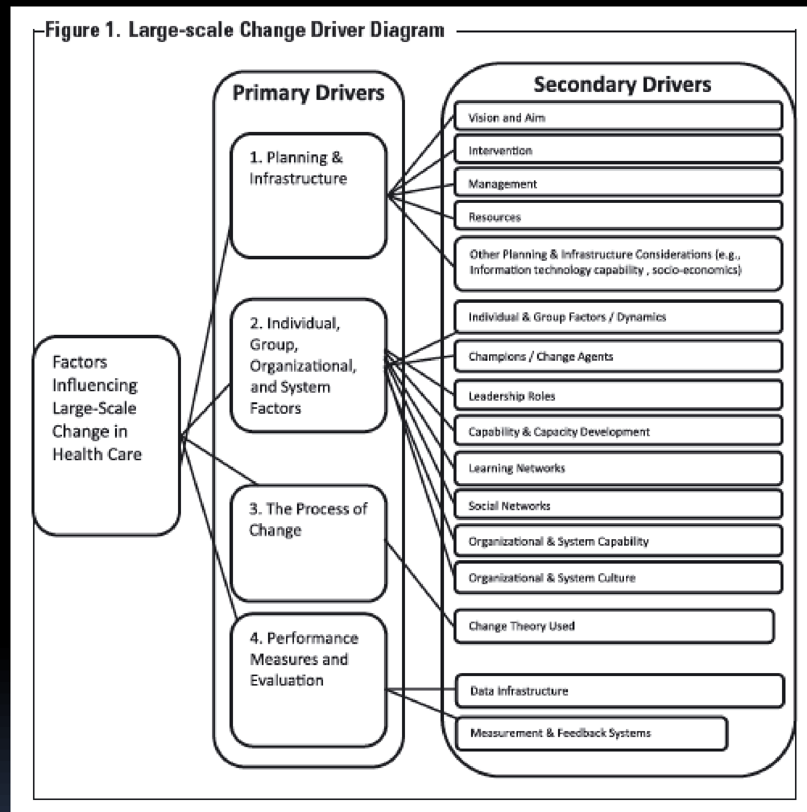


Figure 1. Large-scale Change Driver Diagram

30 Journal for Healthcare Quality

Large-Scale Improvement Initiatives in Healthcare: A Scan of the Literature

Rocco J. Perla, Elizabeth Bradbury, Christina Gunther-Murphy

2013 Vol 35 (1)

Global Quality Imaging: Improvement Actions

Lawrence S. Lau, MBBS[a], Maria R. Pérez, MD[b], Kimberly E. Applegate, MD, MS[c], Madan M. Rehani, PhD[d], Hans G. Ringertz, MD, PhD[e], Robert George, ARMIT, Dip Pract Man[f]

Workforce shortage, workload increase, workplace changes, and budget challenges are emerging issues around the world, which could place quality imaging at risk. It is important for imaging stakeholders to collaborate, ensure patient safety, improve the quality of care, and address these issues. There is no single panacea. A range of improvement measures, strategies, and actions are required. Examples of improvement actions supporting the 3 quality measures are described under 5 strategies: conducting research, promoting awareness, providing education and training, strengthening infrastructure, and implementing policies. The challenge is to develop long-term, cost-effective, system-based improvement actions that will bring better outcomes and underpin a sustainable future for quality imaging. In an imaging practice, these actions will result in selecting the right procedure (justification), using the right dose (optimization), and preventing errors along the patient journey. To realize this vision and implement these improvement actions, a range of expertise and adequate resources are required. Stakeholders should collaborate and work together. In today's globalized environment, collaboration is strength and provides synergy to achieve better outcomes and greater success.

Key Words: Quality and safety, quality improvement, radiation protection, radiation safety, procedure justification, optimization of protection, radiology errors, adverse events, referral guidelines

J Am Coll Radiol 2011;8:330-334.

IMPROVEMENT STRATEGIES

Quality actions can be discussed under 5 strategies:

- conduct research
- promote awareness
- provide education and training
- strengthen infrastructure
- implement policies

and clinical elements. The World Health Organization (WHO) aims to promote a research agenda on radiation risk assessment, with particular attention to children and pregnant women [1]. Studies in atomic bomb and Chernobyl accident survivors who had received fetal or childhood exposure showed a higher cancer risk. Second cancers [2] were reported following childhood radiotherapy after sufficiently long follow-up. Many factors contribute to this risk after radiation exposure.

