



XXI CONGRESSO BRASILEIRO DE FÍSICA MÉDICA

24 a 27 de agosto de 2016

Florianópolis, Santa Catarina

MINI-CURSO:
**"Ferramentas de gestão de risco
em radioterapia"**

AULA 2: Barreiras de segurança, checklist, timeout e NIZ

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Mestrando em Engenharia de Produção (Gestão da Qualidade) - PPGEP/UFSCar

25 de agosto de 2016

Aulas

AULA 1: Contexto, definições e mapa de processo

AULA 2: Barreiras de segurança, checklist, timeout e NIZ

AULA 3: Fatores humanos e hierarquia das ações

AULA 4: Sistema de Aprendizagem com Incidentes e Análise de Causas Raízes

AGENDA

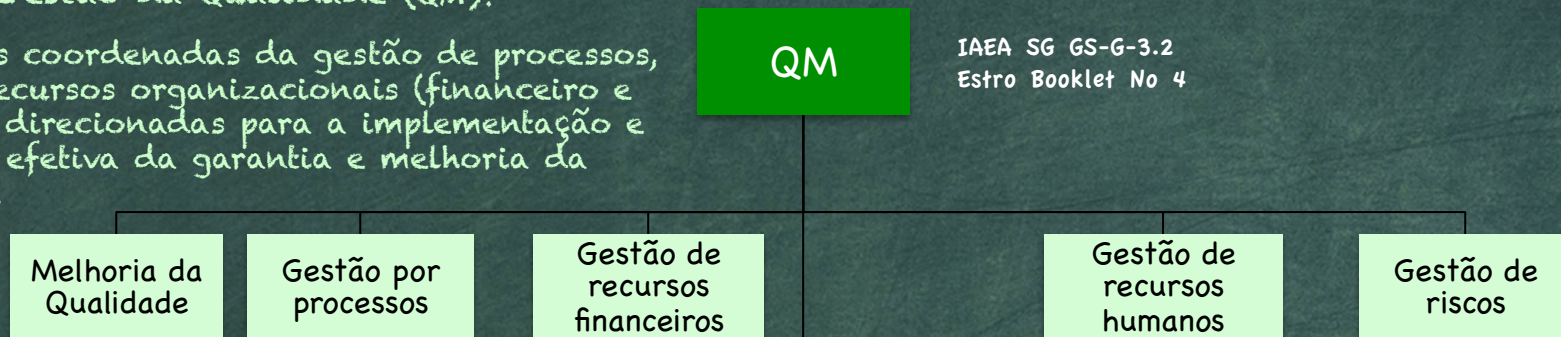
- O que é "controle de qualidade de processo"?
- O que é "barreira de segurança"?
- Ferramentas para determinar e executar barreiras

AGENDA

- O que é "controle de qualidade de processo"?
- O que é "barreira de segurança"?
- Ferramentas para determinar e executar barreiras

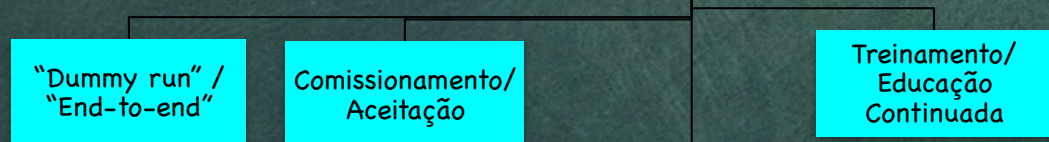
O que é Gestão da Qualidade (QM)?

Atividades coordenadas da gestão de processos, riscos e recursos organizacionais (financeiro e humanos) direcionadas para a implementação e aplicação efetiva da garantia e melhoria da qualidade



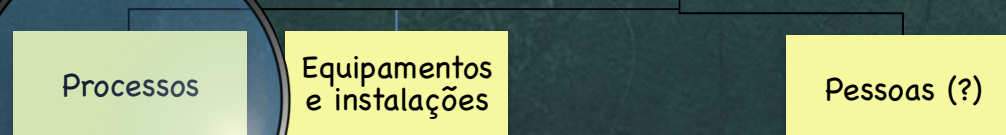
O que é Garantia da Qualidade (QA)?

Ações planejadas e sistemáticas para fornecer confiança adequada que um produto ou serviço satisfaça dados requerimentos para qualidade



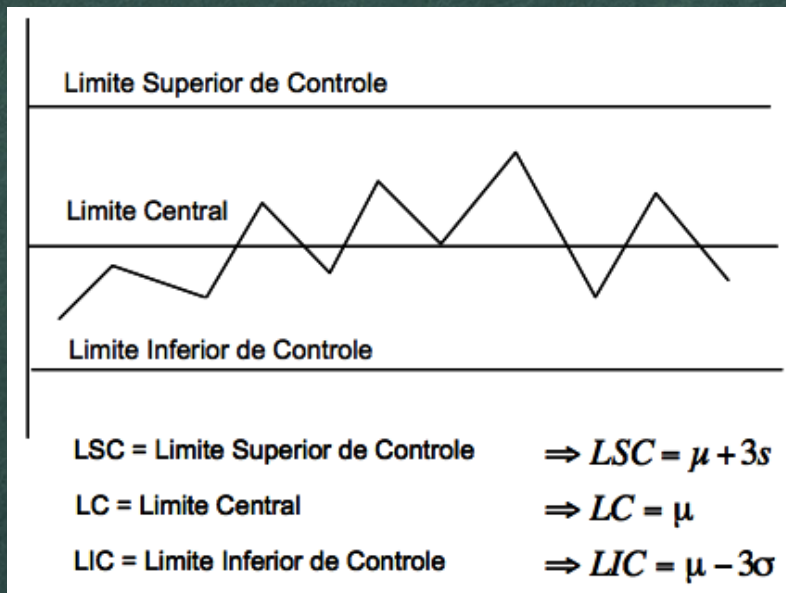
O que é Controle da Qualidade (QC)?

Técnicas operacionais de medição de desempenho (processos, infraestrutura e pessoas), comparação com padrões existentes e ações necessárias para manter ou recuperar a conformidade com os padrões (p. ex. checagens/verificações e monitoramentos)



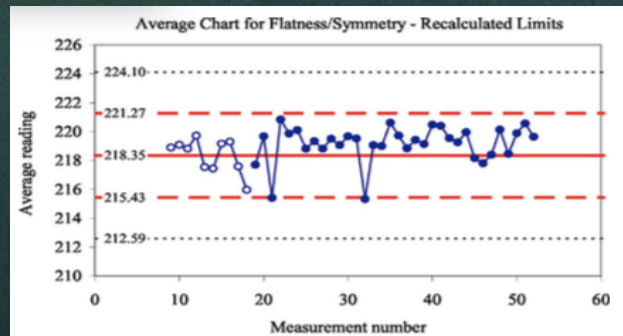
AUDITORIA

CONTROLE ESTATÍSTICO DE PROCESSO (CEP)



Statistical process control for radiotherapy quality assurance

Todd Pawlicki⁽¹⁾
 Department of Radiation Oncology, Stanford University School of Medicine, Stanford, California 94305
 Matthew Whitaker
 Radiological Imaging Technology, Inc., 637 Elton Drive, Colorado Springs, Colorado 80907
 Arthur L. Boyer
 Department of Radiation Oncology, Stanford University School of Medicine, Stanford, California 94305



