

Best Practices for Physics Plan and Chart Review: Report of AAPM TG 275

A Survey of Physics Plan Review Practices

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Disclosures & Acknowledgements

Disclosures:

Member of TG-275

Acknowledgements:

Eric Ford & TG-275 Members

Michael Woodward & AAPM Staff

Scott Harmsen

Survey Participants

TG275 - 4 Charges

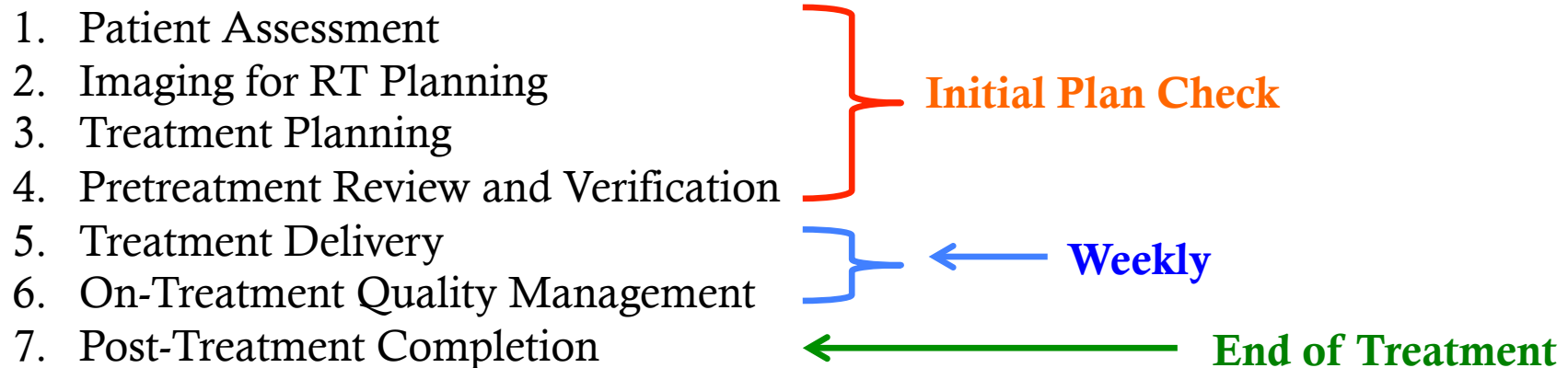
1. Review existing recommendations for physics checks and staff qualifications
2. Conduct a survey to determine current practices for physics checks
3. Provide risk-based recommendations for physics checks
4. Provide recommendations to vendors (i.e. systems design) for the physics check process

Survey Design

Consensus recommendations for incident learning database structures in radiation oncology.

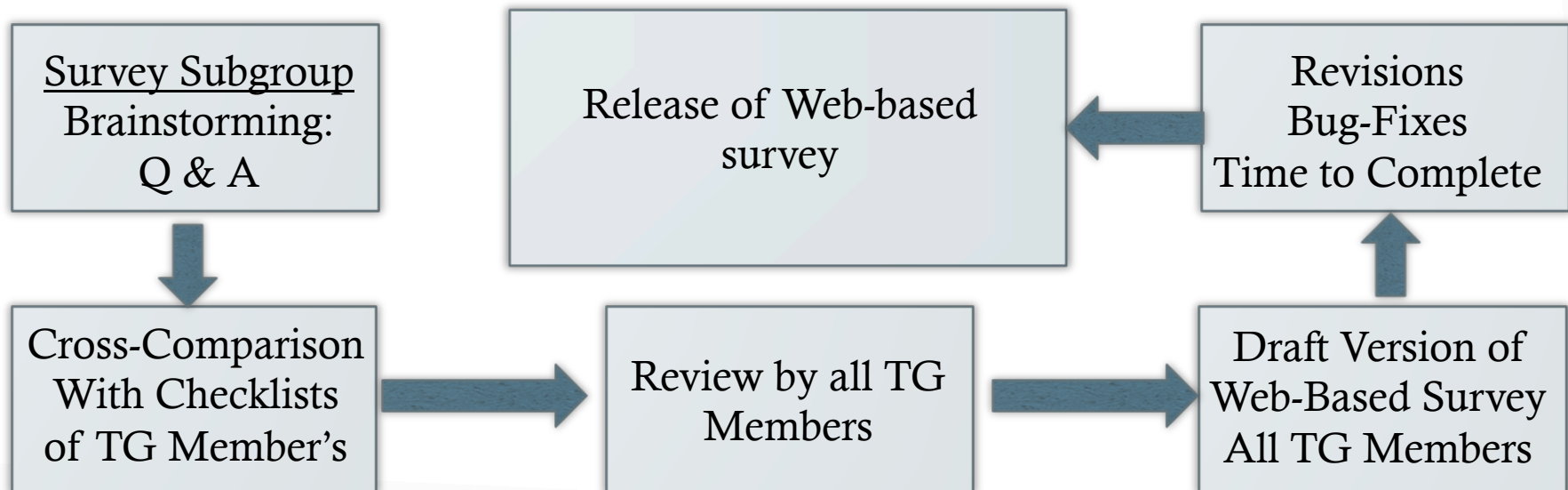
Ford EC¹, Fong de Los Santos L, Pawlicki T, Sutlief S, Dunscombe P.

