



Clinical audits for breast cancer radiotherapy in Norway

multidisciplinary, peer review, quality improvement

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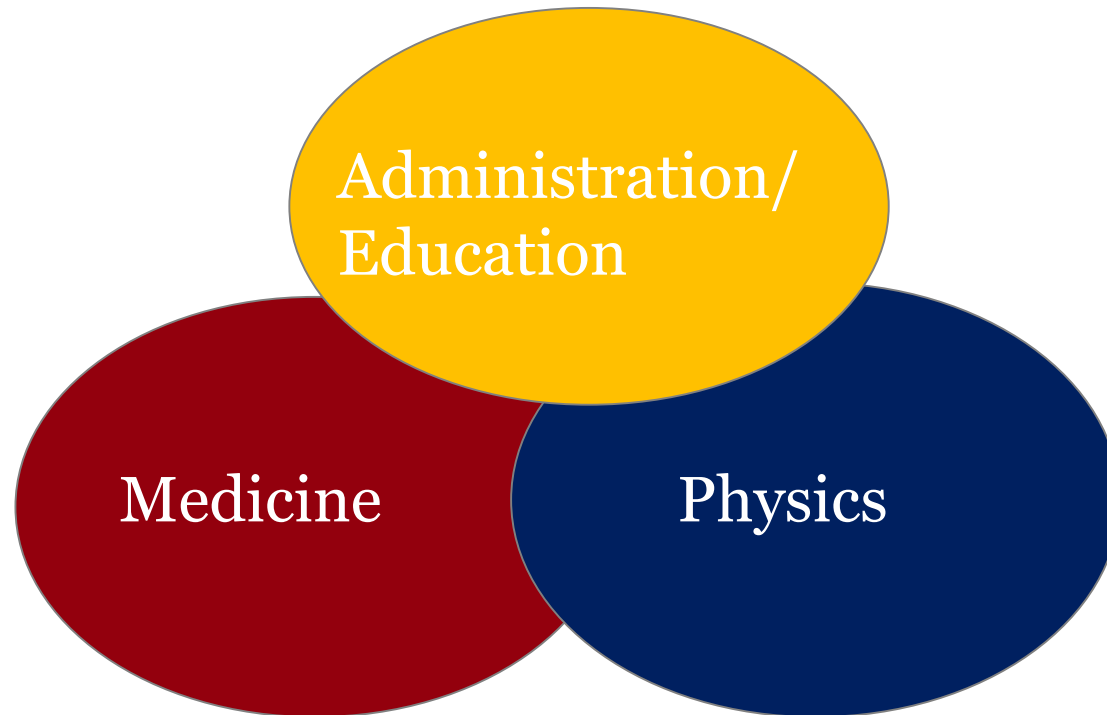
Statens strålevern

Norwegian Radiation Protection Authority

www.nrpa.no

Quality assurance in radiotherapy in Norway; the KVIST initiative

- The KVIST group was established at NRPA in 2000 and works explicitly with national quality assurance projects in radiotherapy.



- One project has been to establish a national system for clinical auditing in radiotherapy.



Clinical audit

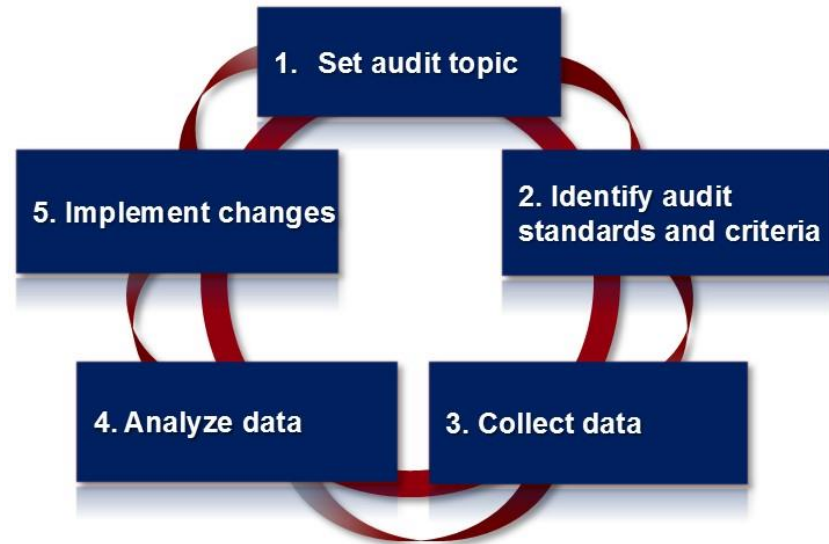
“Clinical audit is a quality improvement process that seeks to improve patient care and outcomes through systematic review of patient care against explicit criteria and the implementation of change.”