Quadro 3.1 - Regras para decisão sobre estabilidade do processo

Um ou mais pontos situados fora dos limites de controle	
Sequência de 6 ou mais pontos consecutivos acima ou abaixo da linha média	
Sequência de 7 ou mais pontos consecutivos que aumentam ou diminuem consistentemente	
Em 5 pontos consecutivos, 4 estão situados do mesmo lado em relação à linha central e fora do intervalo de $\pm 1\sigma$ em torno da média	
Sequência de 8 ou mais pontos consecutivos fora do intervalo de $\pm 1\sigma$ em torno da média, de qualquer lado	
Em 3 pontos consecutivos, 2 estão situados do mesmo lado em relação à linha central e fora do intervalo de $\pm 2\sigma$ em torno da média	
Existência de oscilações cíclicas	
Outras: 10 em 11; 12 em 14; 14 em 17; 16 em 20 pontos consecutivos estão do mesmo lado da linha média	

AGENDA

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- O que é "barreira de segurança"?
- Ferramentas para determinar e executar barreiras

MODELO DO QUEIJO SUIÇO

Controles administrativos, sistemas passivos ou tarefas de checagens dentro do processo cuja função principal é prevenir um erro ou equívoco de ocorrer ou propagar-se pelo processo.
(Ford et al., 2012; IAEA 2007)

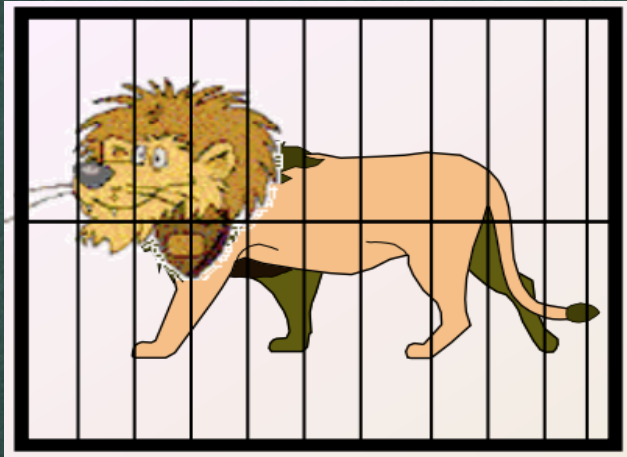
Circunstância, agente ou ação com potencial de causar dano ("fonte de dano potencial")
(OMS, 2009)



Perda na estrutura ou função do corpo e/ou qualquer efeito prejudicial resultante
(OMS, 2009)

Probabilidade da ocorrência do perigo combinada com a severidade do dano ao paciente
(ICRP, 2009)

MODELO DO QUEIJO SUIÇO

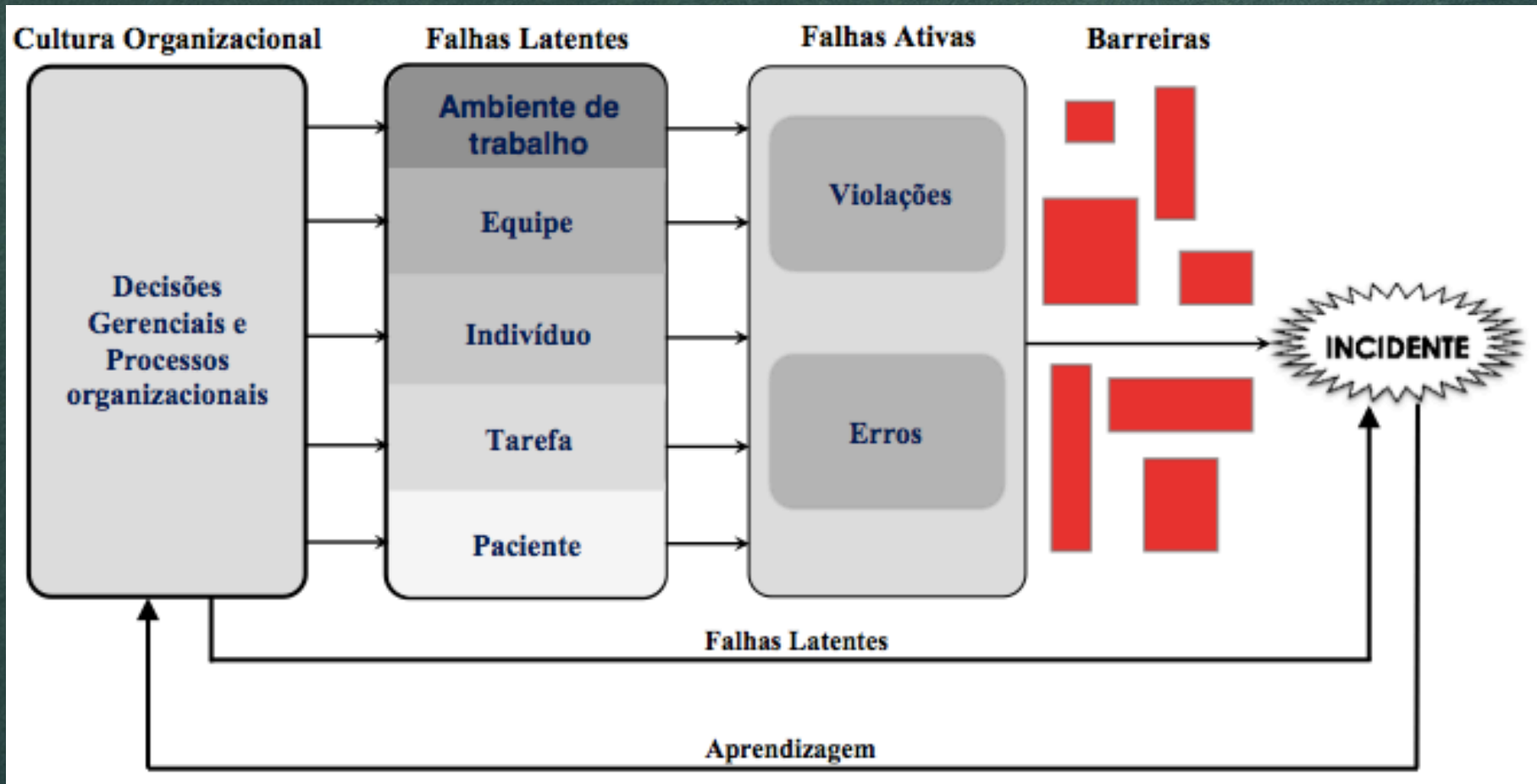


Cia



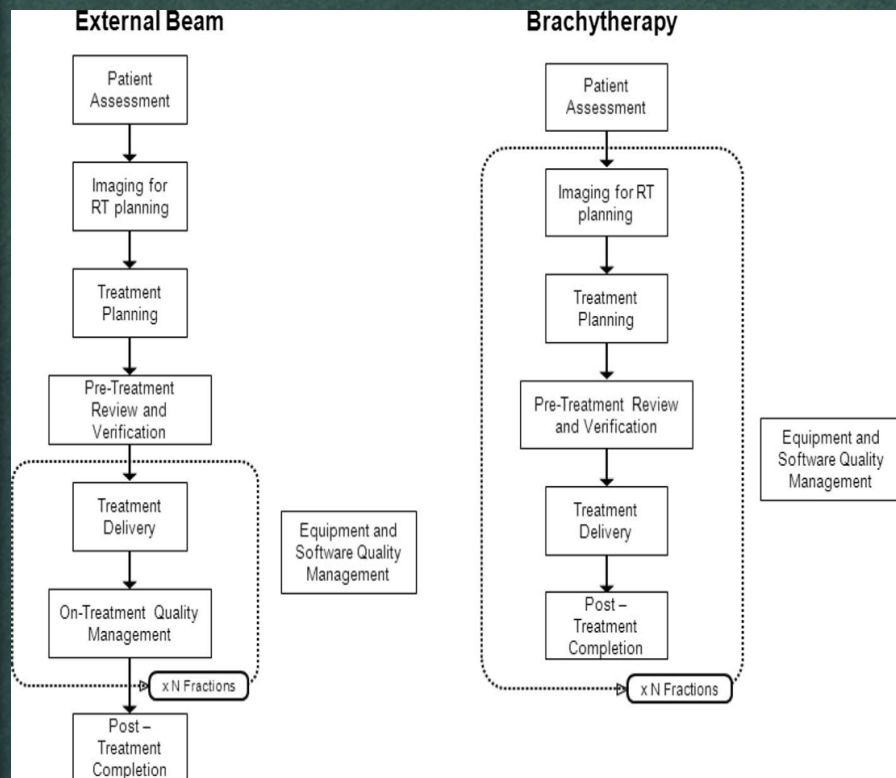
Probabilidade da ocorrência
do perigo combinada com a
severidade do dano ao
paciente
(ICRP, 2009)

Modelo de Acidentes Organizacionais (J. Reason)



- Físicas (cercas)
- Naturais (distâncias)
- Ações humanas (checagens)
- Controles administrativos (treinamentos)

Barreiras de segurança ou pontos críticos de controle visa prevenir um erro ou equívoco de ocorrer ou propagar-se pelo processo



APPENDIX B: PROCESS MAPS

1. Process map, EBRT

“SB” indicates a process step that serves primarily as a safety barrier. The symbol ⊗ indicates processes in which the patient is physically present during at least some part of the process.