Examples of large scale quality improvement in Radiology

Conduct research

British Journal of Radiology (2006) 79, 968-980

doi: 10.1259/bjr/93277434

National survey of doses from CT in the UK: 2003

P C Shrimpton, PhD[1], M C Hillier, HNC[1], M A Lewis, MSc[2] and M Dunn, MSc[2]

+ Author Affiliations

Dr Paul C Shrimpton, Radiation Protection Division, Health Protection Agency, Chilton, Didcot, Oxon OX11 0RQ, UK. E-mail: paul.shrimpton@hpa-rp.org.uk

A review of patient doses from CT examinations in the UK for 2003 has been conducted on the basis of data received from over a quarter of all UK scanners, of which 37% had multislice capability. Questionnaires were employed to collect scan details both for the standard protocols established at each scanner for 12 common types of CT

Large scale improvement

	Data Year(s)	P Pediatric (predom or solely) G General	No. of centers	% MSCT	% 64 slice	Data – Patient (P) Phantom (Ph) Protocol (Pr)	Body CT 16cm / 32cm phantom
UK 05 Shrimpton	03	G + P	20-50	37	0	Pr (P)	16
Germany 07 Galanski	05-06	P	42	85	? 5-10	Pr P	16 + 32
Switzerland 08 Verdun	05	P	9	66	11	Pr	16
France 09 Brisse	07-08	P	20	100	36	Pr	32
Greece 09 Yakoumakis	n/a	G 83% P 17%	12	58	0	Ph	16
Belgium 10 Buls							

Slide courtesy of Dr. Karen Thomas, Sick Kids Hospital, Toronto

Applications of the PDSA cycle

To analyze estimated radiation dose from a hospital or facility enrolled in the ACR Dose Index Registry (DIR)

- To compare its pediatric doses to those from similar facilities
  - For patients of the same body size
  - For the same clinical scan indication

Promote awareness

International organizations that promote radiology protection for children on a large scale

There are many international organizations that work toward radiation protection

ALATRO: Latin American Society of Therapeutic Radiology and Oncology
ASTRO: American Society of Therapeutic Radiology and Oncology
EANM: European Association of Nuclear Medicine
EC: European Commission
ESTRO: European Society of Therapeutic Radiology and Oncology
FORO: Iberoamerican Forum of Nuclear Regulators.
IAEA: International Atomic Energy Agency
IAMRA: International Association of Medical Regulatory Authorities;
ICRP: International Commission on Radiological Protection
IFMSA: International Federation of Medical Students' Associations
ILO: International Labour Organization
IOMP: International Organization of Medical Physics
IRPA: International Radiation Protection Association
IRQN: International Radiology Quality Network
ISR: International Society of Radiology
ISRRT: International Society of Radiographers and Radiological Technologists
NEA: Nuclear Energy Agency
UN: United Nations
UNSCEAR: United Nations Scientific Committee on the Effects of Atomic Radiation
WFME: World Federation for Medical Education
WFNMB: World Federation of Nuclear Medicine and Biology
WMA: World Medical Association

International Radiology Quality Network

- Promote quality in radiology since 2002
- "Collaboration is strength"
- Promote evidenced-based and appropriate utilization
- Work with WHO, IG to develop simple guidelines

International Radiation Protection Agency

IRPA
INTERNATIONAL RADIATION PROTECTION ASSOCIATION
IRPA c/o CEPN, 28 rue de la Redoute, 92260 Fontenay-aux-Roses, France

- Arose from Health Physics Society
- 1960s
- One of first to create international "umbrella" association
- Large regional and international meeting

International Society of Radiology

- Founded in 1925
- Sponsors international congress and “virtual congress”
- Open source textbooks
- Journals to underserved populations
- Hans Ringertz, Past President