NICE 2002

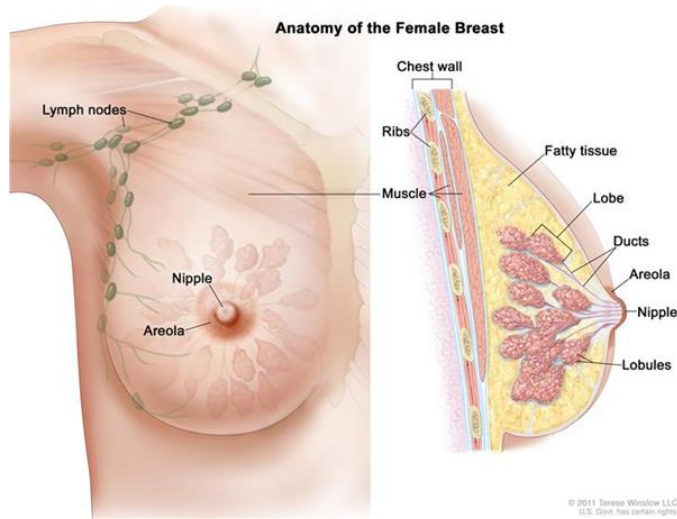
Clinical audit has two goals:

1. *quality control*
clinical practice compliance to national or local guidelines
2. *quality improvement*
clinical evaluations, multidisciplinary discussions, leads to the implementation of change in clinical practice or guidelines when indicated

The audit circle

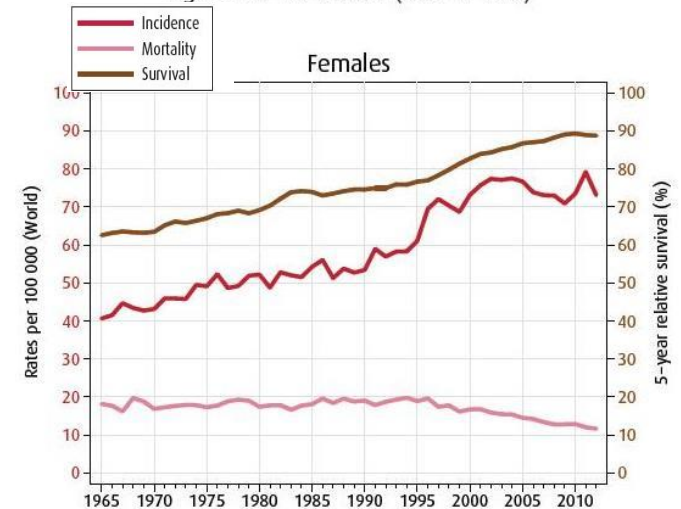


Breast cancer in Norway



National Cancer Institute © 2011 Terese Winslow LLC, U.S. Govt.

Figure 10-M: Breast (ICD-10 C50)