1. Patient assessment ⊗

- | | | |
|----|------|---|
| SB | 1.1 | Verification of patient ID by two methods |
| | 1.2 | Diagnosis definition including imaging and outside records |
| SB | 1.3 | Review and verification of pathology report |
| | 1.4 | Physical exam |
| | 1.5 | Clinical staging |
| | 1.6 | Evaluation of patient medical conditions |
| | 1.7 | Evaluation of special needs for radiotherapy (e.g., pacemakers) |
| | 1.8 | Evaluation of previous radiotherapy treatments (including treatment port images and planning records) |
| | 1.9 | Evaluation of other treatment modalities (i.e., chemo, surgery) |
| | 1.10 | Decision to treat |
| | 1.11 | Entering patient information into radiation oncology information system |
| | 1.12 | Selection of clinical protocol |
| | 1.13 | Selection of clinical trial (if any) |
| | 1.14 | Patient consent |
| | 1.15 | Patient education |
| | 1.16 | Insurance evaluation |
| SB | 1.17 | Peer review of treatment decision (e.g., tumor board) |
| | 1.18 | Fiducial placement |
| SB | 1.19 | Evaluation/ordering of workup for IV contrast |
| | 1.20 | Social work and nutritional assessment |
| | 1.21 | Other |

2. Imaging for RT planning ⊗

- | | | |
|----|-----|---|
| SB | 2.1 | Verification of patient ID |
| | 2.2 | Imaging decision (type and technique) |
| | 2.3 | Physician directive for imaging technique and immobilization |
| | 2.4 | Patient positioning |
| | 2.5 | Construction of immobilization and ancillary devices |
| | 2.6 | Documentation of patient positioning and immobilization and ancillary devices |
| | 2.7 | Contrast administration |
| | 2.8 | Primary image acquisition (CT) |
| | 2.9 | Marking reference point on patient and/or localization device and in software |

- | | | |
|----|------|---|
| SB | 3.9 | Preliminary evaluation of treatment plan by physicist |
| SB | 3.10 | Preliminary evaluation of treatment plan by physician |
| | 3.11 | Iteration of treatment plan |
| | 3.12 | Set up for image-guidance/motion management |
| | 3.13 | Final plan and prescription approval by physician |
| | 3.14 | Plan information transfer to radiation oncology information system |
| | 3.15 | Scheduling treatment session(s) |
| | 3.16 | Archiving of the treatment plan (images, RT dose and RT structures) |
| | 3.17 | Other |
| | 4. | Pretreatment review and verification |
| SB | 4.1 | Physics plan review |
| SB | 4.2 | Independent dose calculation |
| | 4.3 | Plan data transfer to treatment unit |
| SB | 4.4 | Verification of parameters at treatment unit |
| SB | 4.5 | Pretreatment patient specific plan measurement (e.g., IMRT QA) |
| SB | 4.6 | Physics verification/approval |
| SB | 4.7 | Physician plan peer review (e.g., chart rounds) |
| SB | 4.8 | Therapists chart check |
| | 4.9 | Other |
| | 5. | Treatment delivery ⊗ |
| SB | 5.1 | Verification of patient ID |
| SB | 5.2 | Time-out (e.g., verification of clinical parameters, treatment consent, etc.) |
| | 5.3 | Prepare patient for treatment (medications, IV, anesthesia, sedation, etc.) |
| | 5.4 | Selection of intended course/session |
| | 5.5 | Plan information transfer to treatment unit |
| | 5.6 | Selection of intended field |
| | 5.7 | Patient positioning and immobilization |
| | 5.8 | Setting treatment accessories and treatment unit parameters |
| SB | 5.9 | Validation of treatment accessories and treatment unit parameters |
| SB | 5.10 | Image-guided verification |
| | 5.11 | Utilization of motion management system |
| SB | 5.12 | Physician verification before treatment |
| SB | 5.13 | In vivo dosimetry |
| | 5.14 | Treatment delivery |
| SB | 5.15 | Intratreatment monitoring |
| | 5.16 | Record of treatment delivery |
| | 5.17 | Monitor evaluation of special needs (e.g., pacemaker protocol) |
| | 5.18 | Other |

EBRT: 91 etapas (35 SB ou 38,5%)

BDT: 88 etapas (32 SB ou 36,4%)

SB: Safety Barriers

CQ DE PROCESSO

[Monitor unit calculations for external photon and electron beams: Report of the AAPM Therapy Physics Committee Task Group No. 71.](#)

Gibbons JP, Antolak JA, Followill DS, Huq MS, Klein EE, Lam KL, Palta JR, Roback DM, Reid M, Khan FM.

Med Phys. 2014 Mar;41(3):031501. doi: 10.1118/1.4864244.

PMID: 24593704 **Free Article**

Booklet 10: Independent Dose Calculations: Concepts and Models



Mikael Karlsson , Anders Ahnesjö , Dietmar Georg , Tufve Nyholm , Jorgen Olofsson

[Enhancing the role of case-oriented peer review to improve quality and safety in radiation oncology: Executive summary.](#)

Marks LB, Adams RD, Pawlicki T, Blumberg AL, Hoopes D, Brundage MD, Fraass BA.

Pract Radiat Oncol. 2013 Jul;3(3):149-156.

PMID: 24175002 **Free PMC Article**

AAPM COMMITTEE TREE

Em desenvolvimento

Task Group No. 275 Strategies for Effective Physics Plan and Chart Review in Radiation Therapy

[AAPM Task Group 103 report on peer review in clinical radiation oncology physics.](#)

Halvorsen PH, Das IJ, Fraser M, Freedman DJ, Rice RE 3rd, Ibbott GS, Parsai EI, Robin TT Jr, Thomadsen BR; American Association of Physicists in Medicine.

J Appl Clin Med Phys. 2005 Fall;6(4):50-64. Epub 2005 Nov 21.

PMID: 16421500

[Quality control quantification \(QCQ\): a tool to measure the value of quality control checks in radiation oncology.](#)

Ford EC, Terezakis S, Souranis A, Harris K, Gay H, Mutic S.

Int J Radiat Oncol Biol Phys. 2012 Nov 1;84(3):e263-9. doi: 10.1016/j.ijrobp.2012.04.036. Epub 2012 Jun 9.

PMID: 22682808

[QA issues for computer-controlled treatment delivery: this is not your old R/V system any more!](#)

Fraass BA.

Int J Radiat Oncol Biol Phys. 2008;71(1 Suppl):S98-S102. doi: 10.1016/j.ijrobp.2007.05.089.