Process Map for EBRT – 91 Common Steps



Survey Design

Who: AAPM members specializing in radiation oncology (~4500)
How: Web-based AAPM survey tool
Question Type: Closed-ended questions



Participation Initiatives

1. E-mail blasts to membership
2. Free registration AAPM Meeting
3. SDEP Template Provided – CME credits
4. Promotion on Social Media
LinkedIn
MedPhys List

SDEP Template Provided

Significance (statement of educational need): Effective physics plan and chart review in radiation therapy is an integral component of patient safety. The initial plan check, on-treatment chart check, and end-of-treatment chart check provide safety barriers to suboptimal or erroneous treatment. AAPM Task Group 275 is developing national benchmarks and recommendations for the type or extent of checks to perform for an effective physics plan and chart review in radiation therapy. I will participate in a survey being administered by TG-275 to gauge current practices with respect to chart reviews. By completing this SDEP, I will be evaluating my own medical physics practice and comparing my results with a baseline of current practices provided by TG-275.

Initial Expectation and Planned Evaluation: The expectations of this project are the following: learn about my current physics plan and chart review practices, understand emerging national standards, and if necessary bring my practices into better conformance with those standards. The planned evaluation consists of comparing my practices to a national aggregate by way of the survey administered by AAPM TG-275.

Educational Plan:

- 1) Complete the survey provided by AAPM TG-275.
- 2) Review the references listed below (under item 5) describing the practices, efficacy and tools related to physics plan review.
- 3) Compare my practices to the aggregate data released by TG-275.
- 4) Based on the AAPM TG-275 aggregate survey data of review practices and the literature review, I will assess my current practices and if deficiencies are found, I will document those deficiencies and implement additional checks on my initial plan check and on-treatment chart check processes.
- 5) Literature to review:
 - ACR Technical standard for the performance of radiation oncology physics for external beam therapy, 2010
 - Ford, E.C., et al., Quality control quantification (QCQ): a tool to measure the value of quality control checks in radiation oncology. Int J Radiat Oncol Biol Phys, 2012, 84(3): p. e263-9.
 - Yang et al. Technical Note: Electronic chart checks in a paperless radiation therapy clinic, Med Phys 2012, 39: p. 4726
 - Siochi, R.A., et al., Radiation therapy plan checks in a paperless clinic. Journal of Applied Clinical Medical Physics, 2009, 10(1): p. 43-62.

Web-Based Survey

External Beam and Protons:

Demographics
(55)

Initial Check
(151)

Weekly Check
(52)

EOT Check
(15)

Average Completion Time: 24 minutes

Raw Survey Results: ~2200 entries

Problems with Raw Data: Duplicate Entries
Entries with no clear source

“Clean” Data Set

Solutions to create a clean data set:

- Non-attributable entries were removed
- Most complete session was used for those with duplicate entries

1,526 non-duplicate responses

- 1,310 United State (85.8%)
- 60 Canada (3.9%)
- 107 Other countries (7.1%)
- 49 Blank (3.2%)



1,370 US + Canada responses used in the analysis and FMEA cross-comparison

Respondent Demographics

Facility Setting

- 40% community hospitals
- 31% academic-affiliates

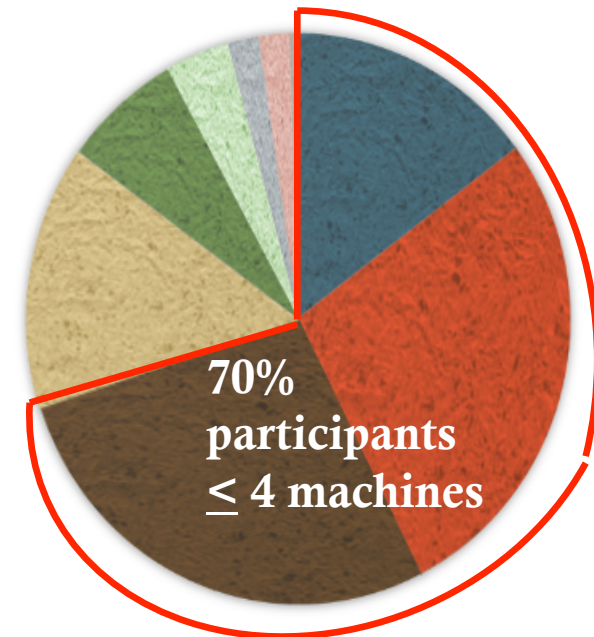
AAPM Membership (Therapy)

- 39.5% community hospitals
- 32.3% academic-affiliates

Representative of AAPM Membership?

Number of Machines

- 1
- 2
- 3-4
- 5-6
- 7-8
- 9-10
- 11-14
- 15-20
- 21-24
- >25



Services Offered

Common	Utilization	Less Common	Utilization
Electrons	96.3%	LDR	45.7%
Photons	95.9%	TBI	28.0%
3D Tx	95.9%	TSE	18.7%
IMRT	95.5%	IORT	14.9%
SBRT	80.8%	Orthovoltage	12.4%
VMAT	79.4%	Specialized Tx	11.5%
HDR	71.8%	Other	8.3%
SRS	67.4%	Protons	6.8%
Brachytherapy	65.0%		

Why is Physics Check Important?

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

[Ford EC¹](#), [Terezakis S](#), [Souranis A](#), [Harris K](#), [Gay H](#), [Mutic S](#).

Evaluation of 4000+ incidents

Physics check was found to be the most sensitive check

A combination of certain checks was found to be most effective.

