Treatment Errors and Near-Misses in a Radiotherapy Department

Dr M Hosseini-Ashrafi
Radiation Protection and Solutions Ltd, UK

and Neil Robinson (PHNHST)

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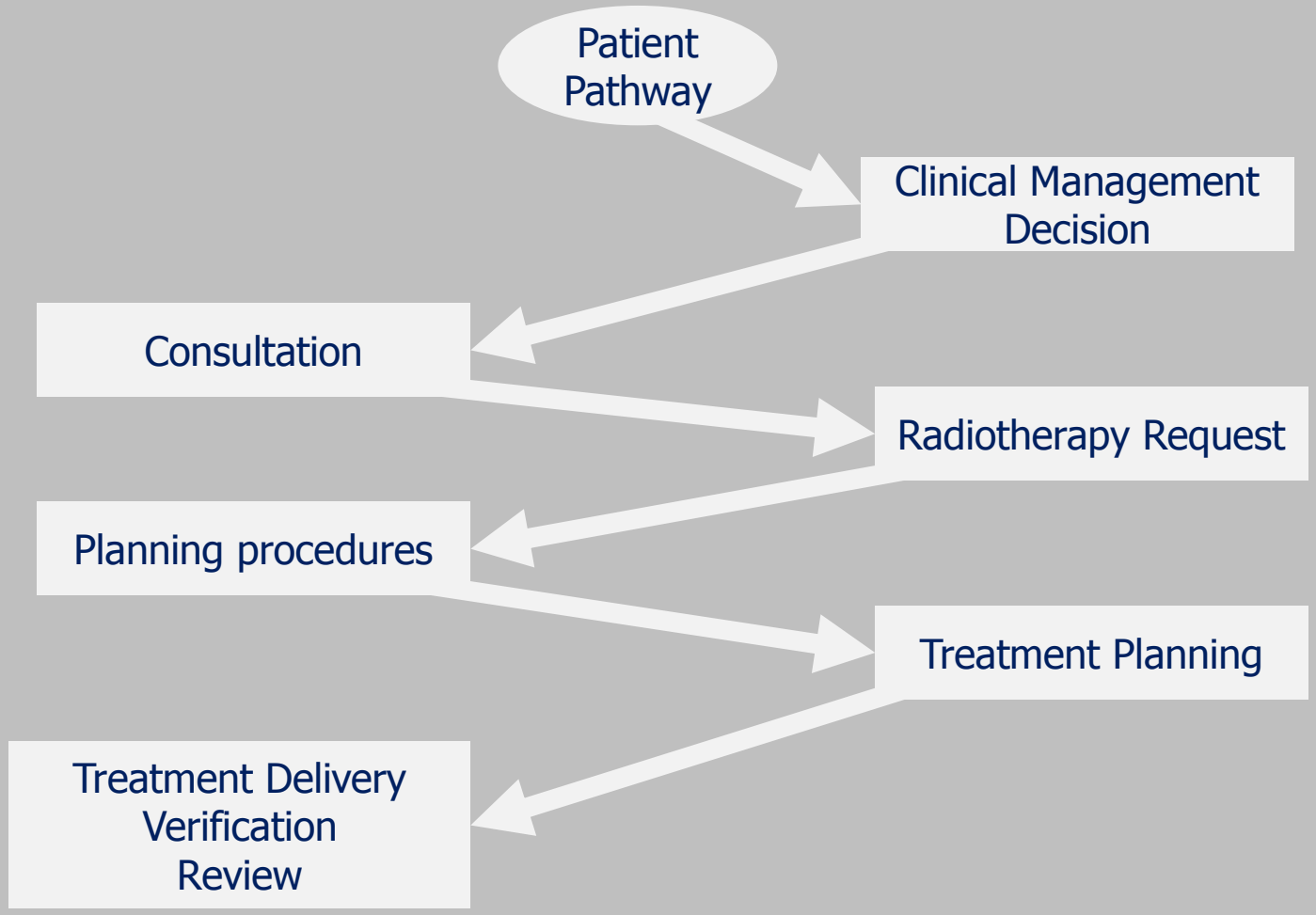
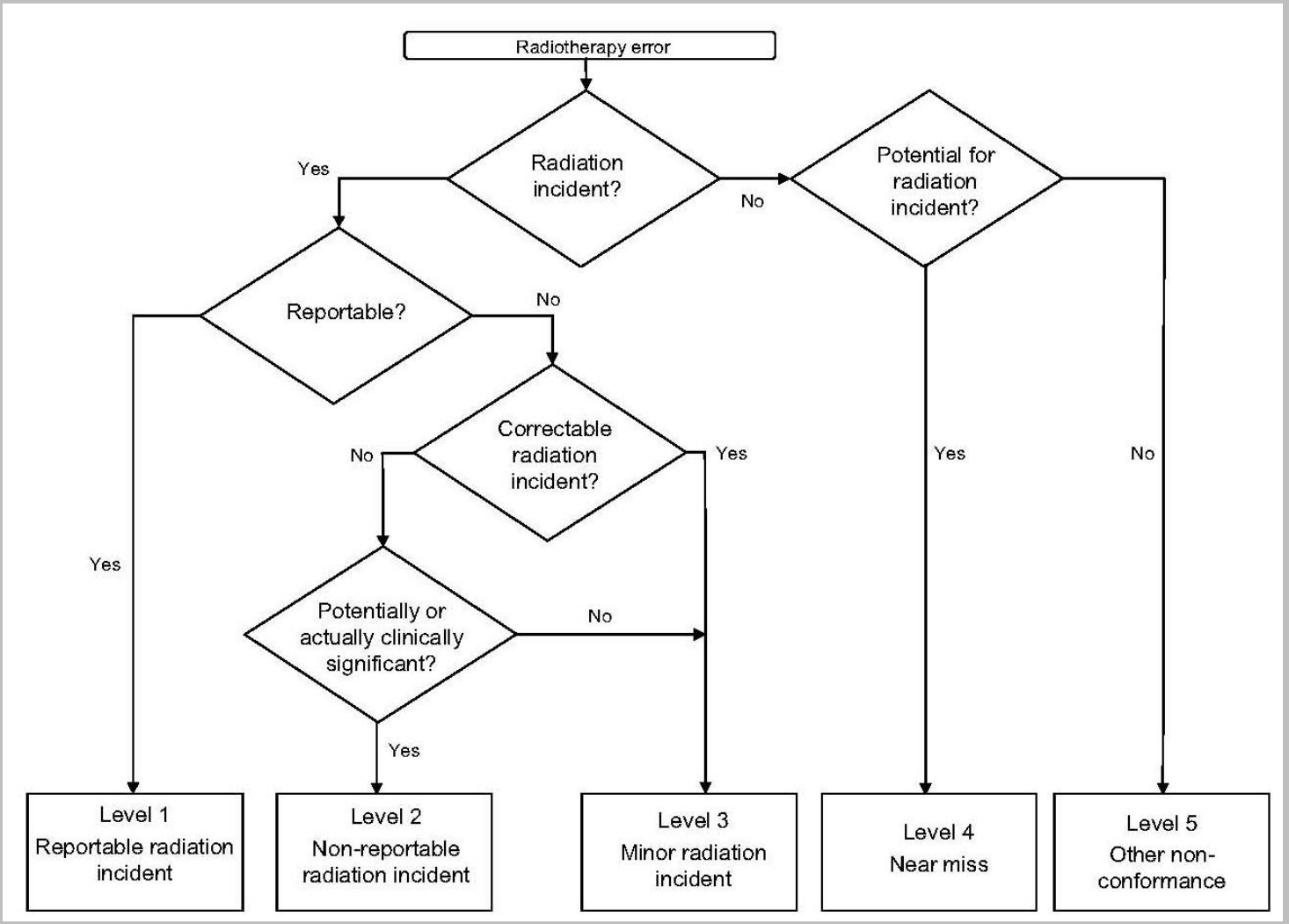
Introduction

Radiotherapy Chain



Introduction(continued)