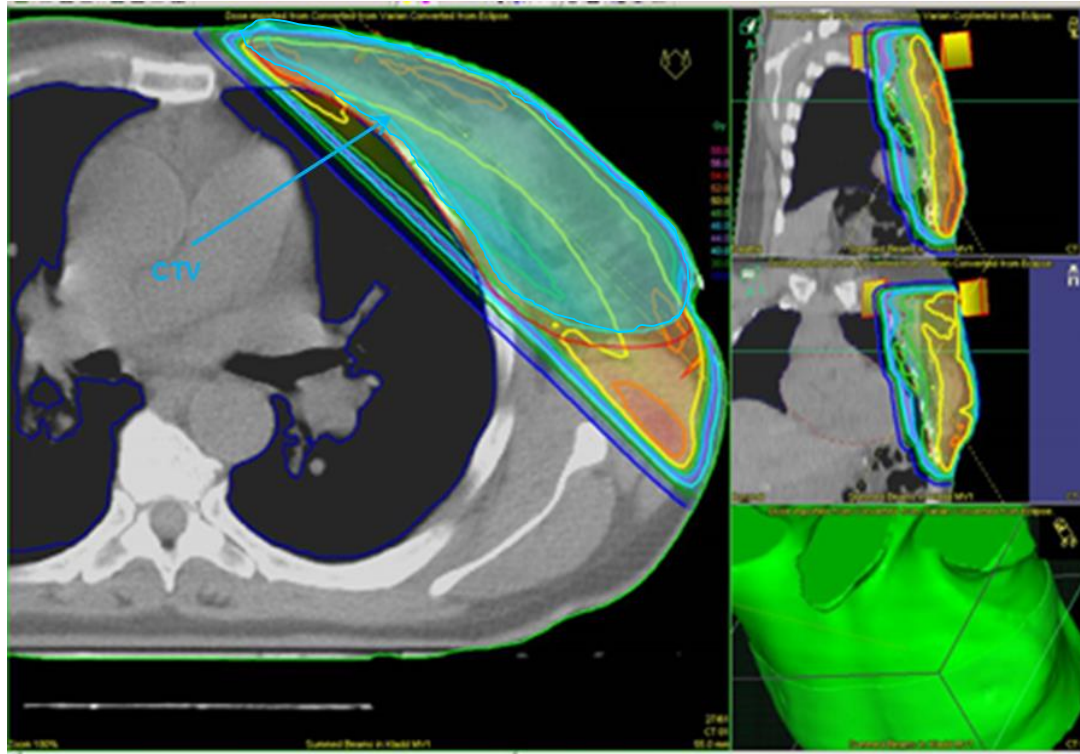


Larsen IK. Cancer in Norway 2014

- The breast cancer incidence in Norway has increased through the last decades.
- The 5 – year relative survival is nearly 90% and increasing.
- The number of long term breast cancer survivors having had RT is increasing.



Radiotherapy treatment plan for breast cancer; the isodose chart

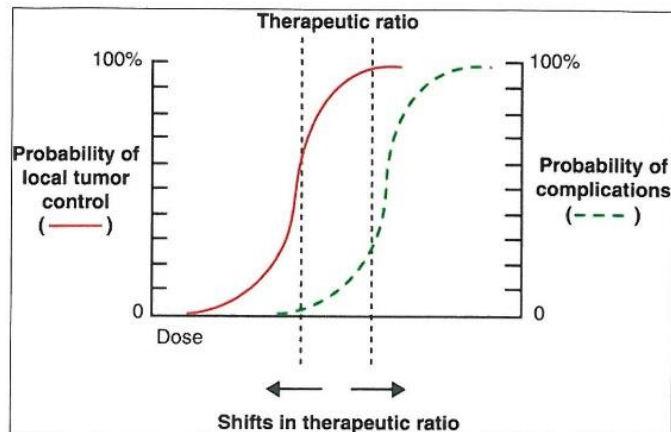


- The MV attenuation and the shape of the chest wall causes heterogenic dose within the defined treatment volume, CTV (turquoise outlining/area)
- Yellow line represents the area of 100% isodose line (prescribed dose)
- Planning goal: The dose within the treatment volume shall be between 95% and 107% of the prescribed dose



The principal challenges in RT:

- Deliver a sufficient dose to the tumour to cure cancer or control local tumour growth (TCP)
- Avoid or minimize complications to normal tissue around the tumor (NTCP):
 - Darby et al 2012: The risk of developing cardio vascular disease after BCRT is increasing by 7% for each Gy to the heart
 - Grantzau 2014: The risk of developing secondary lung cancer after BCRT is increasing by 8% for each Gy to the lung



Background

- The Norwegian Breast Cancer Group (NBCG) develop evidence based national guidelines for RT balancing the goal to cure or controlling the tumour growth against the risk of unwanted late effects after treatment.
- The guidelines are implemented at all nine RT departments in Norway