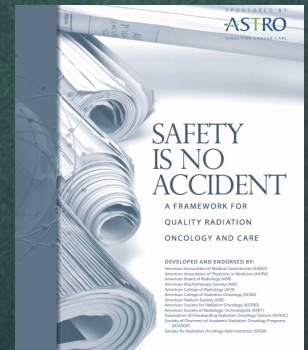
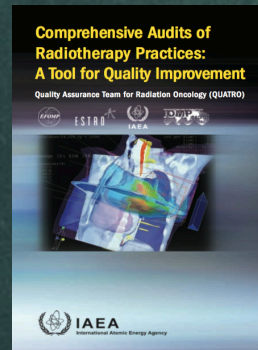
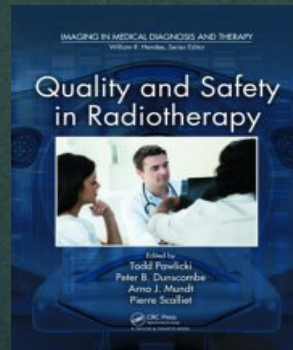
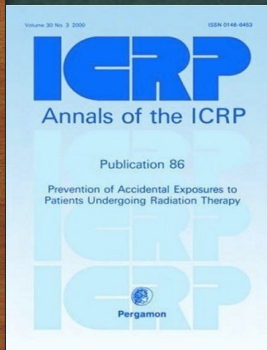
PMID: 18406948 **Free PMC Article**

[Audit tool for external beam radiation therapy departments.](#)

Ritter T, Balter JM, Lee C, Roberts D, Roberson PL.

Pract Radiat Oncol. 2012 Oct-Dec;2(4):e39-44. doi: 10.1016/j.prr.2012.03.011. Epub 2012 May 14.

PMID: 24674183



EXEMPLOS - CQ PROCESSO

BARREIRA

Revisão da estratégia de tratamento ("tumor board") - conduta terapêutica

Revisão da transferência de dados eletrônicos

Revisão do planejamento

Revisão de ficha

Verificação independente de UM/fluências

Revisão do planejamento ("chart round")

Acompanhamento de posicionamento no 1o dia

Verificação de SSD

Imagens de verificação de posicionamento (portais e IGRT)

Estratégias para movimentos respiratórios (gating, 4DCT, etc) e fisiológicos

Dosimetria in vivo

Verificação independente da administração de medicamentos

Auxílio a pacientes debilitados (risco de queda)

Uso adequado de EPI's e procedimentos de higiene (risco de infecção)

RESPONSÁVEL

Equipe multidisciplinar

Físico, dosimetrista e técnico

Físico e Rádio-oncologista

Físico, Técnico e Rádio-oncologista

Físico

Rádio-oncologista

Rádio-oncologista e Físico

Técnico

Rádio-oncologista e técnico

Rádio-oncologista, físico e técnico

Físico

Enfermagem

Técnico e Enfermagem

Todos

Checklist for the Prevention of Accidental Exposures

Organisation, functions, and responsibilities

- Have all necessary functions and responsibility been allocated?
- Are all functions and responsibilities understood?
- Is the number of staff commensurate to workload?
- Is this number re-assessed when workload increases, or when new equipment is purchased?

Education and training

- Is every member of the staff educated and trained according to their responsibilities?
- Is this education and training documented?
- Is there a programme for continuing and personal development?
- Are lessons from accidents and their prevention included in continued training?
- Are there provisions for additional training (new equipment, new procedures)?
- Are emergency plans exercised as part of the training?

Acceptance testing and commissioning

- Is there a programme for formal acceptance of equipment in place?
- Is it carried out according to international or national standards?
- Is there a programme of commissioning in place?
- Does it include treatment equipment as well as treatment planning systems and simulators and other ancillary equipment?

Quality Assurance Programme

- Is a programme of QA established?
- Is the programme based on accepted protocols? Which ones?
- Are all tasks of the QA clearly assigned to the right persons?
- Are the necessary tools and instruments available?
- Are audits part of the programme?

Communication

- Is a communication policy in place and understood by the staff?
- Is reporting of unusual equipment behaviour required?
- Is reporting of unusual patient reactions required?
- Are procedures for equipment transfer for maintenance and return in place?

Patient and site identification

- Are there procedures to ensure correct identification of patient and site?
- Is there a protocol for patient's chart check?

External beam

Calibration

- Are there provisions for initial beam calibration?
- Is independent verification in place foreseen and planned?
- Is there an accepted protocol? Which one?
- Is a programme for follow-up calibration in place?
- Is participation in an audit programme part of the programme?

Treatment planning (clinical dosimetry)

- Are treatment planning systems included in the programme of acceptance and testing?
- Is treatment planning documented according to accepted protocols?
- Are cross-checks and redundant and independent verification included?

In-vivo dosimetry

- Has a system for in-vivo dosimetry been considered?

Brachytherapy

Source activity and identification

- Are there provisions for source activity verification and identification of the source before use?

Dose calculation and treatment planning

- Are there provisions for dose calculation and cross-checks?

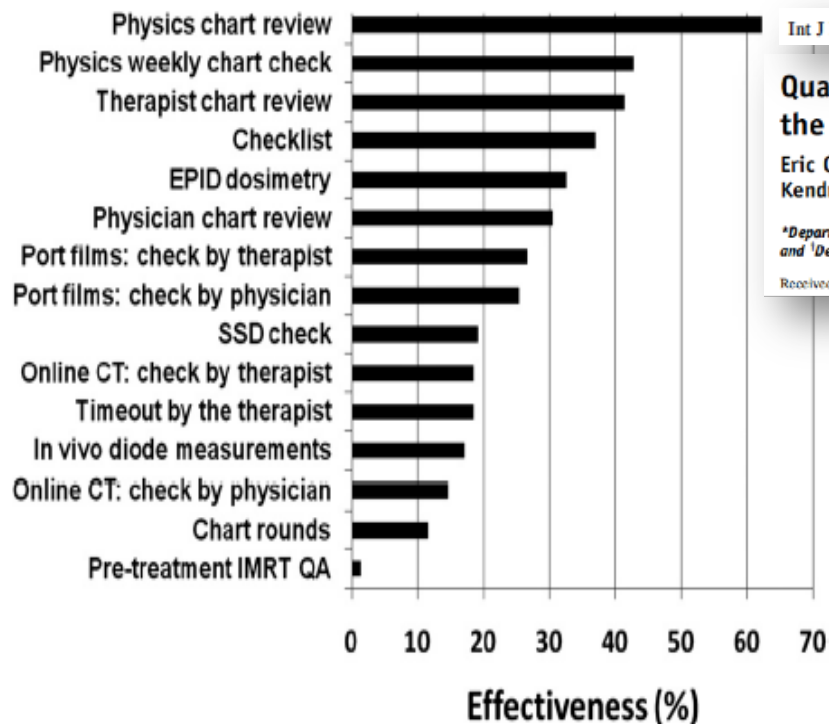
Source positioning and source removal

- Are there provisions to verify source position and to ensure that position remain?
- Are there provisions to ensure that sources do not remain in the patient, including monitoring of patients and clothes?

Fig. 5. A checklist for accident prevention.