International Society of Radiology

ISR

The International Society of Radiology

2nd Virtual Congress

April 2009

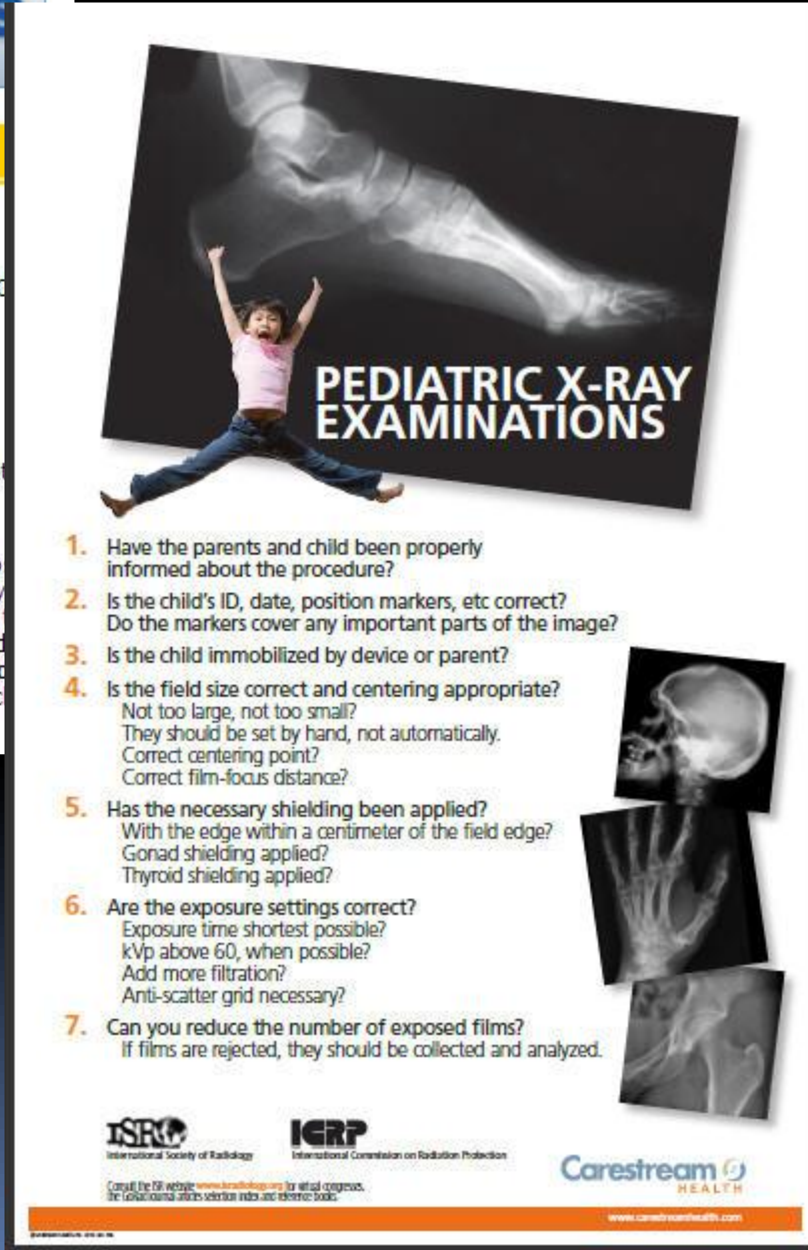
Coming soon!

February 18, 20

Dear Doctors:

The International Society of Radiology has the pleasure of announcing the complet
of our sponsored second world-wide virtual congress.

It will be available to all radiologists in your society for free via the ISR web
http://www.isradiology.org starting in early April. Please use your communications with y
individual members to call this new virtual congress to their attention. The contents of
second virtual congress are all new. They include some **40 presentations from lead**
radiology teachers around the world. They also will include **case studies and electro**
posters. We still have time and space for additional posters and case studies, until 10 Marc
any of your members are interested to submit them.



International Society of Radiographers and Radiologic Technologists

Brazilian College of Radiology and Diagnostic Imaging

IMAGE™

WISELY

Provide Education and Training

Information for
Health Professionals
Member States
Patients and Public

Member Area
- Member States Area
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Diagnostic and Interventional Radiology

Training material developed in collaboration with
World Health Organization (WHO)
Pan American Health Organization (PAHO)
International Labour Organization (ILO)
International Society of Radiology (ISR)
International Organization for Medical Physics (IOMP)
International Society of Radiographers and Radiological Technologists (ISRRT)

Pycc

Lectures/Slides

All 23 modules (ZIP of 28 files, 89.29 Mb)