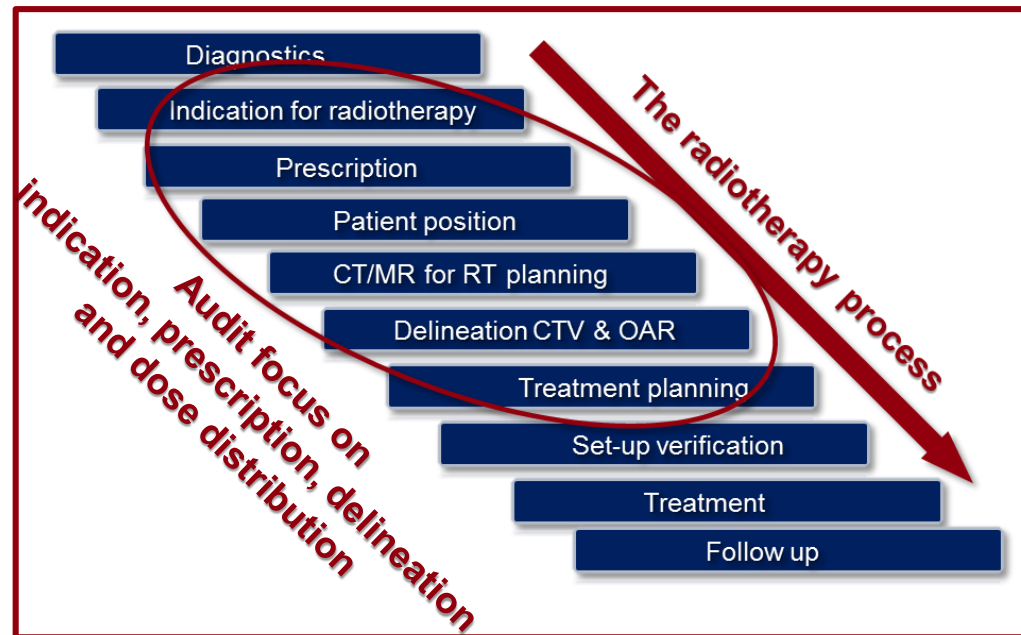
However...

- In 2008, a national workshop indicated some deviance between clinical practice and guideline principles regarding:
 - definition of treatment volumes and the heart
 - dose distribution for selected patient cases
- To assess compliance with the national RT guidelines for a larger sample of patients, the KVIST group, the NBCG and the RT departments decided to carry out a national audit.



Materials and methods

- Audit topic: Post-surgery RT for breast cancer
- Audit standard: The NCCG guidelines
- Audit criteria:
 - Indication for RT
 - Treatment technic
 - CT for RT treatment planning
 - Definitions of treatment volumes and organs at risk
 - Dose and homogeneity to the treatment volumes
 - Dose to the heart and lung



Materials and methods

- Invitations to participate were sent
 - Volunteer participation
- Site-visits by multi-disciplinary external audit teams:
 - 7 auditors to each hospital (total pool of 20 auditors)
- 20 consecutive patients (starting treatment 1st of January 2009) from each RT departments included:
 - 180 (174-171) patient files evaluated qualitatively and quantitatively (10% of patient treated for post-surgery RT for breast cancer in Norway in 2009)

Example qualitative evaluation

| 3.2.2 Definition of CTV | |
|-------------------------|--|
| 3.2.2.1 | CTVbreast/chestwall adequat in depth (to m. resp costae) |
| 3.2.2.2 | CTVbreast/chestwall caudal border |
| 3.2.2.3 | CTVbreast/chest wall cran border (axillary tail included?) |
| 3.2.2.4 | CTVbreast/chest wall med border |
| 3.2.2.5 | CTVbreast/chest wall lateral / posterior border |
| 3.2.2.12 | Margins from CTV to PTV |
| 3.2.2.13 | Conclusion: Definition of CTV |

Example quantitative evaluation

| 3.2.3 Dose to CTV breast/chest wall , DVH (50Gy to CTV) | |
|---|----------------------|
| 3.2.3.1 | Mean dose (Gy) |
| 3.2.3.3 | Max dose to CTV (Gy) |
| 3.2.3.4 | Min dose to CTV (Gy) |
| 3.2.5 Dose to the heart and lung | |
| 3.2.5.5 | The heart, V25Gy (%) |
| 3.2.5.8 | Left lung V20Gy (%) |