EXEMPLOS - CQ PROCESSO

BARREIRAS DE SEGURANÇA (PRÁTICAS DE CONTROLE)		
(Atividades ou pontos críticos de controle dentro do processo cuja função principal é prevenir um erro ou equívoco de ocorrer ou propagar-se pelo processo) – Ford et al (2012)		
Avaliação	1- Checagem da identificação do paciente (Médico Titular) 2- Decisão terapêutica em equipe multidisciplinar (Médico Titular)	
Simulação	11- Checagem da identificação do paciente (Técnico de Radioterapia) 12- Checagem de procedimentos especiais (Dosimetristas) 13- Checagem da transcrição dos acessórios utilizados (Técnico de Radioterapia)	
Planejamento	21- Checagem da importação/fusão (Dosimetrista) 22- Checagem do delineamento (Médico Titular) 23- Checagem da dosimetria clínica (Físico Titular) 24- Checagem do planejamento (Médico Titular) 25- Assinatura e carimbo da prescrição de dose (Médico Titular)	
Preparação	31- Verificação da ficha técnica e aprovação do plano para tratamento (Físico Titular) 32- Verificação da ficha técnica para tratamento (Técnico de Radioterapia Coordenador)	
Tratamento	41- Checagem da identificação do paciente (Técnico de Radioterapia) 42- Verificação da ficha técnica para tratamento (Técnico de Radioterapia) 43- Checagem dos filmes portais (Médico Titular) 44- Checagem de SSD (Técnico de Radioterapia) 45- Checagem do posicionamento no primeiro dia (Médico e Físico Titular)	46- Parâmetros de mesa – aquisição durante tratamento somente com supervisão do físico (Técnico de Radioterapia) 47- Verificação da qualidade dos acessórios de imobilização e equipamentos da sala de tratamento (Técnico de Radioterapia) 48- Verificação do campo luminoso na pele/máscara (Técnico de Radioterapia)
Acompanhamento	51- Checagem da identificação do paciente (Técnico de Enfermagem/Médico/Enfermeiro) 52- Checagem independente da administração de medicamentos por outro profissional (Técnico de Enfermagem/Enfermeiro) 53- Checagem da disponibilidade na Radioterapia do prontuário de paciente com anestesia (Técnico de Enfermagem)	
Alta	61- Checagem da identificação do paciente (Médico Titular)	
Outros	71- Programa de Manutenção Preventiva de máquinas e equipamentos (Físico Coordenador) 72- Programa de Garantia de Qualidade nas máquinas (Físico Coordenador) 73- Disponibilização de cadeiras de rodas (Enfermeira Coordenadora) 74- Disponibilização de EPI's (Enfermeira Coordenadora)	



Int J Radiation Oncol Biol Phys, Vol. 84, No. 3, pp. e263–e269, 2012

Quality Control Quantification (QCQ): A Tool to Measure the Value of Quality Control Checks in Radiation Oncology

Eric C. Ford, PhD,^{*} Stephanie Terezakis, MD,^{*} Annette Souranis,^{*} Kendra Harris, MD,^{*} Hiram Gay, MD,[†] and Sasa Mutic, PhD[‡]

^{*}Department of Radiation Oncology and Molecular Radiation Sciences, Johns Hopkins University, Baltimore, Maryland; and [†]Department of Radiation Oncology, Washington University, St. Louis, Missouri

Received Dec 23, 2011, and in revised form Mar 21, 2012

Fig. 2. Effectiveness of each individual quality control (QC) check for detecting the reported high severity incidents. IMRT = intensity modulated radiation therapy; EPID = Electronic Portal Imaging Device; SSD = Source-to-Skin Distance; CT = Computed Tomography; QA = Quality Assurance.

- Mesmo com todas barreiras implementadas, estima-se que a efetividade global seja de 97%
- Combinação eficaz de barreiras (ordem > número)
- Dosimetria in-vivo (pouco usado) X QA IMRT por paciente (muito usado)

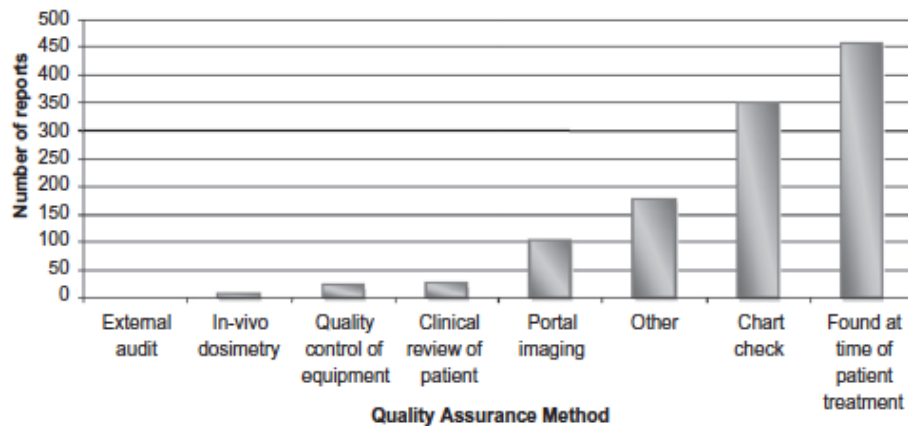


Fig. 2. Quality assurance method by which the incident was detected.

Radiation Oncology Safety Information System (ROSIS) – Profiles of participants and the first 1074 incident reports

Joanne Cunningham ^{a,*}, Mary Coffey ^a, Tommy Knöös ^b, Ola Holmberg ^c

^aDiscipline of Radiation Therapy, School of Medicine, Trinity College, Dublin, Ireland; ^bRadiation Physics, Skåne University Hospital and Medical Radiation Physics, Lund University, Sweden; ^cRadiation Protection of Patients Unit, Radiation Safety and Monitoring Section, Division of Radiation, Transport and Waste Safety, International Atomic Energy Agency, Vienna, Austria

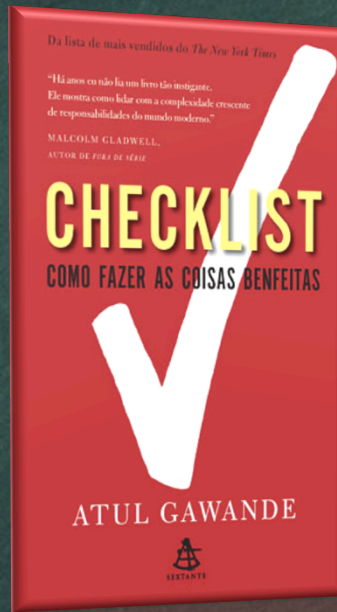


- 2 principais barreiras:
 - Revisão de ficha pelo físico/dosimetrista (pré, pós e durante tratamento)
 - Detecção durante tratamento pelo técnico de radioterapia
- Limitações de algumas barreiras: dosimetria in vivo (↓ custo-benefício) e auditoria externa (importante para QA, mas ineficaz para QC)
- “Profissionais devem trabalhar com atenção”: barreira menos tangível, mas é um elemento importante da cultura de segurança.

AGENDA

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- O que é "barreira de segurança"?
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CHECKLIST



RECOMENDAÇÕES GERAIS:

- 5-9 itens, não demorar mais que 60-90 segundos para preencher
- Redação deve ser simples e objetiva, conter itens vitais, caber em 1 página, não conter cores desnecessárias, escrito em caixa alta, baixa para facilitar leitura (fonte "Helvetica"), não conter "e" ou "ou" e assinalar com iniciais (ao invés de ✓)

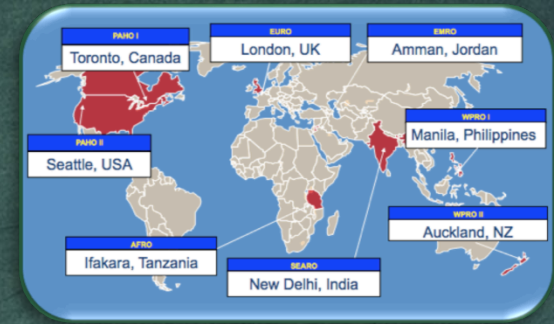


Table 5. Outcomes before and after Checklist Implementation, According to Site.*

Site No.	No. of Patients Enrolled		Surgical-Site Infection		Unplanned Return to the Operating Room		Pneumonia		Death		Any Complication	
	Before	After	Before	After	Before	After	Before	After	Before	After	Before	After
1	524	598	4.0	2.0	4.6	1.8	0.8	1.2	1.0	0.0	11.6	7.0
2	357	351	2.0	1.7	0.6	1.1	3.6	3.7	1.1	0.3	7.8	6.3
3	497	486	5.8	4.3	4.6	2.7	1.6	1.7	0.8	1.4	13.5	9.7
4	520	545	3.1	2.6	2.5	2.2	0.6	0.9	1.0	0.6	7.5	5.5
5	370	330	20.5	3.6	1.4	1.8	0.3	0.0	1.4	0.0	21.4	5.5
6	496	476	4.0	4.0	3.0	3.2	2.0	1.9	3.6	1.7	10.1	9.7
7	525	585	9.5	5.8	1.3	0.2	1.0	1.7	2.1	1.7	12.4	8.0
8	444	584	4.1	2.4	0.5	1.2	0.0	0.0	1.4	0.3	6.1	3.6
Total	3733	3955	6.2	3.4	2.4	1.8	1.1	1.3	1.5	0.8	11.0	7.0
P value			<0.001		0.047		0.46		0.003		<0.001	