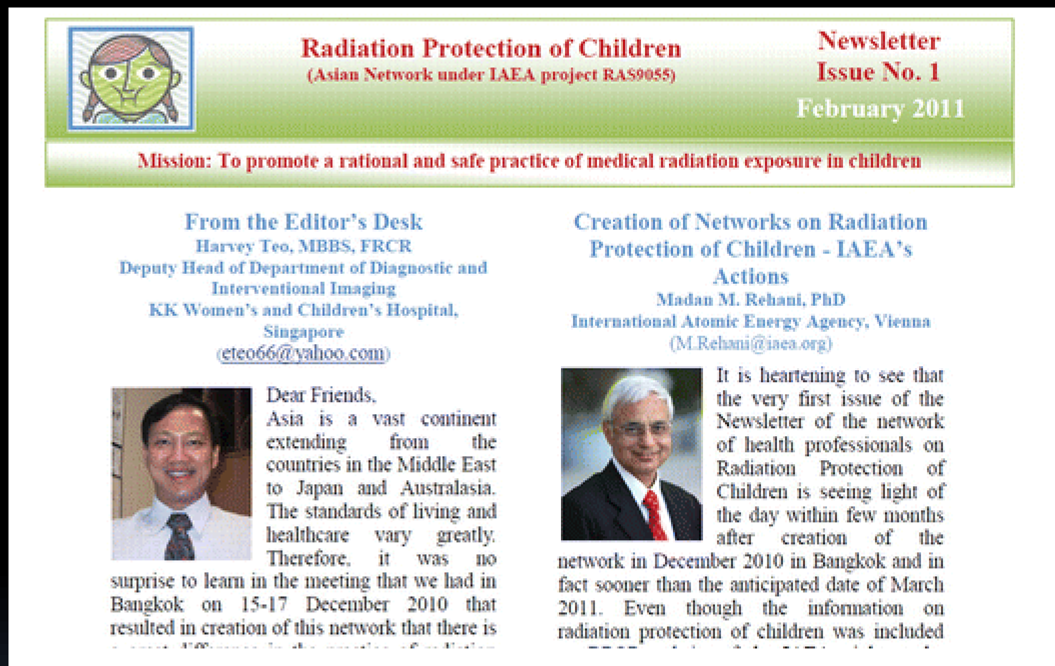
- 00. Principles of Radiation Protection and Motivation for the Course (10,548 KB)
- 01. Overview of radiation protection in diagnostic radiology (1,147 KB)
- 02. Radiation units and dose quantities (2,153 KB)
- 03. Biological effects (7,386 KB)
- 04. International system of radiation protection (871 KB)
- 05. Interaction of radiation with matter (10,586 KB)
- 06. X-ray production (6,517 KB)
- 07. X-ray beam (1,877 KB)
- 08. Factors affecting image quality (16,119 KB)
- 09. Medical exposure BSS (1,739 KB)
- 10. Patient dose assessment (1,050 KB)
- 11. Quality assurance (673 KB)
- 12. Shielding and X-ray facility design (1,047 KB)
- 13. Occupational exposure: Part 1 (1,240 KB)
- 13. Occupational exposure: Part 2 (5,493 KB)
- 14. Radiation exposure in pregnancy (1,101 KB)
- 15. Optimization of protection in radiography: Part 1 (12,399 KB)
- 15. Optimization of protection in radiography: Part 2 (1,207 KB)
- 16. Optimization of protection in fluoroscopy: Part 1 (5,554 KB)

Strengthen infrastructure

- Building workforce

What can be done to increase the number of radiologic technologists worldwide?

Creating communities of learners



Radiation Protection of Children
(Asian Network under IAEA project RAS9055)

Newsletter
Issue No. 1
February 2011

Mission: To promote a rational and safe practice of medical radiation exposure in children

From the Editor's Desk

Harvey Teo, MBBS, FRCR
Deputy Head of Department of Diagnostic and Interventional Imaging
KK Women's and Children's Hospital, Singapore
(eteo66@yahoo.com)

Dear Friends,
Asia is a vast continent extending from the countries in the Middle East to Japan and Australasia. The standards of living and healthcare vary greatly. Therefore, it was no surprise to learn in the meeting that we had in Bangkok on 15-17 December 2010 that resulted in creation of this network that there is

Creation of Networks on Radiation Protection of Children - IAEA's Actions

Madan M. Rehani, PhD
International Atomic Energy Agency, Vienna
(M.Rehani@iaea.org)

It is heartening to see that the very first issue of the Newsletter of the network of health professionals on Radiation Protection of Children is seeing light of the day within few months after creation of the network in December 2010 in Bangkok and in fact sooner than the anticipated date of March 2011. Even though the information on radiation protection of children was included

Implement Policies

Regulatory actions

- European Commission
- Euratom Treaty
- FDA
- International Electrotechnical Commission

Objectives

- Review an example of large scale quality improvement
- Define the steps of the PQI cycle
- Discuss the QMP role as part of team
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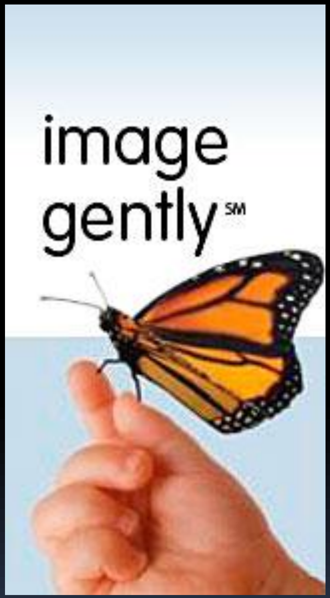
- Use of Image Gently resources for PQI

Alliance for Radiation Safety in Pediatric Imaging



- Founded in 2007
- To improve radiation protection for children worldwide
- >74 health care organizations/agencies
- >800,000 radiologists

  radiology technologists

  medical physicists

Social marketing

Social marketing is similar to an advertising campaign

Target audience

1. Public
2. Health professionals
3. Vendors
4. Government
5. Agencies
6. Parents/public

Media

1. Print
2. Internet
3. Television
4. Posters
5. E-mail
6. Scientific publications
7. Social media

www.imagegently.org


The 3rd WHO International Conference
Children's Health and the Environment
June 7 ~ 10, 2009 Busan, Republic of Korea
CEH 2009
7-10 June

image gently℠

The Alliance for Radiation Safety in Pediatric Imaging

Let's *image gently* when we care for kids! The *image gently* Campaign is an initiative of the Alliance for Radiation Safety in Pediatric Imaging. The campaign goal is to change practice by increasing awareness of the opportunities to lower radiation dose in the imaging of children.