This includes MD chart review, physics chart review, and the use of checklists



Survey:

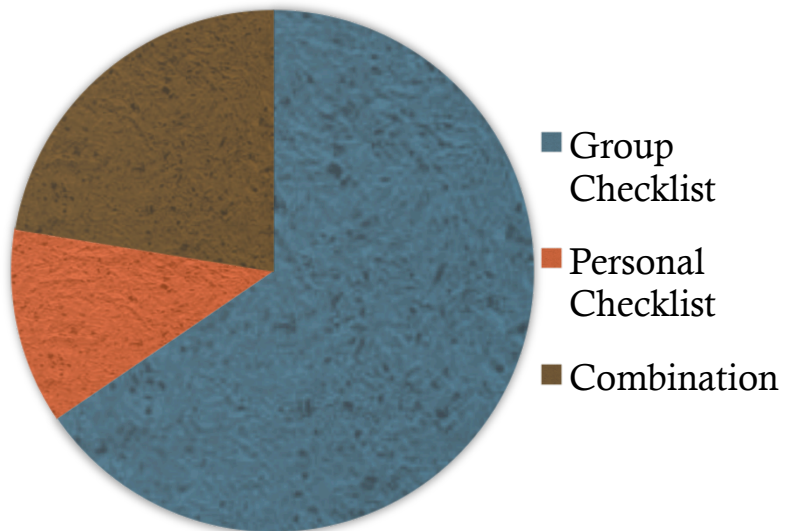
Initial check: 99.3%
(~10% perform after start)