* The most common complications occurring during the first 30 days of hospitalization after the operation are listed. Bold type indicates values that were significantly different (at $P < 0.05$) before and after checklist implementation, on the basis of P values calculated by means of the chi-square test or Fisher's exact test. P values are shown for the comparison of the total value after checklist implementation as compared with the total value before implementation.

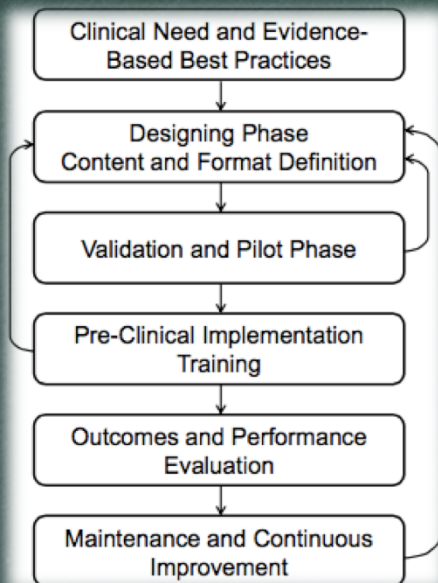
Surgical Safety Checklist



Before induction of anaesthesia (with at least nurse and anaesthetist)	Before skin incision (with nurse, anaesthetist and surgeon)	Before patient leaves operating room (with nurse, anaesthetist and surgeon)
<p>Has the patient confirmed his/her identity, site, procedure, and consent?</p> <input type="checkbox"/> Yes	<p>Confirm all team members have introduced themselves by name and role.</p> <p>Confirm the patient's name, procedure, and where the incision will be made.</p>	<p>Nurse Verbally Confirms:</p> <ul style="list-style-type: none"> The name of the procedure Completion of instrument, sponge and needle counts Specimen labelling (read specimen labels aloud, including patient name) Whether there are any equipment problems to be addressed
<p>Is the site marked?</p> <input type="checkbox"/> Yes <input type="checkbox"/> Not applicable	<p>Has antibiotic prophylaxis been given within the last 60 minutes?</p> <input type="checkbox"/> Yes <input type="checkbox"/> Not applicable	<p>To Surgeon, Anaesthetist and Nurse:</p> <ul style="list-style-type: none"> What are the key concerns for recovery and management of this patient?
<p>Is the anaesthesia machine and medication check complete?</p> <input type="checkbox"/> Yes	<p>Anticipated Critical Events</p> <p>To Surgeon:</p> <ul style="list-style-type: none"> What are the critical or non-routine steps? How long will the case take? What is the anticipated blood loss? <p>To Anaesthetist:</p> <ul style="list-style-type: none"> Are there any patient-specific concerns? <p>To Nursing Team:</p> <ul style="list-style-type: none"> Has sterility (including indicator results) been confirmed? Are there equipment issues or any concerns? 	
<p>Is the pulse oximeter on the patient and functioning?</p> <input type="checkbox"/> Yes	<p>Is essential imaging displayed?</p> <input type="checkbox"/> Yes <input type="checkbox"/> Not applicable	
<p>Does the patient have a:</p> <p>Known allergy?</p> <input type="checkbox"/> No <input type="checkbox"/> Yes		
<p>Difficult airway or aspiration risk?</p> <input type="checkbox"/> No <input type="checkbox"/> Yes, and equipment/assistance available		
<p>Risk of >500ml blood loss (7ml/kg in children)?</p> <input type="checkbox"/> No <input type="checkbox"/> Yes, and two IVs/central access and fluids planned		

Medical Physics Practice Guideline 4.a: Development, implementation, use and maintenance of safety checklists

Task Group Authors: Luis E. Fong de los Santos, Chair, Suzanne Evans, Eric C. Ford, James E. Gaiser, Sandra E. Hayden, Kristina E. Huffman, Jennifer L. Johnson, James G. Mechalakos, Robin L. Stern, Stephanie Terezakis, Bruce R. Thomadsen, Peter J. Pronovost, Lynne A. Fairbent, AAPM Staff



Checklist fornece proteção contra falhas de memória e atenção (distrações) a partir do estabelecimento de um processo sistemática de verificações e aumenta a disciplina para melhoria de desempenho

A CHECKLIST FOR CHECKLISTS		
Development	Drafting	Validation
<input type="checkbox"/> Do you have clear, concise objectives for your checklist? Is each item: <input type="checkbox"/> A critical safety step and in great danger of being missed? <input type="checkbox"/> Not adequately checked by other mechanisms? <input type="checkbox"/> Actionable, with a specific response required for each item? <input type="checkbox"/> Designed to be read aloud as a verbal check? <input type="checkbox"/> One that can be affected by the use of a checklist? Have you considered: <input type="checkbox"/> Adding items that will improve communication among team members? <input type="checkbox"/> Involving all members of the team in the checklist creation process?	Does the Checklist: <input type="checkbox"/> Utilize natural breaks in workflow (pause points)? <input type="checkbox"/> Use simple sentence structure and basic language? <input type="checkbox"/> Have a title that reflects its objectives? <input type="checkbox"/> Have a simple, uncluttered, and logical format? <input type="checkbox"/> Fit on one page? <input type="checkbox"/> Minimize the use of color? Is the font: <input type="checkbox"/> Sans serif? <input type="checkbox"/> Upper and lower case text? <input type="checkbox"/> Large enough to be read easily? <input type="checkbox"/> Dark on a light background? <input type="checkbox"/> Are there fewer than 10 items per pause point? <input type="checkbox"/> Is the date of creation (or revision) clearly marked?	Have you: <input type="checkbox"/> Trialed the checklist with front line users (either in a real or simulated situation)? <input type="checkbox"/> Modified the checklist in response to repeated trials? Does the checklist: <input type="checkbox"/> Fit the flow of work? <input type="checkbox"/> Detect errors at a time when they can still be corrected? <input type="checkbox"/> Can the checklist be completed in a reasonably brief period of time? <input type="checkbox"/> Have you made plans for future review and revision of the checklist?

Implementation of Electronic Checklists in an Oncology Medical Record: Initial Clinical Experience

By Kevin V. Albuquerque, MD, Alexis A. Miller, MD, and John C. Roeske, PhD

Department of Radiation Oncology, Loyola University of Chicago Medical Center, Maywood, IL; Department of Radiation Oncology, Illawarra Cancer Care Centre, Wollongong, New South Wales, Australia

- Aumento de disciplina
- Uso mais eficiente do tempo de máquina
- Menor ansiedade do paciente.

Enhancing the role of case-oriented peer review to improve quality and safety in radiation oncology: Executive summary.

Marks LB, Adams RD, Pawlicki T, Blumberg AL, Hoopes D, Brundage MD, Fraass BA.

Pract Radiat Oncol. 2013 Jul;3(3):149-156.