Radiotherapy Error Classification Grid (reproduced from Towards Safer Radiotherapy)



Aims

The purpose of this study was to:

- Apply a procedure for mistake detection and risk analyses to a radiotherapy planning service
- Identify focused and resource efficient risk reduction solutions

Method: Mistake Severity ranking

- A scoring method was developed to enable application of a risk analysis procedure
- 51 mistake codes/types were generated
- A five grade severity ranking system was adopted:
  - Grades 1, 2 and 3 were assigned to mistakes with a high severity ranking
  - Grade 4 was assigned to mistakes with a moderate severity ranking
  - Grade 5 was assigned to mistakes with an insignificant severity rankings

Method (continued): Mistake risk ranking

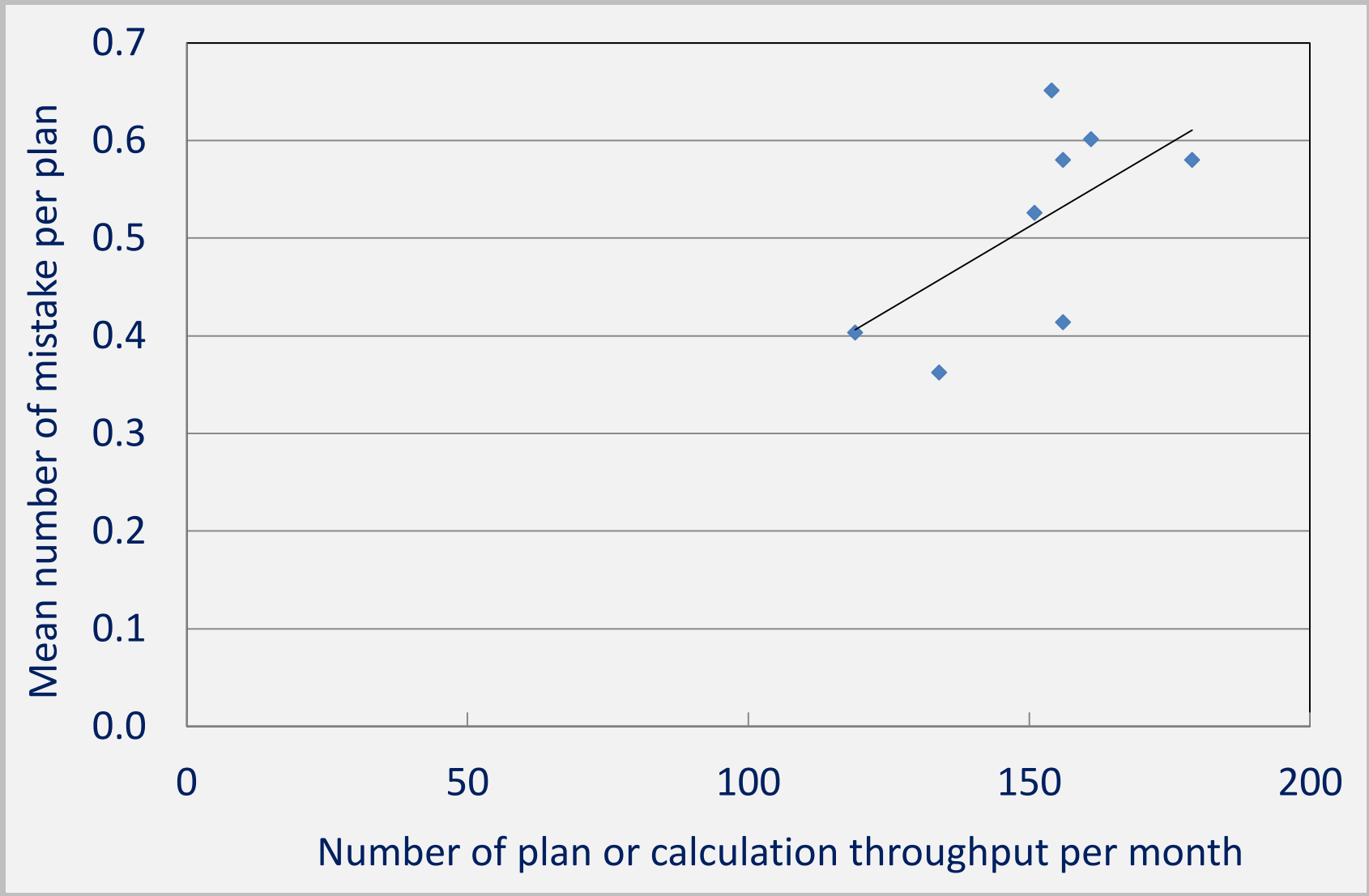
- Likelihood of the mistake remaining undetected was evaluated