MD Approval: 96%

Checklists: 64%

Checklists and Physics Checks

Type of Checklists Used



72%

Formal procedure for initial plan check

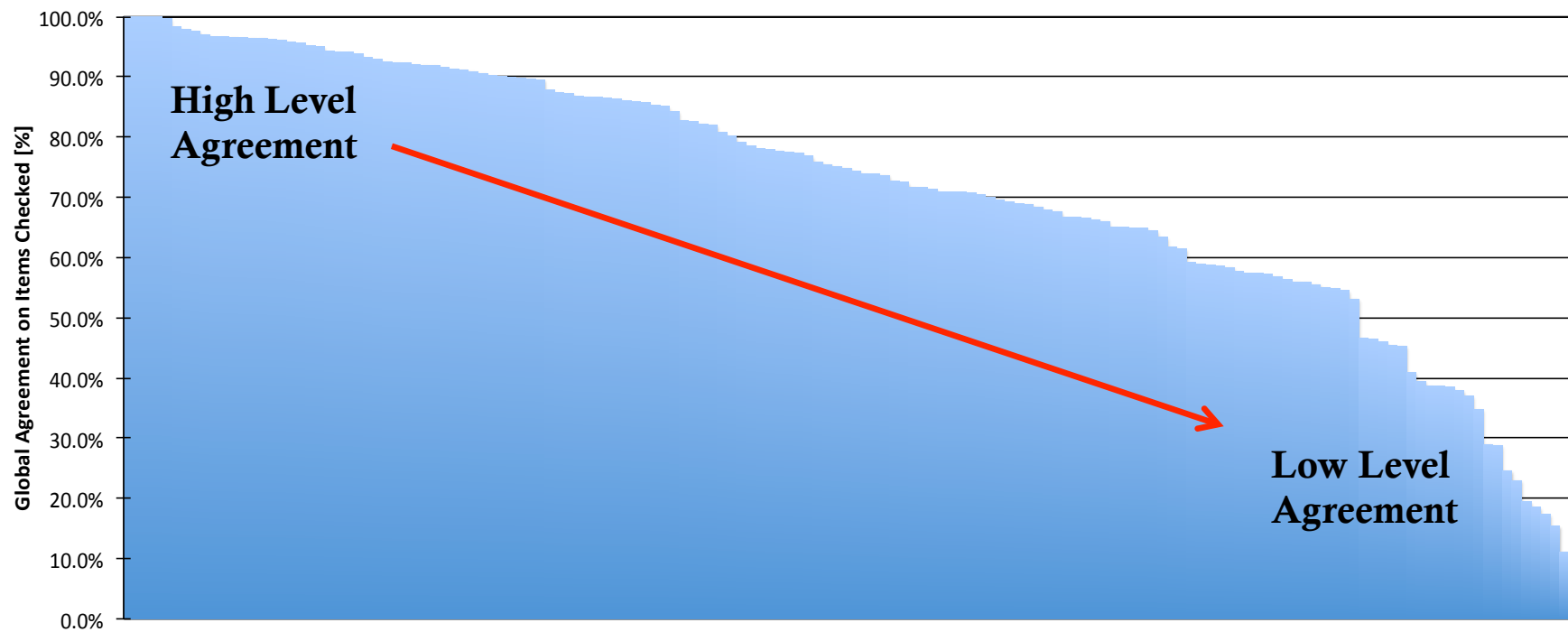
58%

Forcing Functions to ensure appropriate checks / approvals

51%

Record near misses and deviations found during physics check

151 Initial Plan Check Items Sorted by Agreement

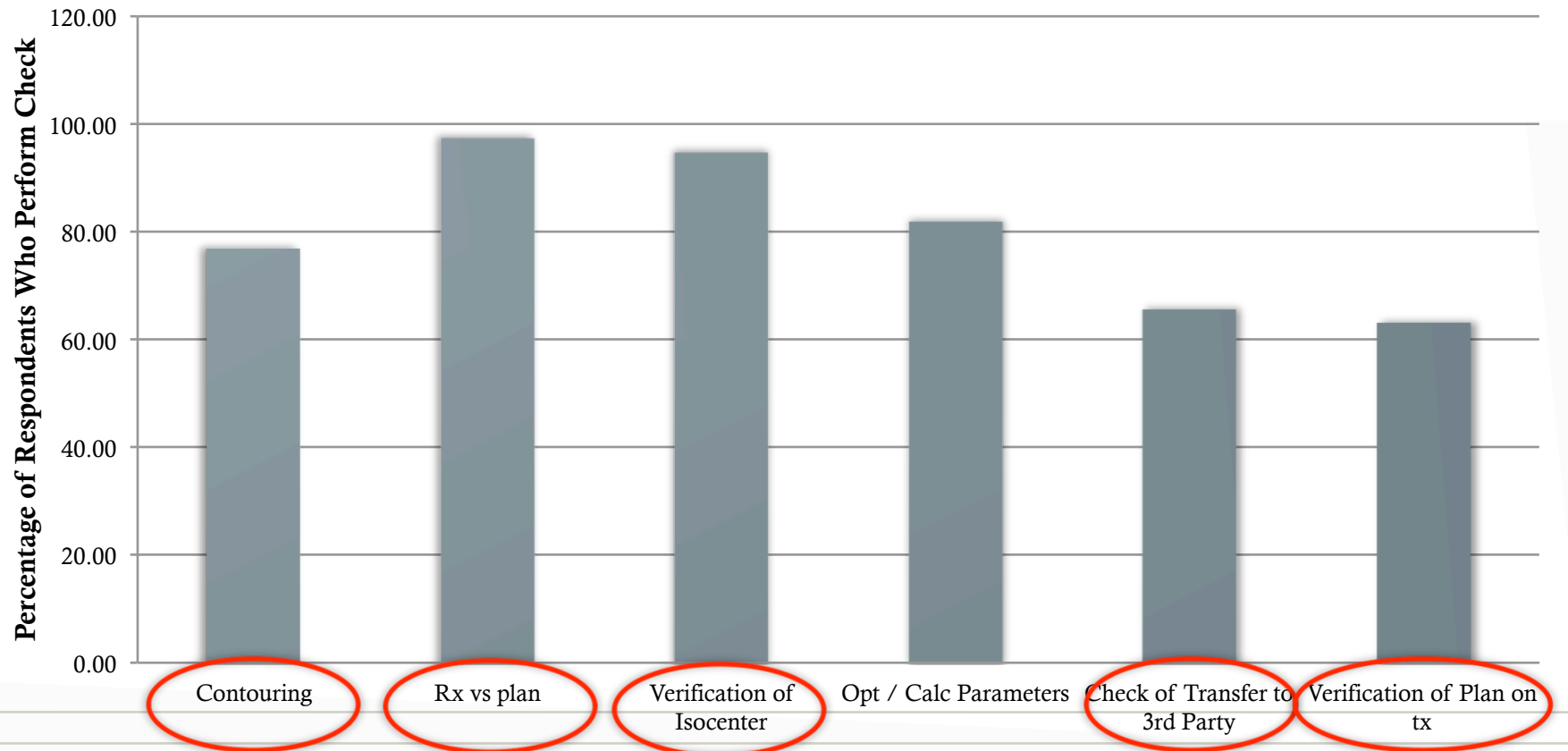


Courtesy: Luis Fong de los Santos

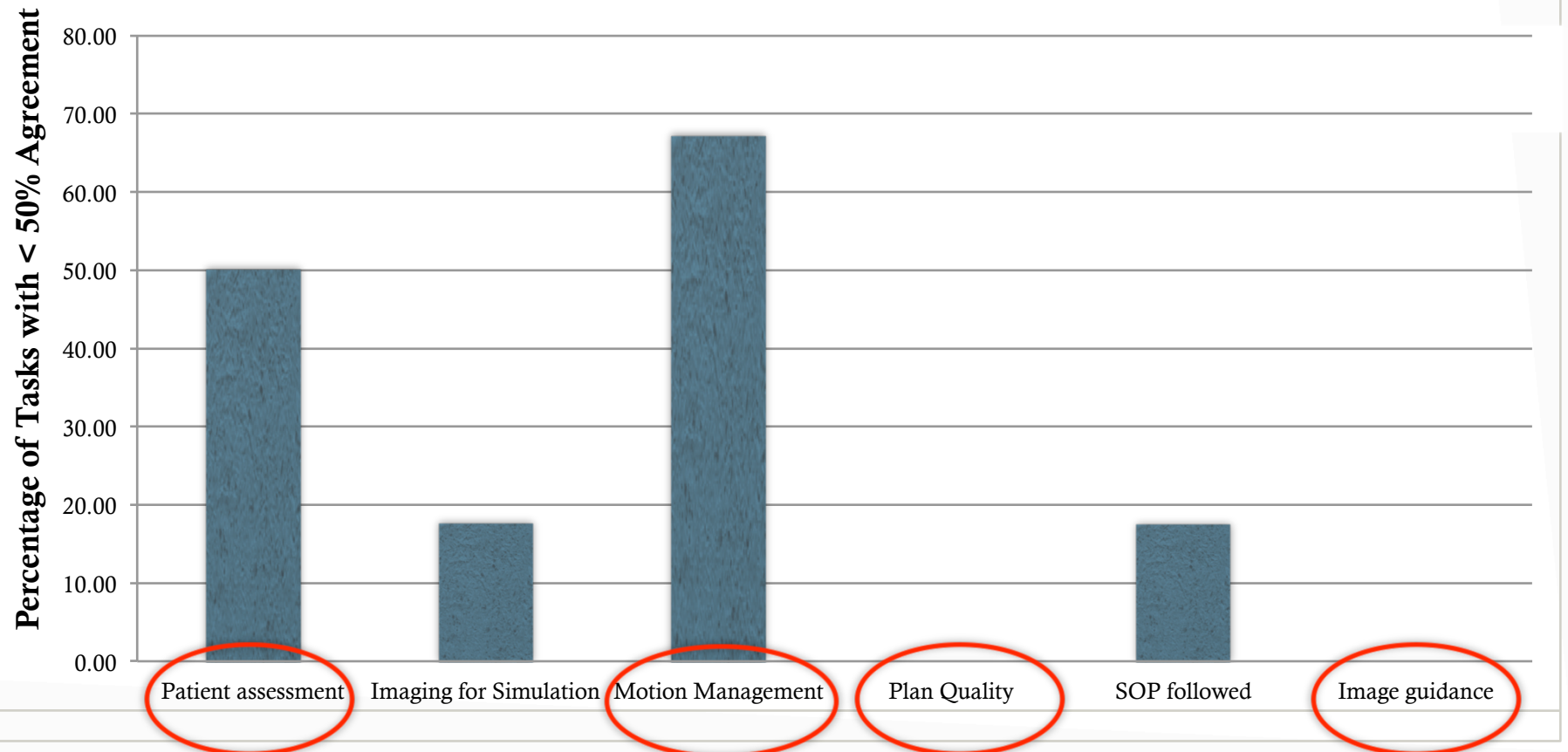
Initial Plan Check Details

Section	# of Options	Examples
Patient Assessment	14	Path, consent, consult, diagnosis...
Imaging for Simulation	17	Immobilization, contrast, artifacts
Motion Management	3	4DCT / gating parameters
Plan Quality <i>Stand Alone</i>	7	DVH, hot spots, prior radiation
SOP followed <i>Questions</i>	23	Dose rate, dose tracking, warnings
Image Guidance	8	Matching instructions, DRR's