PMID: 24175002 **Free PMC Article**

Table 2 Prioritization of targets for peer review

Item for peer review	Prioritization	Rationale for priority level	Timing of peer review and associated comments	Example clinical situations where peer review is anticipated to be particularly useful
1) Decision to include radiation as part of treatment	Level 2	Guidelines often exist, but these decisions are often individualized	Pretherapy preferred	Unusual/nonguideline cases
2) General radiation treatment approach	Level 3	There are many guidelines and best practice statements that address this issue. If standard dose/volume constraints are respected, patient risks are low regardless of the specific RT approach taken.	Preradiation preferred. Altering some aspect of the treatment approach once RT has been initiated can be cumbersome (eg, image guidance approach), while other aspects are more easily changed during RT. The safest environment is one where mid-treatment changes are minimized.	Retreatment cases
3) Target definition*	Level 1	Every patient's tumor is different and visualization on different types of images can vary. Each image fusion is unique.	Pretreatment peer review of how targets are defined (eg, which images and which "pixels") is critical as mistargeting can lead to poor clinical outcomes. Preplanning review is ideal but is not critical for every case.	Tight margins; eg, SBRT
4) Normal tissue image segmentation	Level 3	There are atlases for normal tissues.	Review of normal tissues can be done during RT since the risks are less (especially for fractionated regimens). Normal tissue pre-RT peer review needed for single and hypofractionation cases.	Tight margins; eg, SBRT
5) Planning directive (dose/volume goals/constraints for targets and normal tissues)	Level 2	Patient risks are low if standard dose/volume limits are respected. Guidelines and best practice recommendations often exist, but these decisions are often individualized.	Preplanning or pretreatment	
6) Technical plan quality	Level 2	Normal tissue dose/volume guidance documents are generally available, but the compromises between normal tissue vs target doses are often patient specific.	For conventional fractionation, this may be acceptable to perform during RT, as there is usually an opportunity to alter the plan. The safest environment is one where mid-treatment changes are minimized.	IMRT, SBRT
7) Treatment delivery (eg, patient setup)	First day is Level 1, especially for curative cases. Other days are Level 2.	The first day's setup is critical to avoid systematic errors and their propagation.	Therapist peer review of setup must be done pre-RT for the first fraction, and ideally for all subsequent fractions. Portal or localization image peer review must be done before the second treatment. Physicist and physician involved with pretreatment QA for complex cases (eg, SBRT).	IMRT (since portal or localization imaging often does not provide independent assessment of target volume location)

Level 1 indicates highest priority for peer review (where there are marked interpatient variations), Level 2 next highest (where there are often guidelines/atlas to aid in decision), and Level 3 the next (other targets for peer review).

RT, radiation therapy; IMRT, intensity modulated radiation therapy; SBRT, stereotactic body radiation therapy.

* Target definition includes the decision regarding the need for multimodality imaging, the fusion of the images, and the target definitions on the images.

AAPM Task Group 103 report on peer review in clinical radiation oncology physics.

Halvorsen PH, Das IJ, Fraser M, Freedman DJ, Rice RE 3rd, Ibbott GS, Parsai EI, Robin TT Jr, Thomadsen BR; American Association of Physicists in Medicine.

J Appl Clin Med Phys. 2005 Fall;6(4):50-64. Epub 2005 Nov 21.

PMID: 16421500

CHART REVIEW CHECKLIST

DATE: 11-15-03

Facility Name: Community Cancer Center

Physicist name: Mary Precise

Description	Patient number:									
	1		2		3		4		5	
Prescription: The chart contains a signed and dated prescription, including:	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
(i) Treatment site	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
(ii) Planned total dose and fractionation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
(iii) Modality and energy	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
(iv) Normalization (e.g. % isodose, depth)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Treatment plan: If a graphic dose distribution plan was generated, the plan matches the prescription (modality/energy/dose/site) and has been signed by the physician and physicist.	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Meter setting: The monitor unit calculation is clearly documented, and checked by another person or another method before the 3 rd fraction or 20% of the total dose.	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Set-up: The setup information is clearly and comprehensively documented (e.g., setup distance, field parameters, positioning equipment, diagrams / photos).	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Dose delivery: The prescribed and delivered dose agree, and accumulated dose to relevant critical structures is documented. There is documentation of a weekly chart check by the physicist or a designee, and a final check by the physicist at completion of treatment.	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Brachytherapy: If the treatment included brachytherapy, there is documentation of:	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
(i) A written directive prior to treatment	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
(ii) Independent source strength verification (in chart or log book)	NEA	<input checked="" type="checkbox"/>	NEA	<input checked="" type="checkbox"/>	NEA	<input checked="" type="checkbox"/>	NEA	<input checked="" type="checkbox"/>	NEA	<input checked="" type="checkbox"/>
(iii) Adequate localization of source(s)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
(iv) Post-implant dosimetry (prostate seeds)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Comments:	No setup photos.						4 field + implant			

Privileged and Confidential Peer Review

Fig. 4. Chart review checklist. The reviewer can use this as a tool to ensure that all charts are consistently and thoroughly evaluated.

FIVE RIGHTS

Right Drug

Right Patient

Right Dose

Right Route

Right Time



TIMEOUT

Pausa imediatamente antes da execução de uma tarefa crítica para verificar possíveis discrepâncias



Exemplos em radioterapia:

1) Técnico antes de iniciar a entrega do tratamento:

- Identificação do paciente
- Identificação da região de tratamento
- Verificação dos parâmetros e posicionamento

2) Físico antes da calibração dosimétrica do acelerador

- Parâmetros do setup (SSD, tam. de campo, energia, etc)
- Conexões e funcionalidade do conjunto dosimétrico

TIMEOUT

What's **{WRONG}** with this picture?



How **{NOT}** to do a time out!

NO INTERRUPTION ZONE (NIZ)

"Zona livre de interrupção" => diminuir
distrações ("lapsos") no ambiente de trabalho

- Ausência de telefones e acesso às redes sociais
- Grupo de pessoas conversando sobre assuntos gerais
- Condições físicas (ruídos, luminosidade, temperatura, etc)



Locais radioterapia: console, planejamento,
medicação, etc

Resultados positivos na aviação ("cockpit
estéril" - FAA 1981) e em UTI*



Resumindo...

O que é "controle de qualidade de processo"?

- QM x QA x QC
- Equipamentos, processos e pessoas \Rightarrow padrões de desempenho devem estar bem definidos e claros a todos

O que é "barreira de segurança"?

- Modelo do Queijo Suíço
- Checagens, procedimentos administrativos, dispositivos físicos, software

Ferramentas para determinar e executar barreiras

- Mapa de processo, aprendizagem com incidentes e FMEA
- Checklist, timeout e NIZ

Exercício

1. Patient assessment ☺

- 1.1 Verification of patient ID by two methods
- 1.2 Diagnosis definition including imaging and outside records
- 1.3 Review and verification of pathology report
- 1.4 Physical exam
- 1.5 Clinical staging
- 1.6 Evaluation of patient medical conditions
- 1.7 Evaluation of special needs for radiotherapy (e.g., pacemakers)
- 1.8 Evaluation of previous radiotherapy treatments (including treatment port images and planning records)
- 1.9 Evaluation of other treatment modalities (i.e., chemo, surgery)
- 1.10 Decision to treat
- 1.11 Entering patient information into radiation oncology information system
- 1.12 Selection of clinical protocol
- 1.13 Selection of clinical trial (if any)
- 1.14 Patient consent
- 1.15 Patient education
- 1.16 Insurance evaluation
- 1.17 Peer review of treatment decision (e.g., tumor board)
- 1.18 Fiducial placement
- 1.19 Evaluation/ordering of workup for IV contrast
- 1.20 Social work and nutritional assessment
- 1.21 Other

