Management of Patient Dose in Radiology: Which models can achieve optimisation?

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Survey of Responsibilities and Practices

- Survey of practices in different parts of the world.
- Questionnaire about testing of X-ray equipment, patient dose surveys, and optimisation of protection.
- Regulatory requirements and arrangements in practice.
- Electronic versions sent by email to medical physicists working in different parts of the world. (Oct 2011-Apr-2011)
- Questionnaire in English, but versions translated into Portuguese (for Brazil) and Thai (for Thailand).

Aim of the Survey

- Collection of views/opinions on practices from medical physicists in different parts of the world.
- Not a comprehensive survey of practice and no attempt was made to avoid bias.
- 133 responses from 44 countries.
- Responses also obtained from 12 US states

44 Countries from which data collected

- Africa: Algeria, Botswana, Gabon, Ghana, Mali, Niger, Nigeria, Sudan, Tanzania, Uganda, Zambia, Zimbabwe
- Asia: Iran, Israel, Malaysia, Nepal, Philippines, Thailand
- Australasia: Australia, New Zealand
- Eastern Europe: Bulgaria, Croatia, Greece, Macedonia, Russia, Serbia, Slovenia
- Western Europe: Austria, France, Ireland, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, UK
- Latin America: Argentina, Brazil, Colombia, Cuba, Mexico, Peru
- USA: California, Colorado, Louisiana, Michigan, Nevada, New York, North Carolina, North Dakota, South Dakota, Vermont, Wisconsin, Washington State

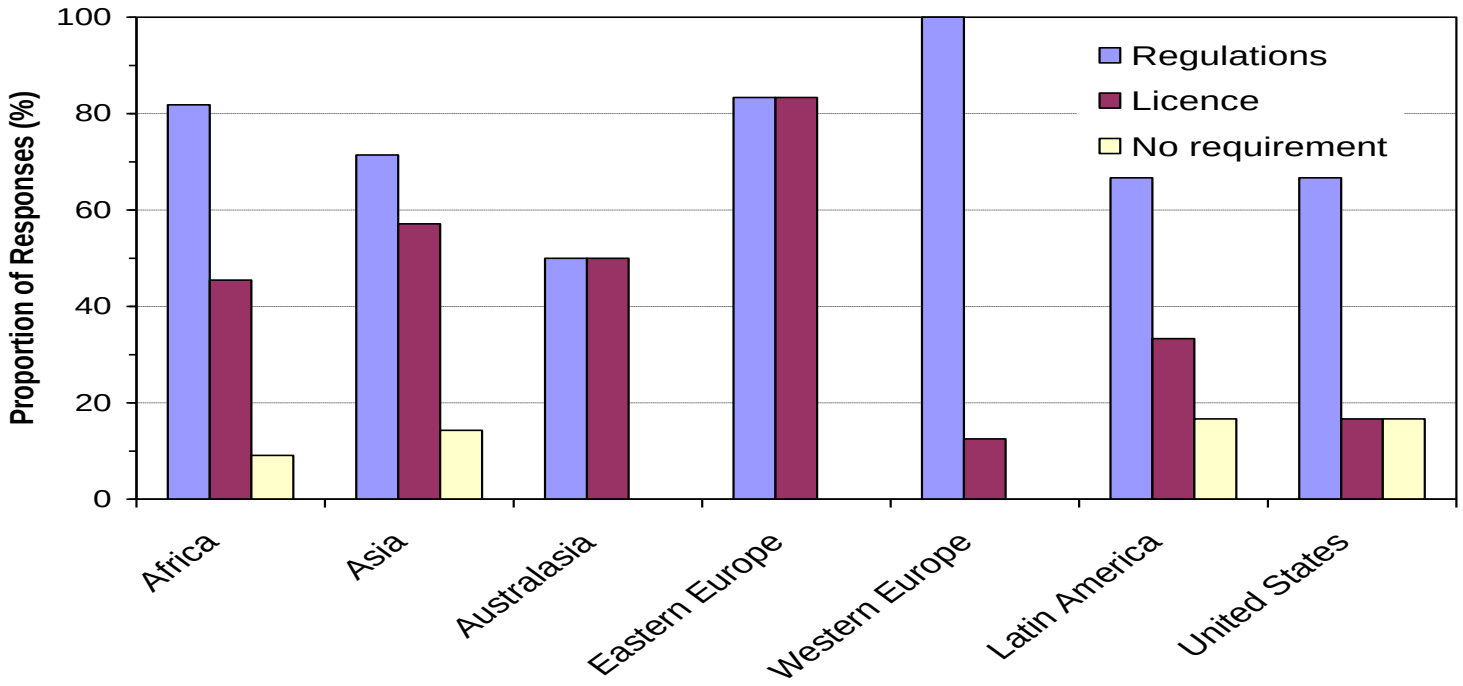
Mandatory requirement for X-ray Equipment Performance Tests by Country/State

76% of countries have regulations that require performance tests.