Contouring <i>Parent & Nested</i>	9	Targets, Margins, density overrides
Prescription verses Plan <i>Questions</i>	13	Site / laterality, fractions, dose
Documentation of Isocenter	2	Shifts, multiple isocenters
Opt / Calculation Parameters	7	Objectives, Calculation algorithm/size
Transfer for 3 rd party	27	Energy, MU, MLC control points
Verification of plan on treatment	6	Fusion, DVH comparison

Percentage of Respondents Who Perform the Check (Parent Questions) Initial Plan Review



Percentage of Potential Checks on Stand Alone Questions where <50% Respondents Perform the Function on Initial Plan Review



Weekly and Final Checks

92.4% perform a weekly check

~70% have a formal procedure

56% use a checklist

1 in 4 do not have a mechanism
to ensure checks aren't missed

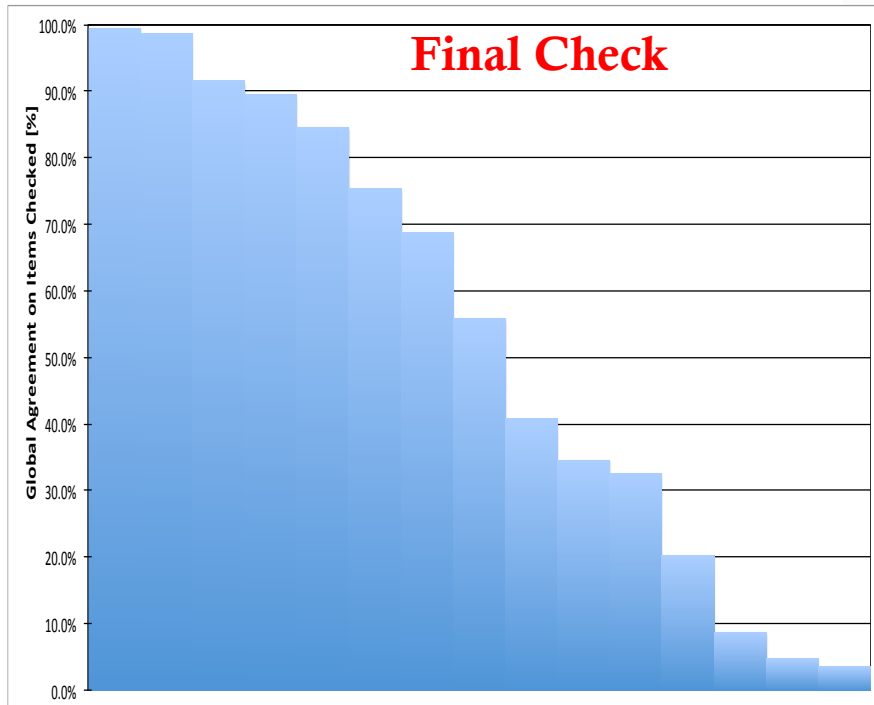
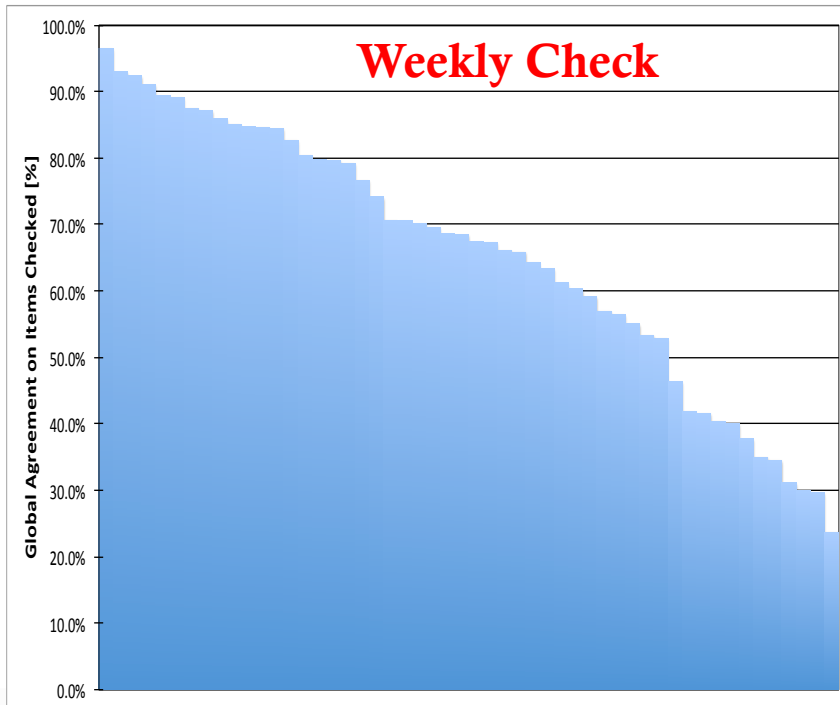
1 in 5 caught a reportable event