- A risk ranking system was developed from the product of the potential severity and the likelihood of the mistake remaining undetected
  - A red ranking was assigned to high risk mistakes (6)
  - An amber ranking was assigned to moderate risk (7)
  - A yellow ranking was assigned to low risk (11)
  - A green ranking was assigned to very low risk mistakes (24)
  - The miscellaneous mistake codes were assigned a colour ranking of blue (3)

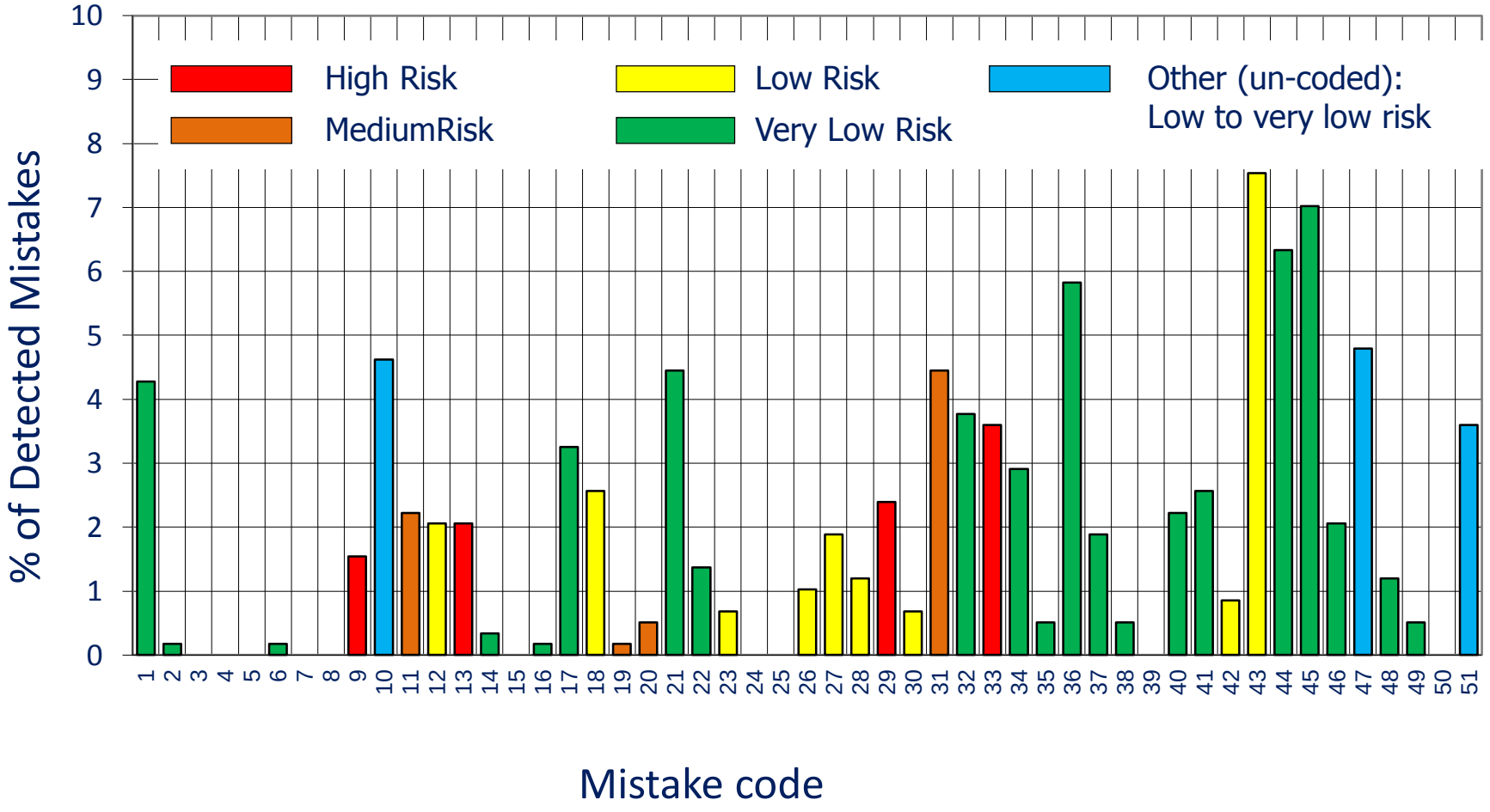
Results(1): Mistake statistics