2. Imaging for RT planning ☺

- 2.1 Verification of patient ID
- 2.2 Imaging decision (type and technique)
- 2.3 Physician directive for imaging technique and immobilization
- 2.4 Patient positioning
- 2.5 Construction of immobilization and ancillary devices
- 2.6 Documentation of patient positioning and immobilization and ancillary devices
- 2.7 Contrast administration
- 2.8 Primary image acquisition (CT)
- 2.9 Marking reference point on patient and/or localization device and in software
- 2.10 Utilization of other imaging modalities (i.e., MRI, US, PET)
- 2.11 Transfer of images to treatment planning system
- 2.12 Transfer of images to archiving system
- 2.13 Other

3. Treatment planning

- 3.1 Registration of image sets
- 3.2 Delineation of target(s)
- 3.3 Delineation of organs-at-risk
- 3.4 Preliminary prescription parameters, constraints & technique (i.e., physician intent)
- 3.5 Physics consult
- 3.6 Isocenter definition
- 3.7 Dose distribution optimization
- 3.8 Dose distribution calculation
- 3.9 Preliminary evaluation of treatment plan by physicist
- 3.10 Preliminary evaluation of treatment plan by physician
- 3.11 Iteration of treatment plan
- 3.12 Set up for image-guidance/motion management
- 3.13 Final plan and prescription approval by physician
- 3.14 Plan information transfer to radiation oncology information system
- 3.15 Scheduling treatment session(s)
- 3.16 Archiving of the treatment plan (images, RT dose and RT structures)
- 3.17 Other

4. Pretreatment review and verification

- 4.1 Physics plan review
- 4.2 Independent dose calculation
- 4.3 Plan data transfer to treatment unit
- 4.4 Verification of parameters at treatment unit
- 4.5 Pretreatment patient specific plan measurement (e.g., IMRT QA)
- 4.6 Physics verification/approval
- 4.7 Physician plan peer review (e.g., chart rounds)
- 4.8 Therapists chart check
- 4.9 Other

5. Treatment delivery ☺

- 5.1 Verification of patient ID
- 5.2 Time-out (e.g., verification of clinical parameters, treatment consent, etc.)
- 5.3 Prepare patient for treatment (medications, IV, anesthesia, sedation, etc.)
- 5.4 Selection of intended course/session
- 5.5 Plan information transfer to treatment unit
- 5.6 Selection of intended field
- 5.7 Patient positioning and immobilization
- 5.8 Setting treatment accessories and treatment unit parameters

- 5.9 Validation of treatment accessories and treatment unit parameters
- 5.10 Image-guided verification
- 5.11 Utilization of motion management system
- 5.12 Physician verification before treatment
- 5.13 *In vivo* dosimetry
- 5.14 Treatment delivery
- 5.15 Intratreatment monitoring
- 5.16 Record of treatment delivery
- 5.17 Monitor evaluation of special needs (e.g., pacemaker protocol)
- 5.18 Other

6. On-treatment quality management ☺

- 6.1 Initial physics check
- 6.2 Review of portal images
- 6.3 Review of localization images (including CBCT)
- 6.4 Adaptive replanning
- 6.5 Weekly physics chart check,
- 6.6 Weekly physician management visit, social work, nutrition and nursing
- 6.7 Weekly therapist chart check
- 6.8 Other

7. Post-treatment completion ☺

- 7.1 Verification of patient ID
- 7.2 Final chart check
- 7.3 End of treatment summary to patient and referring providers
- 7.4 Follow up imaging for treatment evaluation
- 7.5 Follow up lab work
- 7.6 Follow up patient management visit
- 7.7 Other

8. Equipment and software quality management

- 8.1 Acceptance testing
- 8.2 Commissioning
- 8.3 Application/system training
- 8.4 Ongoing quality management (e.g., daily, monthly, annual QA, etc.)
- 8.5 Preventive maintenance (PM)
- 8.6 Equipment repair and software changes/updates
- 8.7 Post-repair/changes verification
- 8.8 Documentation of quality management
- 8.9 Respond to medical device alerts
- 8.10 Other

EBRT: 91 etapas (35 SB ou 38,5%)

BDT: 88 etapas (32 SB ou 36,4%)

1. Patient assessment ☺

SB	1.1	Verification of patient ID by two methods
	1.2	Diagnosis definition including imaging and outside records
SB	1.3	Review and verification of pathology report
	1.4	Physical exam
	1.5	Clinical staging
	1.6	Evaluation of patient medical conditions
	1.7	Evaluation of special needs for radiotherapy (e.g., pacemakers)
	1.8	Evaluation of previous radiotherapy treatments (including treatment port images and planning records)
	1.9	Evaluation of other treatment modalities (i.e., chemo, surgery)
	1.10	Decision to treat
	1.11	Entering patient information into radiation oncology information system
	1.12	Selection of clinical protocol
	1.13	Selection of clinical trial (if any)
	1.14	Patient consent
	1.15	Patient education
	1.16	Insurance evaluation
SB	1.17	Peer review of treatment decision (e.g., tumor board)
	1.18	Fiducial placement
SB	1.19	Evaluation/ordering of workup for IV contrast
	1.20	Social work and nutritional assessment
	1.21	Other

2. Imaging for RT planning ☺

SB	2.1	Verification of patient ID
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	2.3	Physician directive for imaging technique and immobilization
	2.4	Patient positioning
	2.5	Construction of immobilization and ancillary devices
	2.6	Documentation of patient positioning and immobilization and ancillary devices
	2.7	Contrast administration
	2.8	Primary image acquisition (CT)
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	3.8	Dose distribution calculation
SB	3.9	Preliminary evaluation of treatment plan by physicist
SB	3.10	Preliminary evaluation of treatment plan by physician
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SB	4.6	Physics verification/approval
SB	4.7	Physician plan peer review (e.g., chart rounds)
SB	4.8	Therapists chart check
	4.9	Other

5. Treatment delivery ☺

SB	5.1	Verification of patient ID
SB	5.2	Time-out (e.g., verification of clinical parameters, treatment consent, etc.)
	5.3	Prepare patient for treatment (medications, IV, anesthesia, sedation, etc.)
	5.4	Selection of intended course/session
	5.5	Plan information transfer to treatment unit
	5.6	Selection of intended field
	5.7	Patient positioning and immobilization
	5.8	Setting treatment accessories and treatment unit parameters

SB	5.9	Validation of treatment accessories and treatment unit parameters
SB	5.10	Image-guided verification
	5.11	Utilization of motion management system
SB	5.12	Physician verification before treatment
SB	5.13	<i>In vivo</i> dosimetry
	5.14	Treatment delivery
SB	5.15	Intratreatment monitoring
	5.16	Record of treatment delivery
	5.17	Monitor evaluation of special needs (e.g., pacemaker protocol)
	5.18	Other

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SB	6.5	Weekly physics chart check,
SB	6.6	Weekly physician management visit, social work, nutrition and nursing
SB	6.7	Weekly therapist chart check
	6.8	Other

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SB	7.1	Verification of patient ID
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	7.3	End of treatment summary to patient and referring providers
	7.4	Follow up imaging for treatment evaluation
	7.5	Follow up lab work
	7.6	Follow up patient management visit
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SB	8.1	Acceptance testing
SB	8.2	Commissioning
	8.3	Application/system training
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SB	8.5	Preventive maintenance (PM)
	8.6	Equipment repair and software changes/updates
SB	8.7	Post-repair/changes verification
	8.8	Documentation of quality management
	8.9	Respond to medical device alerts
	8.10	Other

Obrigado!!!

MINI-CURSO:
"Ferramentas de gestão de risco em radioterapia"

Físico Lucas Augusto Radicchi

Físico Médico em Radioterapia - Hospital de Câncer de Barretos

Mestrando em Engenharia de Produção (Gestão da Qualidade) - PPGE/UFSCar

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XXI CONGRESSO BRASILEIRO DE FÍSICA MÉDICA

24 a 27 de agosto de 2016

Florianópolis, Santa Catarina