83.9% perform a final check

~95% perform task within 5 days

54% produce a document

Agreement for Weekly and Final Checks



Courtesy: Luis Fong de los Santos

6 Demographic Groups

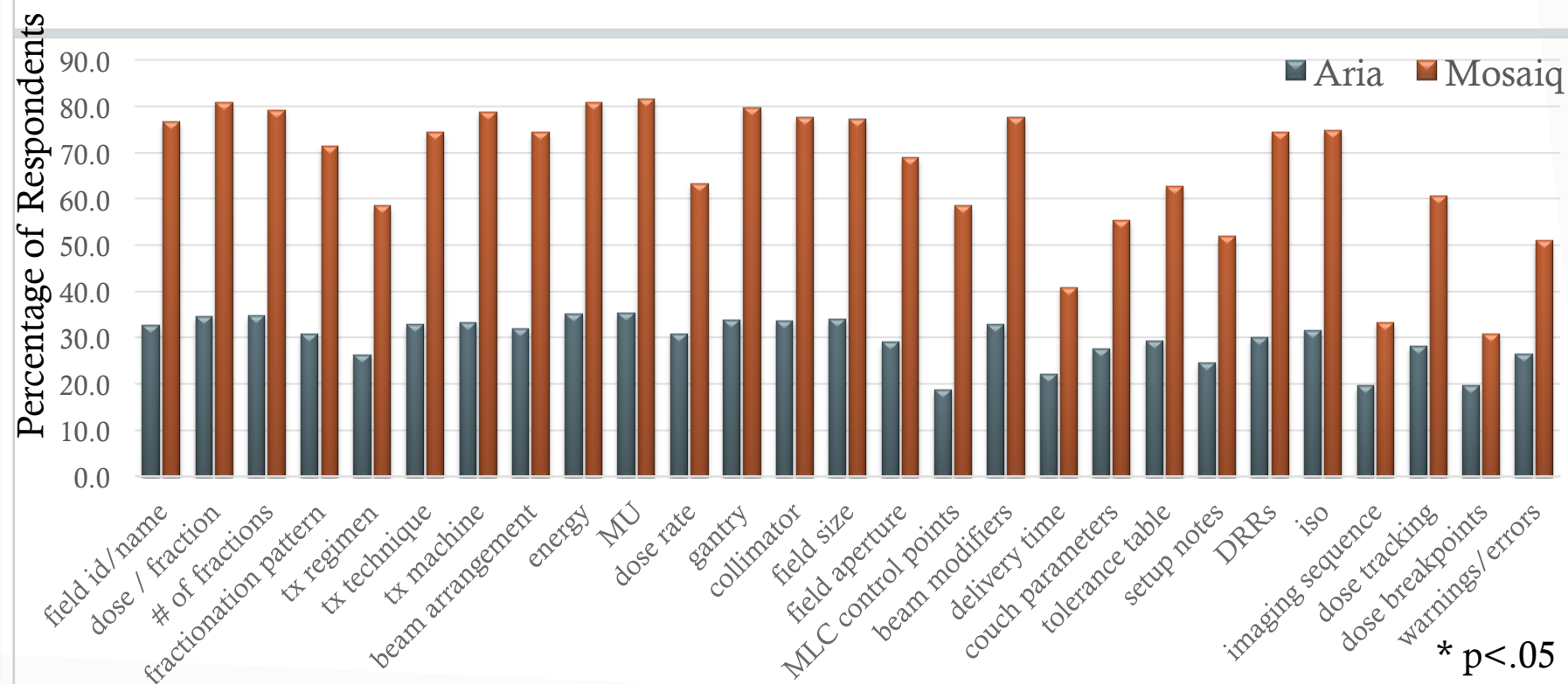
	Group 1	Group 2	Group 3
Clinic Type	Academic <i>n=423</i>	Community* <i>n=893</i>	-----
EMR System	Aria <i>n=687</i>	Mosaiq <i>n=581</i>	-----
Culture of Safety	Always <i>n=132</i>	Usually <i>n=444</i>	Sometimes** <i>n=132</i>
Patients Per Day	<50 <i>n=547</i>	51-100 <i>n=458</i>	>100 <i>n=358</i>
Method of Check	Manual <i>n=649</i>	Automatic / Combined <i>n=691</i>	-----
Days for Check	<1 day <i>n=429</i>	>= 1 day <i>n=911</i>	-----