COURSE OUTLINE

Your Practice Quality Improvement Project

1. What is practice quality improvement?
2. What are the basic steps of practice quality improvement?
3. Why is PQI good for my patients and practice?
4. What are cycles in PQI?
5. Starting my PQI project in Radiation Safety for CT scans in children (Click here for materials you will need to collect prior to performing this PQI project)
6. Materials you will need to complete this PQI project
7. Obtaining baseline data
8. Learning tools and practice interventions to improve my practice
9. Documenting improvement

Go with the Guidelines!

Follow the new North American Guidelines for Pediatric Nuclear Medicine for high quality images at low radiation dose.

North American Consensus Guidelines for Administered Radiopharmaceutical Activities in Children and Adolescents*

Radiopharmaceutical	Recommended administered activity (based on weight only)	Minimum administered activity	Maximum administered activity	Comments
^{123}I-MIBG	5.2 MBq/kg (0.14 mCi/kg)	37 MBq (1.0 mCi)	370 MBq (10.0 mCi)	EANM Paediatric Dose Card (2007 version (13)) may also be used in patients weighing more than 10 kg.
^{99m}Tc-MDP	9.3 MBq/kg (0.25 mCi/kg)	37 MBq (1.0 mCi)		EANM Paediatric Dose Card (2007 version (13)) may also be used.
^{18}F-FDG	Body, 3.7–5.2 MBq/kg (0.10–0.14 mCi/kg) Brain, 3.7 MBq/kg (0.10 mCi/kg)	37 MBq (1.0 mCi)		Low end of dose range should be considered for smaller patients. Administered activity may take into account patient mass and time available on PET scanner. EANM Paediatric Dose Card (2007 version (13)) may also be used.
^{99m}Tc-DMSA	1.85 MBq/kg (0.05 mCi/kg)	18.5 MBq (0.5 mCi)		
^{99m}Tc-MAG3	Without flow study, 3.7 MBq/kg (0.10 mCi/kg) With flow study, 5.55 MBq/kg (0.15 mCi/kg)	37 MBq (1.0 mCi)	148 MBq (4 mCi)	Administered activities at left assume that image data are reframed at 1 min/image. Administered activity may be reduced if image data are reframed at longer time per image. EANM Paediatric Dose Card (2007 version(13)) may also be used. EANM Paediatric Dose Card (2007 version(13)) may also be used.
^{99m}Tc-iminodiacetic acid derivatives (mebrofenin, disofenin)	1.85 MBq/kg (0.05 mCi/kg)	18.5 MBq (0.5 mCi)		Higher administered activity of 37 MBq (1 mCi) may be considered for neonatal jaundice. EANM Paediatric Dose Card (2007 version (13)) may also be used.
^{99m}Tc-MAA (^{99m}Tc-macroaggregated albumin)	If ^{99m}Tc used for ventilation, 2.59 mBq/kg (0.07 mCi/kg) No ^{99m}Tc ventilation study, 1.11 MBq/kg (0.03 mCi/kg)	14.8 MBq (0.4 mCi)		EANM Paediatric Dose Card (2007 version (13)) may also be used. EANM Paediatric Dose Card (2007 version (13)) may also be used.
^{99m}Tc-sodium pertechnetate (Meckel diverticulum imaging)	1.85 MBq/kg (0.05 mCi/kg)	9.25 MBq (0.25 mCi)		EANM Paediatric Dose Card (2007 version (13)) may also be used.
^{18}F-sodium fluoride	2.22 MBq/kg (0.06 mCi/kg)	18.5 MBq (0.5 mCi)		
^{99m}Tc for cystography (different forms)	No weight-based dose		No more than 37 MBq (1.0 mCi) for each bladder-filling cycle	^{99m}Tc-sulfur colloid, ^{99m}Tc-pertechnetate, ^{99m}Tc-diethylene triamine pentaacetic acid, or possibly other ^{99m}Tc radiopharmaceuticals may be used. There is wide variety of acceptable administration techniques for ^{99m}Tc, many of which will work well with lower administered activities.
^{99m}Tc-sulfur colloid For oral liquid gastric emptying	No weight-based dose	9.25 MBq (0.25 mCi)	37 MBq (1.0 mCi)	Administered activity will depend on age of child, volume to be fed to child, and time per frame used for imaging.
For solid gastric emptying	No weight-based dose	9.25 MBq (0.25 mCi)	18.5 MBq (0.5 mCi)	^{99m}Tc-sulfur colloid is usually used to label egg.