Audit results and analysis:

- Audit results based on auditor's clinical evaluation (qualitative) and the evaluation of dose parameters (quantitative) to be:
 - 1: In accordance with the NBCG guidelines
 - 2: Small deviances to the NBCG guidelines
 - 3: Large deviances to the NBCG guidelines



Audit results; clinical evaluation

For 87% of the patient files, all audit criteria were achieved or with small deviance from the national guidelines

The auditor's evaluations of audit criteria against audit standard

| | 1: Achieved | | 2: Small deviations | | Sum 1+2 | |
|---|-------------|--------|---------------------|-------|---------|-------|
| | n | (%) | n | (%) | n | (%) |
| Indication to RT | 173 | (99,5) | 1 | (0,5) | 174 | (100) |
| Prescription | 170 | (98) | 4 | (2) | 174 | (100) |
| CT for dose planning | 172 | (99) | 2 | (1) | 174 | (100) |
| Definition treatment volume | 87 | (50) | 77 | (44) | 164 | (94) |
| Definition heart | 88 | (51) | 75 | (43) | 163 | (94) |
| Dose prescription | 174 | (100) | 0 | (0) | 174 | (100) |
| Dose homogeneity within CTV | 152 | (89) | 19 | (11) | 171* | (100) |
| Dose constrains to the heart | 161 | (94) | 9 | (5) | 170* | (100) |
| Dose constrains to the ipsilateral lung | 167 | (98) | 4 | (2) | 171* | (100) |
| Patient files were all audit criteria were achieved | 44 | (26) | 106 | (61) | 150 | (87) |

* Dose data from 170-171 patients files were collected



Audit results; DVH-parameter evaluation

The evaluations of DVH-parameters against audit standards*

| | 1: Achieved | | 2: Small deviations | | Sum 1+2 | |
|---|-------------|-------|---------------------|------|---------|-------|
| | n | (%) | n | (%) | n | (%) |
| Mean dose to the treatment volumes | 171 | (100) | 0 | (0) | 171 | (100) |
| Minimum dose to the treatment volumes | 66 | (39) | 92 | (54) | 158 | (93) |
| Maximum dose to the treatment volumes | 155 | (91) | 12 | (7) | 167 | (98) |
| Dose constrains to heart ¹ | 155 | (91) | 10 | (5) | 165 | (96) |
| Dose constrains to ipsilateral lung ² | 152 | (89) | 13 | (7) | 165 | (96) |
| Patient files were all audit criteria were achieved completely or with small deviations | | | | | 131 | (77) |

* Data from 171 pat available

¹ V_{25Gy} heart < 5% V_{20Gy} lung ≤ 15 % (local RT) and ≤ 35% (loco-regional RT).

² $V_{20 Gy}$ ≤ 15 % local RT and ≤ 35 % for loco regional RT



Summary

- Clinical audits are welcomed in the Norwegian RT community
 - all RT departments participated voluntarily
- The auditors qualitative evaluation of the audit standards regarding dose homogeneity was less rigid than the DVH quantitative evaluation (87% vs 77%):
 - Suggesting that the auditors evaluated the clinical significance of a low or high dose within the treatment volume to be of minor importance regarding the expected clinical outcome?
 - Emphasizing the importance of both qualitative and quantitative evaluation of patient files followed by a multidisciplinary discussion during clinical audits



Summary

Audit standards were *achieved* for:

- the indication to RT
- the treatment technique
- Patient preparation to RT and CT for dose planning
- the dose prescriptions

Audit standards were *not completely achieved* in three areas:

- the definition of treatment volumes and heart for dose planning
- the dose homogeneity within the treatment volumes
- the dose constrains to the heart and lung



Conclusion;

Auditor's recommendations

- Improved guideline specifications are desired:
 - definition of treatment volumes and the heart
 - criteria for prioritizing the balance between dose homogeneity towards dose to heart and lung
 - improved techniques to reduce dose to the heart
- Repeated clinical audits:
 - Same audit topic
 - Focus on waiting times between surgery and RT
 - Focus on patient positioning (geometry) through the treatment course
- National workshops:
 - Practice on definition of treatment volumes and the heart
 - Practice on dose planning for selected patient cases (structure sets)



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