- Analysis of the radiotherapy physics planning mistakes showed that of the 1210 plans and calculations reviewed:
  - There were 756 (about 62%) which did not have any mistakes identified by the checking processes
  - For the remaining 454, a total of 584 mistakes were detected
  - Giving an overall average number of mistakes per plan or calculation of about 0.5

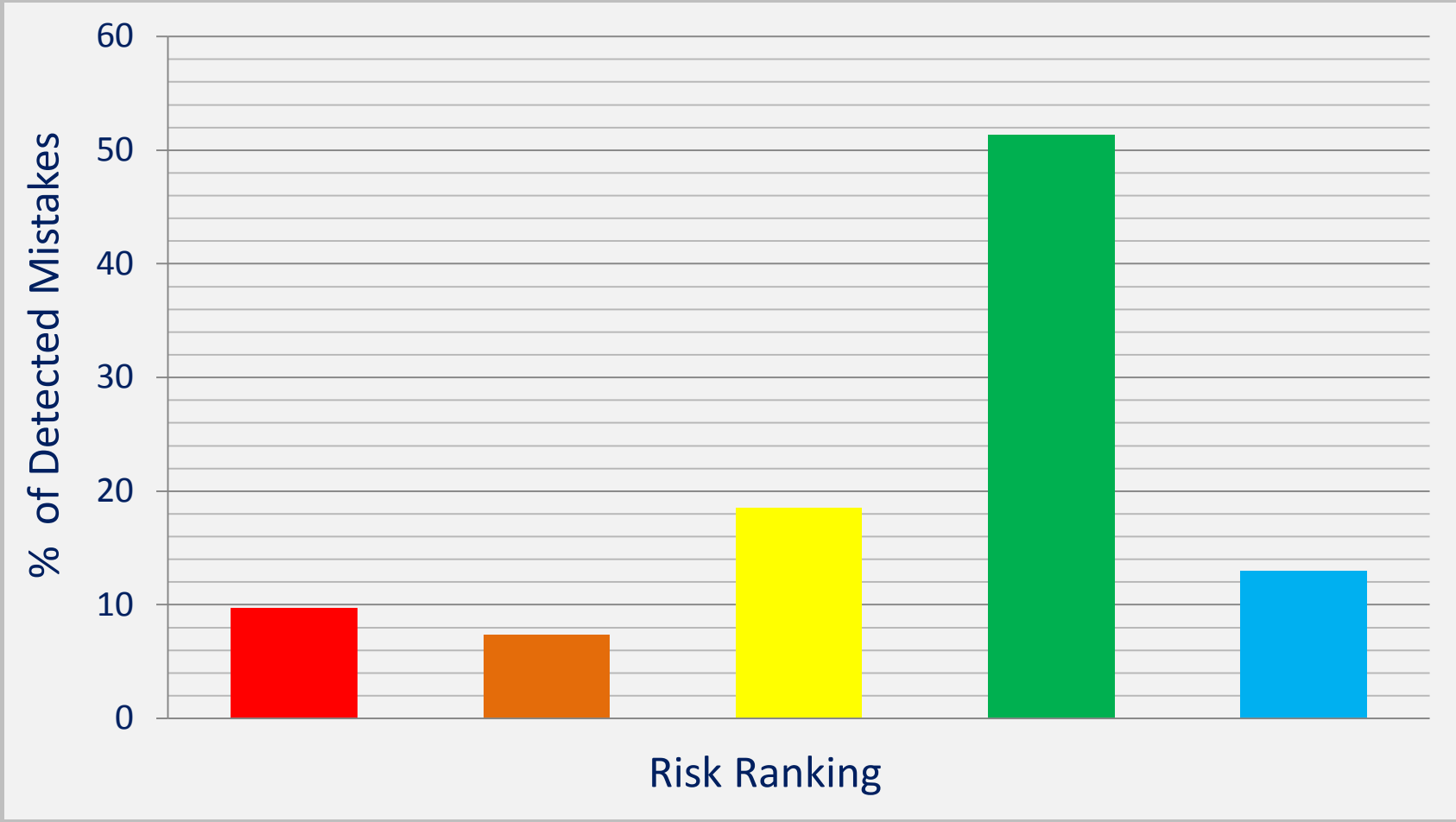
Results (2): Variation of the mean number of mistakes per plan with service throughput