*This information is intended as a guideline only. Local practice may vary depending on patient population, choice of collimator, and specific requirements of clinical protocols.

Administered activity may be adjusted when appropriate by order of the nuclear medicine practitioner. For patients who weigh more than 70 kg, it is recommended that maximum administered activity not exceed product of patient's weight (kg) and recommended weightbased administered activity. Some practitioners may choose to set fixed maximum administered activity equal to 70 times recommended weight-based administered activity, for example, approximately 10 mCi (370 mBq), for ^{18}F body imaging. The administered activities assume use of a low energy high resolution collimator for Tc-99m radiopharmaceuticals and a medium energy collimator for I-123-MIBG. Individual practitioners may use lower administered activities if their equipment or software permits them to do so. Higher administered activities may be required in certain patients. No recommended dose is given for ^{67}Ga-citrate. Intravenous ^{67}Ga-citrate should be used infrequently and only in low doses.

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Digital Radiography Safety Checklist

Safety Steps to Do and Verify for your pediatric patient

www.imagegently.org

Prior to Starting the Exam	Image Capture During the Exam	Image Critique	Following Completion of the Exam
☐ 1. Patient name selected from the worklist.	☐ 1. Beam → body part → image receptor aligned, SID checked, use of grid determined.	☐ 1. Cassete transported to and processed in reader, if applicable*.	☐ 1. Post – processing performed only if necessary.
☐ 2. Patient properly identified.	☐ 2. Patient positioned and body part measured, cassette positioned if applicable*.	☐ 2. Images displayed and reviewed, identification confirmed.	☐ 2. Exam verified and images archived to PACS for reporting.
☐ 3. Appropriateness of request checked.	☐ 3. Beam collimated.	☐ 3. Image quality reviewed	
☐ 4. Explained the exam to patient/parent.	☐ 4. Technical factors selected.	☐ 4. Exposure indicator/index checked, deviation index compared to target exposure index.	
☐ 5. Verified LMP/pregnancy if appropriate.	☐ 5. Shielding and markers placed.	☐ 5. Image reprocessed or repeated as necessary.	
	☐ 6. Final adjustment of tube and settings made.		
	☐ 7. Breathing instructions given.		
	☐ 8. Exposure taken.		

Susan John, MD Chair of CR/DR Education committee

The Alliance for Radiation Safety in Pediatric Imaging

Implementation Manual
Image Gently℠ Digital Radiography
Safety Checklist

Safety Steps to Do and Verify
for Your Pediatric Patient

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The following is a summary of the average values recorded for each Safety Checklist item and average for each of the four checklist categories.

Prior to Exam (5)		4.0
	Patient name selected from the worklist.	0.50
	Patient properly identified.	1.00
	Appropriateness of request checked.	1.00
	Explaination of the exam to patient/parents.	1.00
	Verify LMP/pregnancy if appropriate.	0.50
Image Capture During the Exam (8)		7.0
	Beam to part to image receptor aligned, SID checked. Use of grid determined.	1.00
	Beam collimated.	1.00
	Patient positioned, part measured, and cassette positioning if applicable.	1.00
	Technical factors selected.	1.00
	Shielding and markers placed.	1.00
	Final adjustment of tube and settings made.	0.50
	Breathing instructions given.	0.50
	Exposure taken.	1.00
Image Critique (5)		4.5
	Cassette transported to and processed reader, if applicable.	1.00
	Image displayed and reviewed, identification confirmed.	1.00
	Image quality reviewed.	1.00
	Exposure indicator checked, deviation index compared to target exposure index.	0.50
	Image reprocessed or repeated as necessary.	1.00
Following Completion of the Exam (2)		1.5
	Post-processing performed if necessary.	1.00
	Exam verified and images archived to PACS for reporting.	0.50

15

Appendix A

We have provided a downloadable Excel spreadsheet (www.imagegently.org, under radiologic technologists section) that can be used at your institution for a practice quality improvement project (see attached Excel file). To follow is the Digital Radiography Safety Checklist Data Report. This is populated from the Excel spreadsheet. The following is an example of what a Digital Radiography Safety Checklist report would look like.

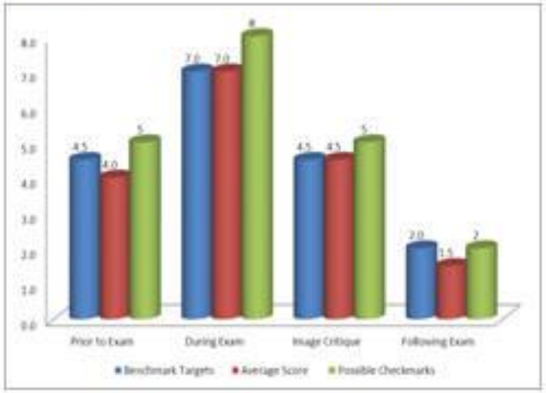
Digital Radiography Safety Checklist Data Report

The following data represents a summary of Digital Radiography Safety Checklists completed for the period of *(insert start date)* through *(insert end date)*.