* Group 2 = respondents from community hospitals, government hospitals and free-standing clinics

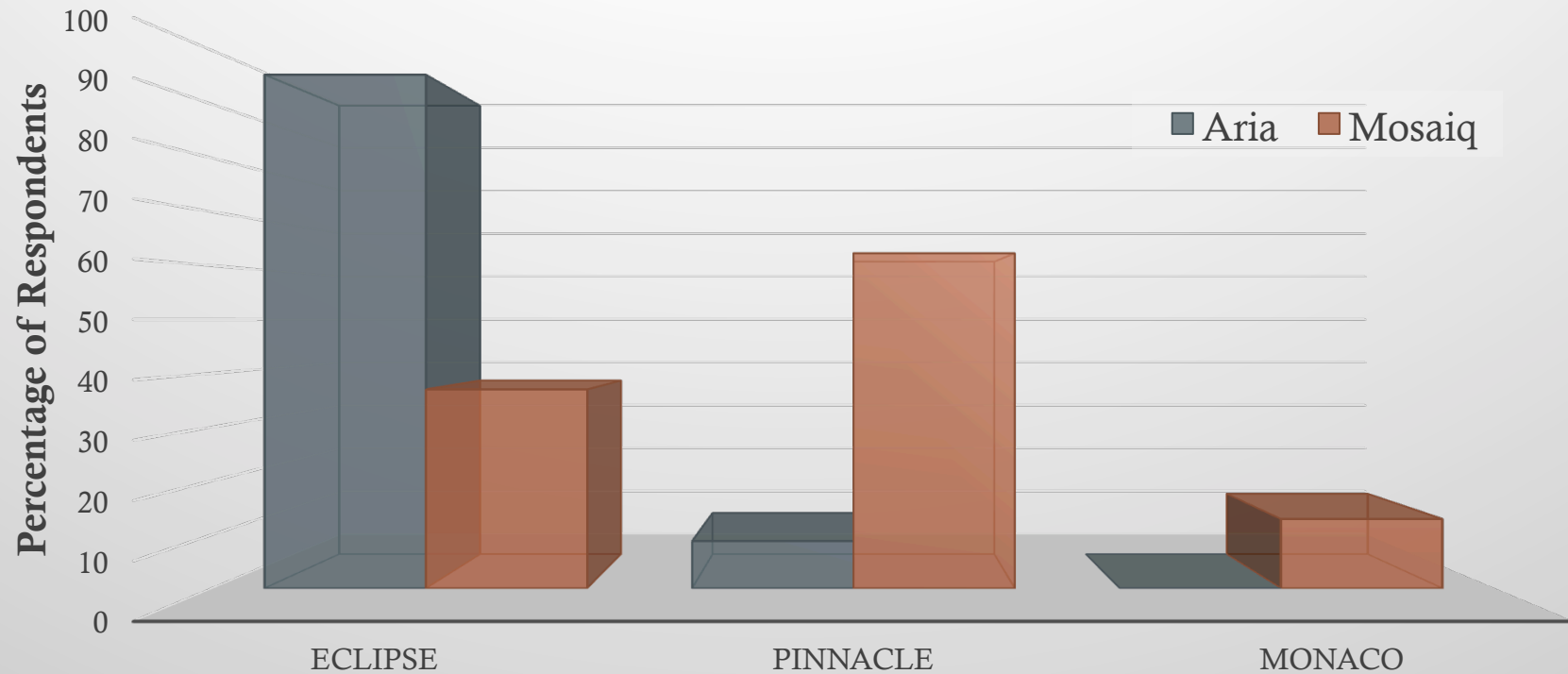
** Group 3 = respondents who answered sometimes, rarely and never

