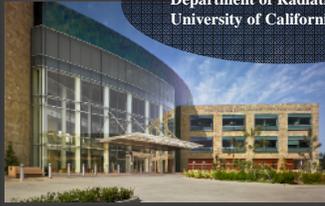


Quality Assurance

History, Current Status, and Future

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History of Quality

- Craftsmanship
 - ✓ Expert and apprentice
- European industrial revolution
 - ✓ Subdivided trades into multiple steps
- The U.S. departure to Taylor's system
 - ✓ Significant increase in productivity

A History of Managing for Quality: The Evolution, Trends, and Future Directions of Managing for Quality. Ed. J.M Juran, 1995 ASQC Quality Press

Quality in the U.S.

Telegraph and Telephony

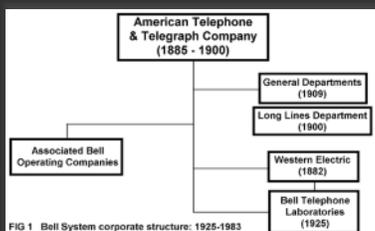


FIG 1 Bell System corporate structure: 1925-1983

From "Encyclopedia of Telecommunications" - Charles L. Brown.
Copyright © 1991 by Marcel Dekker, Inc.

Creating a Telephone system

- Engineering department
- Production department
- Inspection department
 - ✓ Sampling to inspect raw materials/products
 - ✓ Inspection to separate the good & bad

Juran. Early SQC – A historical supplement. 1997: Quality Progress

Parallels with Rad Onc

- Physicists entered the hospital
 - ✓ Craftsman
- Radiation treatments become 'routine'
 - ✓ Industrialization
- Quality = Checking parameters
 - ✓ Inspection

Improving Quality

- Bell Telephone Laboratories
 - ✓ Control Chart invented in 1924
 - ✓ Emphasis on the process
- Western Electric
 - ✓ Social science research (~ 1924)
 - ✓ Quality Management

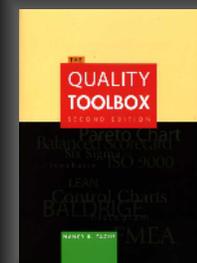
Adams & Butler. Manufacturing the Future – A history of Western Electric. 1999;Cambridge University Press.

WWII and Post-War Japan

- General MacArthur needed to rebuild Japan's communication system
- In 1948, the U.S. government invited Western Electric managers to Japan
- Management training courses started
 - ✓ Practical knowledge of quality control

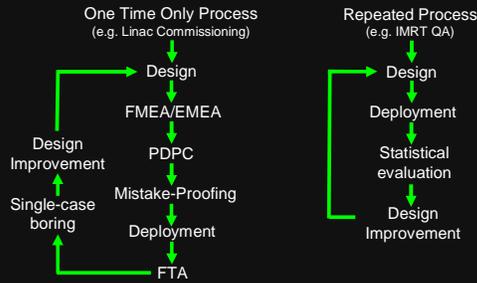
Japan's Most Important Export

- Japanese manufacturers' reputation for superior quality
- In 1986, a group of AT&T manufacturing officials visited Japan
 - ✓ Their goal... to 'learn' QA methods



~112 tools with variations

Different Tools for Different Problems



D Hutchison. *Quality Progress*, 1994.

Issues in Quality

- Two dimensions of quality
 - ✓ High-quality decision making
 - ✓ High-quality performance
- Decision making quality
 - ✓ Peer-review
- Performance quality
 - ✓ Process analysis

Where are we now?

- Measure and inspect against specifications
- Investigate incidents once they have occurred
 - ✓ Does charts rounds really improve quality?
- “If it ain’t broke, don’t fix it.”
 - ✓ This can lead to latent errors in a process that can be manifested long into the future
- Hard work and best efforts are the main mode of operation to improve quality

Typical Approach to Quality

IMRT Example

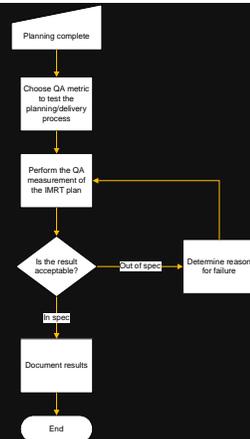
Within specifications
(don't worry about it)

– or –

Outside specifications
(something is wrong,
fix it, and re-measure)

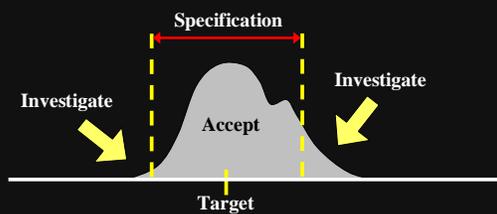
– or –

Getting close to specifications
(come back to it later)



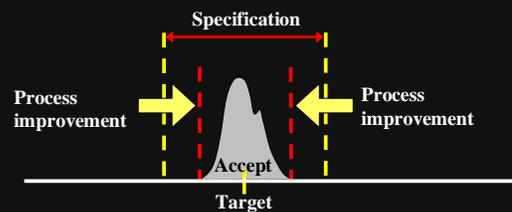
Action Levels

Current Approach to Quality



'Modern' Approach to Quality

Our Future Approach to Quality

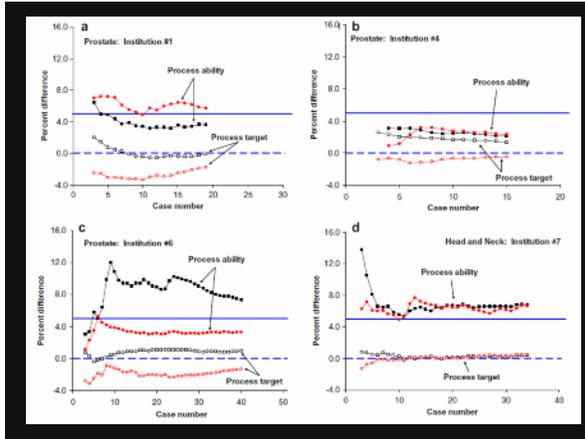


Variations in Quality

- Quality should be universally defined
- How reproducible is IMRT QA from institution to institution?
 - ✓ Measurements and independent computer calculations
- Use control charts as the process analysis tool

Investigation of IMRT QA

- 7 institutions with active IMRT programs
 - ✓ 4 academic
 - ✓ 3 community
- Each institution followed their in-house IMRT procedures
 - ✓ Treatment planning
 - ✓ Quality assurance
 - Point dose in phantom + IMSure



Two Control Charts

- Clinical specifications
 - ✓ Set process requirements
- Control chart limits
 - ✓ Quantify process performance

Pawlicki, Yoo, Court et al. Radiother Oncol 2008

What should we do?

- Efforts to improve decision-making should be focused on the process
 - ✓ Errors are evaluated as process problems, not people problems
- Implement a quality program rather than a detailed prescriptive focus on capability

What should we do?

- Understand the difference between clinical specifications and action levels
- Focus on understanding process performance
 - ✓ It is impossible to improve a process by comparing measurements to specifications

Where do we go from here?

1. Research on modern quality techniques
2. Educate radiation oncology leadership
3. Rapid Task Group publications
4. Close collaboration with vendors
5. Use resources outside of radiation oncology
6. Adopt a patient's (customer) view of quality

Pawlicki and Mundt. *Medical Physics*, 2007.