Total number of records for the reporting period: *(insert number)*

Number of technologists involved in the study: *(insert number)*

The following chart is a comparison of benchmark targets to the average of recorded values.



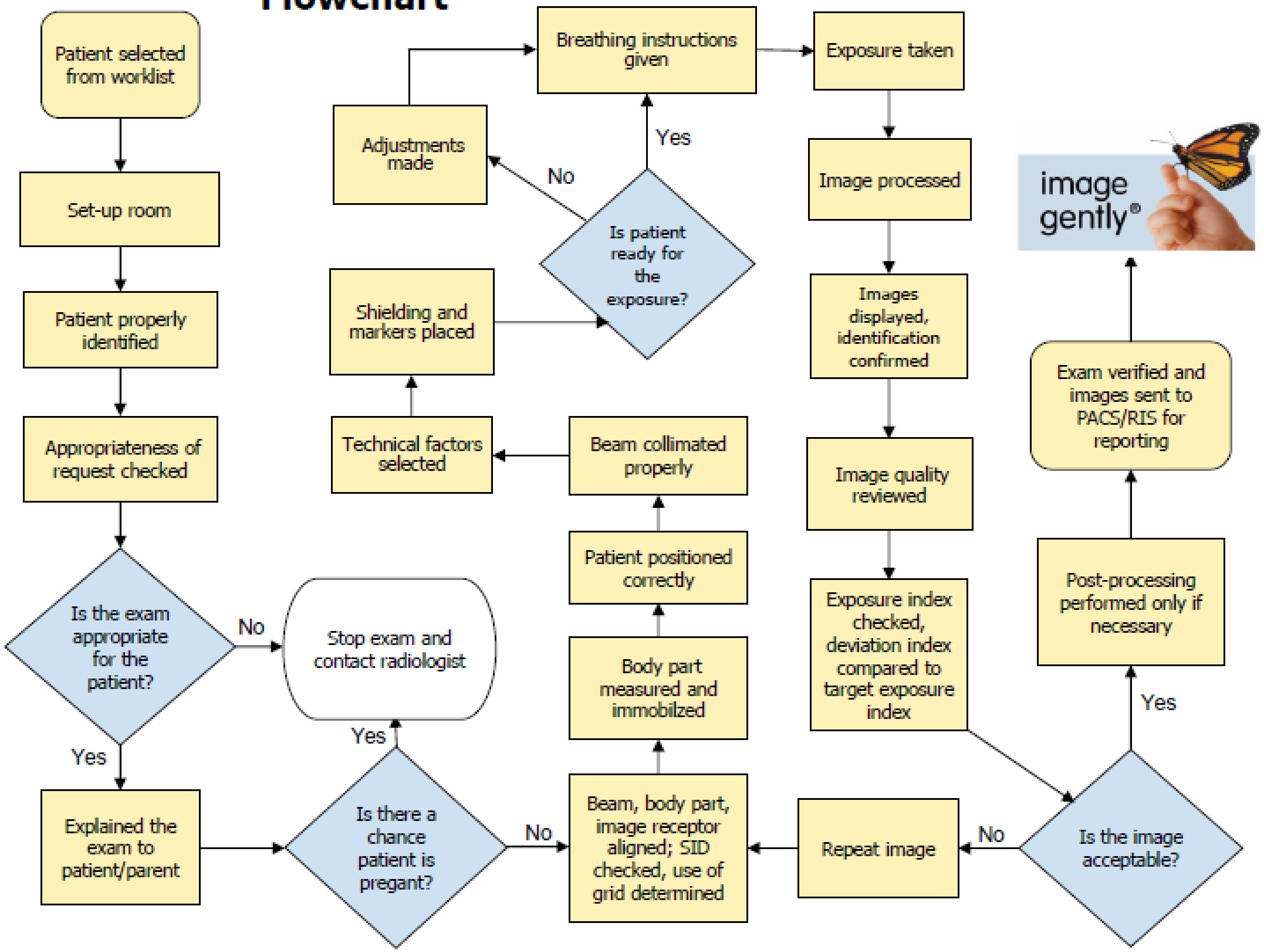
Category	Benchmark Targets	Average Score	Possible Checkmarks
Prior to Exam	4.5	4.0	5
During Exam	7.0	7.0	8
Image Critique	4.5	4.5	5
Following Exam	2.0	1.5	2
Overall Average	18	17.0	20