Checks to Verify Transfer to Third Party System*

Aria and Mosaicq

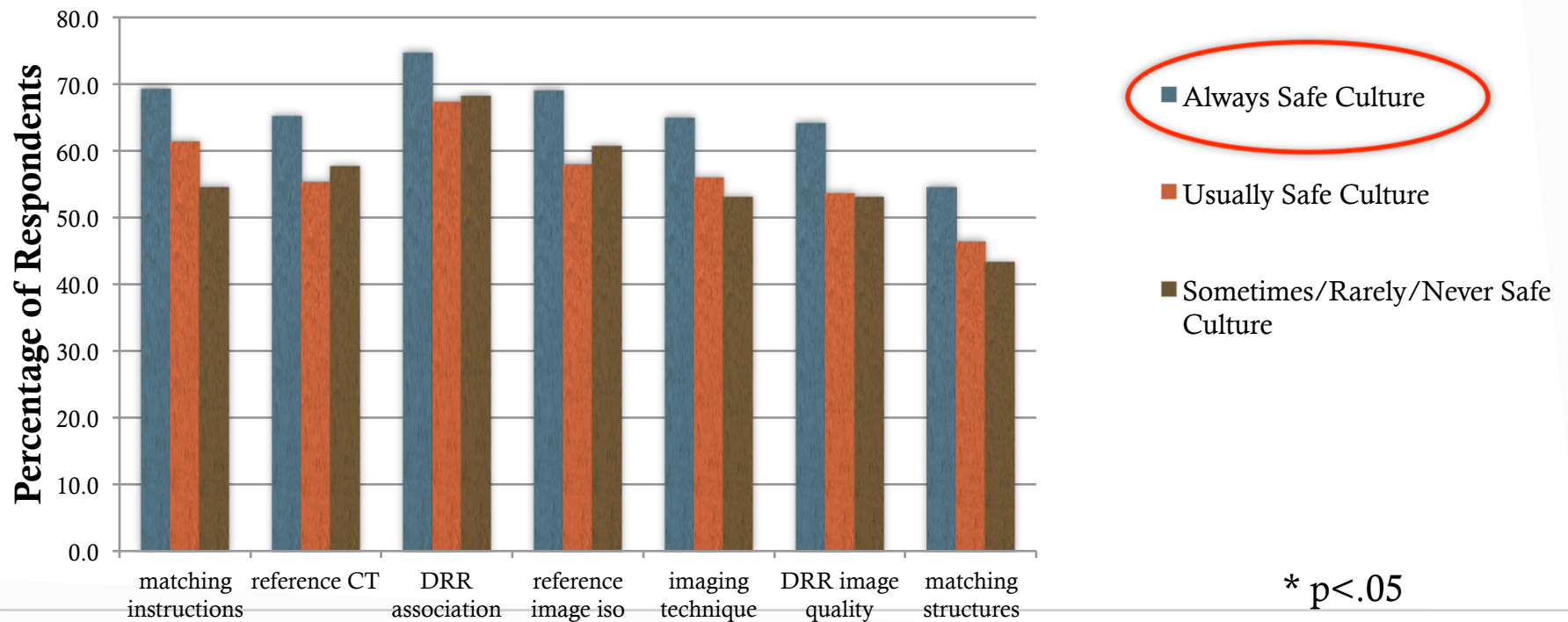


Treatment Planning Systems

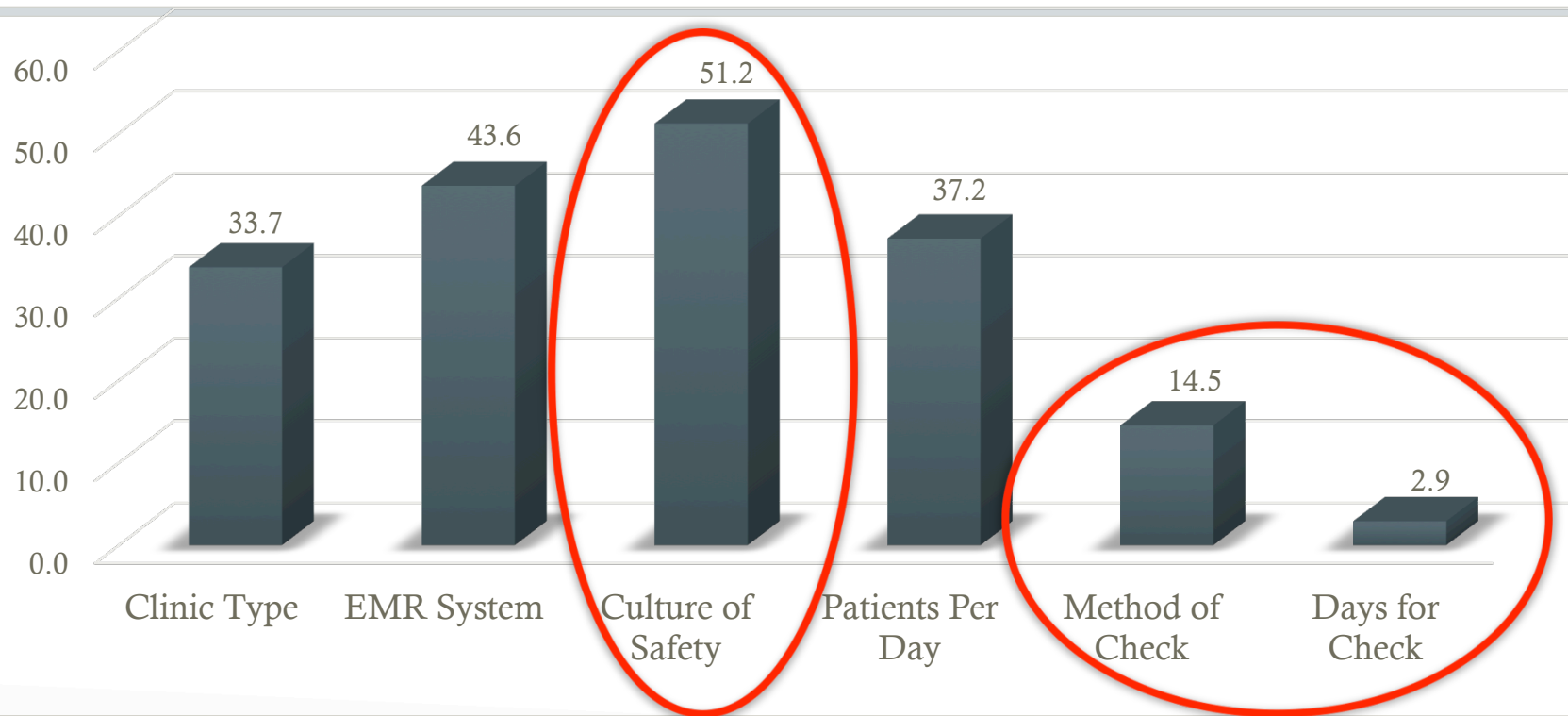


Aria users tend to work in an integrated environment

Checks of Image Guided Setup* Reported Culture of Safety



Percentage of the Initial Plan Check Review Items with Statistically Significant* Variations



* p = .05

Summary

We performed an extensive survey to determine current practices in the physics plan check process

Good response rate – appears to be representative

Various levels of agreement in the checks performed

statistically significant variations based on demographics

What do we do with this information?

Use it with an FMEA



provide recommendations