

GAMMA AGREEMENT INDICES CLINICAL OBSERVATIONS

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INTRODUCTION

Many centres use gamma evaluation for patient specific pre-treatment quality assurance

Why do centres use 3%/3mm –

- that is what Low / other groups used
- it seems ‘reasonable’, compared to resolution, delivery confidence

How do centres determine action level –

- they use the 90% recommended by AAPMTG119 (for radiochromic film), or some other value from the literature / vendor
- or, they choose so as to give a reasonable number of plans passing/failing (or to identify outliers with pass rates > 1 standard deviation from mean, etc.)
- or, they have independently evaluated confidence limits on measurement accuracy for their system or otherwise tested sensitivity to introduced errors

Literature says tighten up!

METHOD

Collected QA data

- for 1265 radiotherapy beams
- from 7 treatment centres (RBWH, PAH, GCCQx5)
- from 4 planning systems (Eclipse, iPlan, Pinnacle, Hi-Art)
- using 3 treatment modalities (IMRT / VMAT / HT)
- using 3 QA systems (Epiqa, MapCheck, ArcCheck)

Treatments grouped in 8 sets

Gamma agreement indices were calculated at %/1mm, 2%/2mm, 2%/3mm, 3%/2mm, 3%/3mm and 5%/3mm

- global normalisation
- 10% lower dose threshold

These centres were doing gamma evaluation on QA measurements for all modulated treatment techniques

(hundreds a year!)

Set	Beams	TPS	Linac	Dosimeter	Software
a	IMRT (402)	Eclipse v11	Varian	aSI000	Epiqa
b	IMRT (128)	Eclipse v9	Varian	MapCheck2	MapCheck
c	IMRT (150)	iPlan v4.5	Varian & m3	MapCheck2	MapCheck
d	VMAT (148)	Eclipse v11	Varian	aSI000	Epiqa
e	VMAT (85)	Eclipse v9	Varian	MapCheck2	Map
f	VMAT (109)	Pinnacle v9.8	Elekta	ArcCheck	SNC Patient
g	IMRT (107)	Eclipse v13.5	Varian	MapCheck2	SNC Patient
h	VMAT (50)	Eclipse v13.5	Varian	ArcCheck	SNC Patient
i	HT (86)	Hi-Art II	Tomo	ArcCheck	SNC Patient

THE DATA

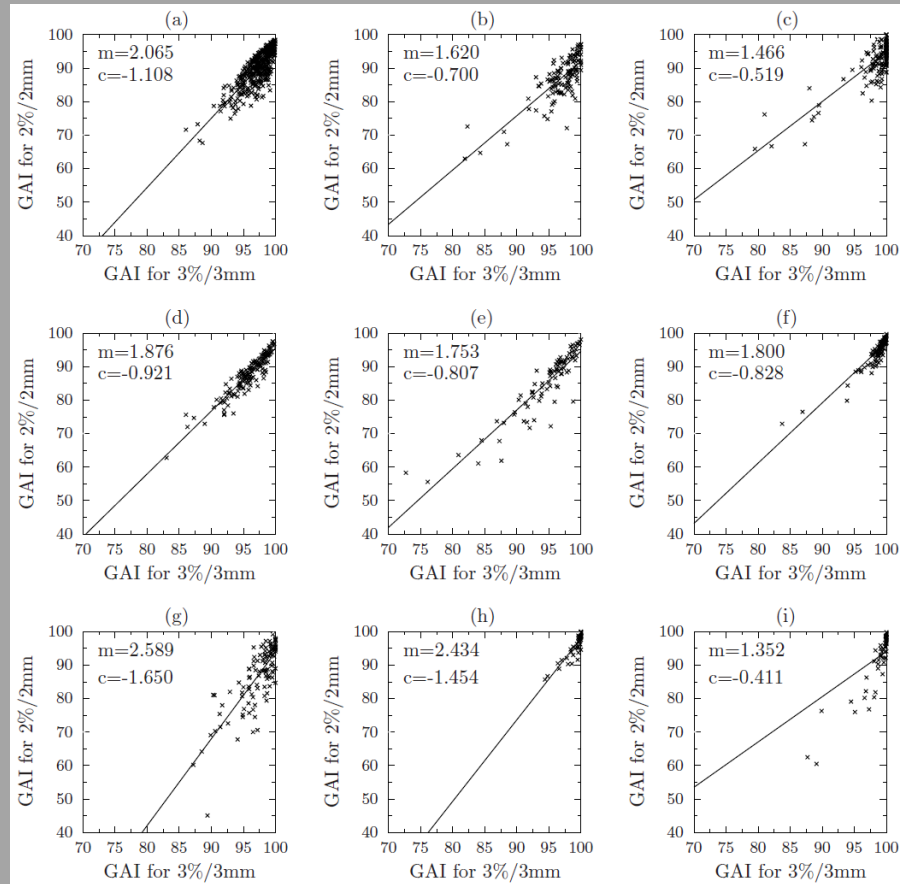
Obtained from RBWH,
PAH and GCCQ
(some of you can
guess which)

METHOD

Pass rates for 1%/1mm, 2%/2mm, 2%/3mm, 3%/2mm and 5%/3mm were plotted against 3%/3mm

Linear regression used to evaluate relationship between pass rates

This could, for example, suggest what a 2%/2mm gamma evaluation pass rate would be for a 3%/3mm pass rate of 94%



THE RESULTS

Pass rates for 2%/2mm
plotted against 3%/3mm

Set	1%/1mm	2%/2mm	2%/3mm	3%/2mm	5%/3mm
a	46%	75%	82%	85%	96%
b	44%	76%	87%	80%	95%
c	45%	80%	89%	83%	92%
d	42%	77%	85%	84%	95%
e	47%	77%	87%	82%	94%
f	57%	79%	86%	85%	95%
g	36%	68%	81%	79%	99%
h	22%	74%	83%	84%	97%
i	51%	85%	86%	87%	93%
All	43%	76%	85%	83%	95%

THE RESULTS

Equivalent to 90% pass rate (or action level) at 3%/3mm

CONCLUSIONS

Centres here using 3%/3mm could adopt 2%/2mm, 2%/3mm or 3%/2mm (with a new action level), and observe the same plans fail

Obvious question – why tighten up if the same plans will fail?

- more data: wider range of values, less ‘clipping’ at 100% pass rate

Using 1%/1mm with these systems wouldn’t see the same plans failing (because 1%/1mm is too strict for these systems)

For most systems examined a 1mm change in DTA has a larger effect than a 1% change in ΔD

Device resolution visible in difference between pass rates with criteria

This data could be used to determine clinical equivalence of pass rates reported in the literature compared to local values

- e.g. centre A finds mean pass rates of 93% for H&N plans at 3%/3mm, centre B finds mean pass rates of 86% at 2%/2mm – are those results similar?