Results (3a): Risk Ranking of detected mistakes



Results (3b): Overall Risk Ranking of detected mistakes



Results (4a): High Risk (Red) Mistakes

Code	TSRC	Description of Mistake	L	%	Cause
2	11e	Incorrect studyset used (if rescan / replan)	L2	0.2	Human Error possible
7	11r	Incorrect calculation reference used (applied instead of at depth)	L1	0	Human Error Possible
9	11r	Incorrect OF / PTR / DD used in calculation	L1	**1.5**	Human Error Possible
13	11n	Isocentre position description incorrect	L1	**2.1**	Not part of DICOM RT PLAN
29	11m	Wedge and/or bolus information incorrect or missing	L1	**2.4**	Not part of DICOM RT PLAN
33	11m	Provisional isocentre position form data /descriptions incorrect	L1	**3.6**	Not part of DICOM RT PLAN

Results (4b): Moderate Risk (Amber) Mistakes

Code	TSRC	Description of Mistake	L	%	RootCause
3	11i	Incorrect site planned	L1	0	Part of main end of process checks
5	11f	Dose does not match CCO prescription	L1	0	Part of main end of process checks
8	11r	Request for 'weighted' contribution not recognised	L3	0	Human Error Possible
11	11e	Markers/tattoos incorrectly positioned / coordinates not correct or missing	L3	**2.2**	Human Error Possible
19	11j	Constraint values exceed CCO request (unjustified)	L2	0.2	Human Error Possible
20	11j	Constraint values could be significantly lower (plan approach incorrect)	L3	0.5	Human Error Possible
31	11m	Couch / board corrections incorrect or missing or other error	L3	**4.5**	Not part of DICOM RT PLAN

Results(5): Radiotherapy incidents

- 20 radiotherapy incidents were investigated using Root Cause Analysis, Root (first) causes, main causes and contributory factors were identified and the associated unintended / erroneous doses were quantified

- Of the 11 EBRT incidents (4 radical and 7 palliative) 7 involved radiotherapy erroneous doses and four had given rise to unintended or redundant CT image doses

- Of the erroneous treatment doses only one could have been detected by in vivo dosimetry

- Of the remaining, 5 could have been detected by enhanced treatment verification processes and one could have also been detected at simulation

- The root (first) causes for most of the investigated incidents were identified to be due to human errors. However, process control systems were thought to be the main causes for most of the incidents

Conclusions

- A process of risk analysis was applied to mistakes in a busy radiotherapy physics planning service
- A small group of mistake types with high risk ranking were identified of which some were made with sufficient frequency to enable focussed and resource efficient intervention
- The analysis showed that the occurrence of these mistakes may be reduced significantly through electronic transfer of the corresponding data and also by the targeted utilisation of available on-set verification technologies

Thank you

m.hosseini-ashrafi@rpsltd-uk.com

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