12

Online PQI project and worksheet

Funded by FDA contract

Digital Radiography Flowchart



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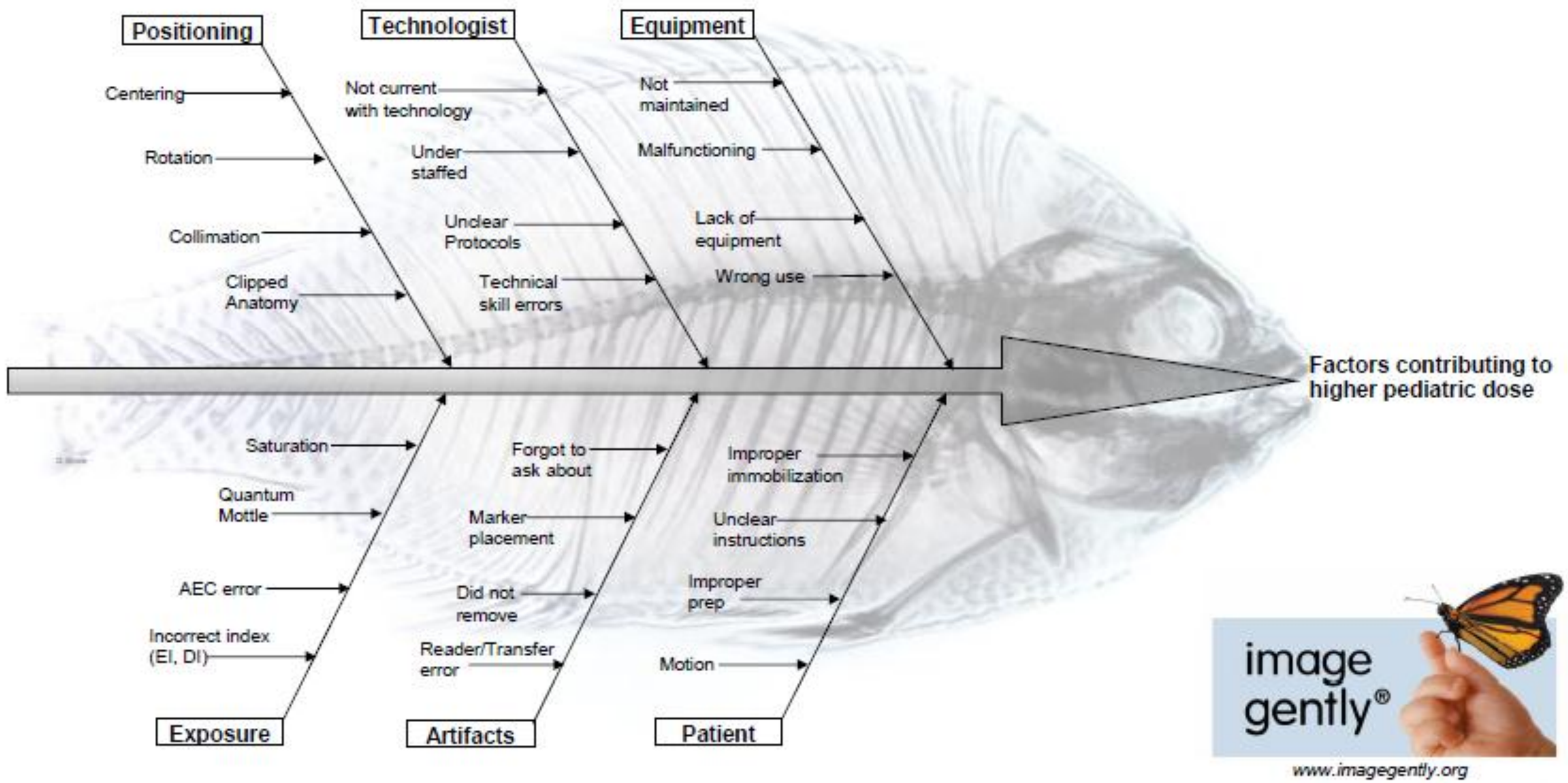

Fishbone diagrams are useful to show cause-and-effect for undesired situations. In this case we want to lower pediatric dose, therefore, we have to consider all of the situations that could cause a child to have more radiation exposure than necessary. The goal is to prevent exposure creep, repeats, and errors by discovering their root cause. Once potential causes have been identified, plans and protocols should be developed to overcome deficient areas. The causes have been grouped into major categories along with corresponding subheadings to identify sources of variation.

Actions to achieve large system improvement

- Systematic transfer of knowledge
- Creation of an environment that facilitated the uptake of ideas
- Unified policy framework and infrastructure for spread
- Create an army to spread change


THANK YOU