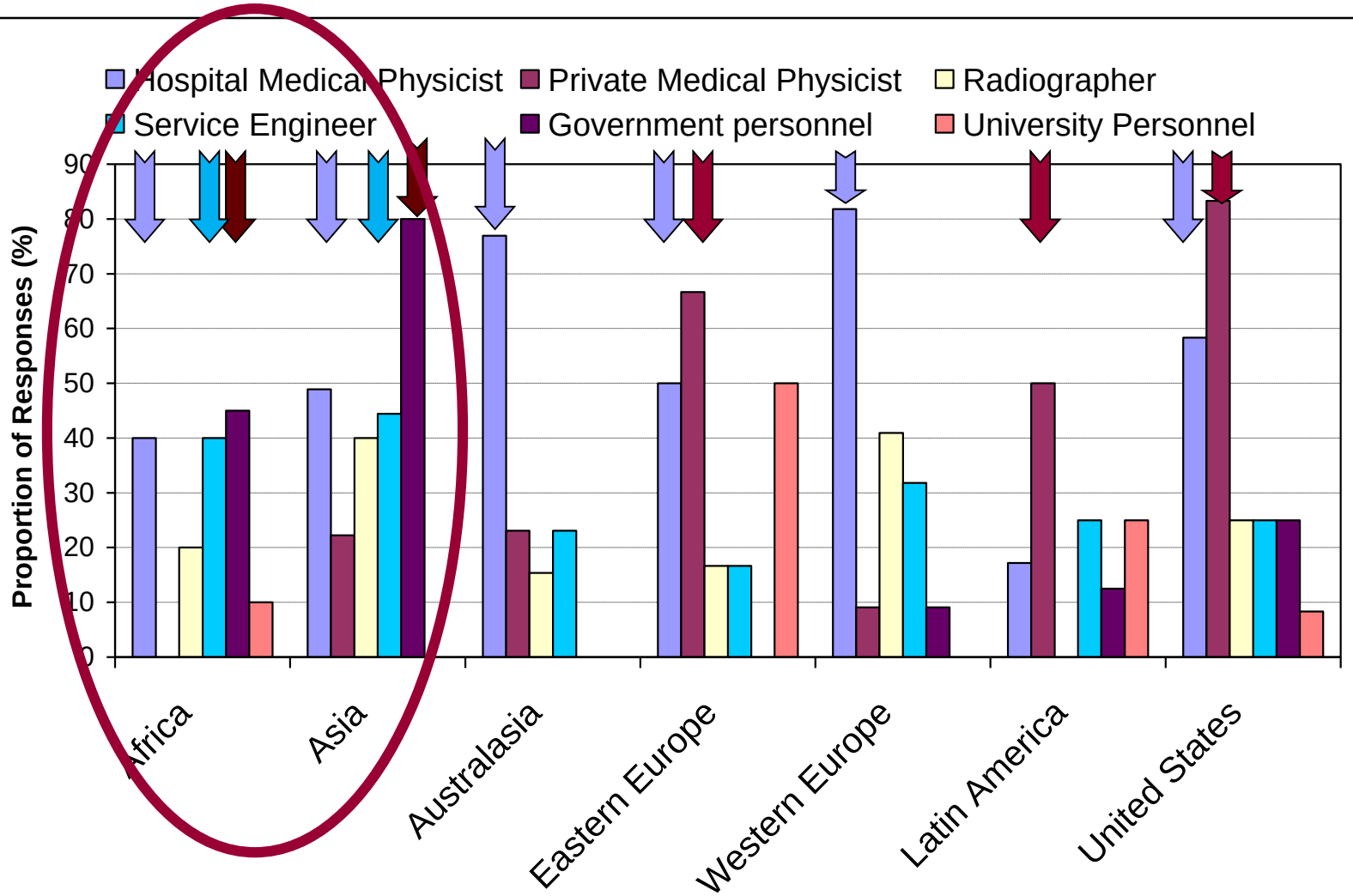
37% have this as a condition of licence.

7% have no mandated need for performance tests.

USA 67% of states have requirement in regulations and 33% in a code of practice.



Who carries out Performance Tests in Different Parts of the Globe?



Patterns in Different Regions

Western Europe and Australia	Lead by hospital medical physicists
USA, Eastern Europe, New Zealand, and Latin America	Private medical physicists more likely to be the ones who tested equipment.
Eastern Europe	University may also be involved with other medical physicists
Africa and Asia	Government personnel, X-ray engineers and hospital physicists all have a role.
Thailand	Service provided by radiographers

Routine Quality Assurance Tests

- Results from centres with medical physics support
- 80%-100% of respondents stated medical X-ray equipment is tested before use in Europe, Australasia, Asia and Africa.
- Only 50% of units are tested before being used clinically in America. All mammography units are tested in USA.
- 80% stated medical X-ray units were tested periodically.
- Africa only 30% - 50% of units were tested.
- Tests supplemented by radiographer quality control tests in Western Europe, Australasia, USA and Latin America.

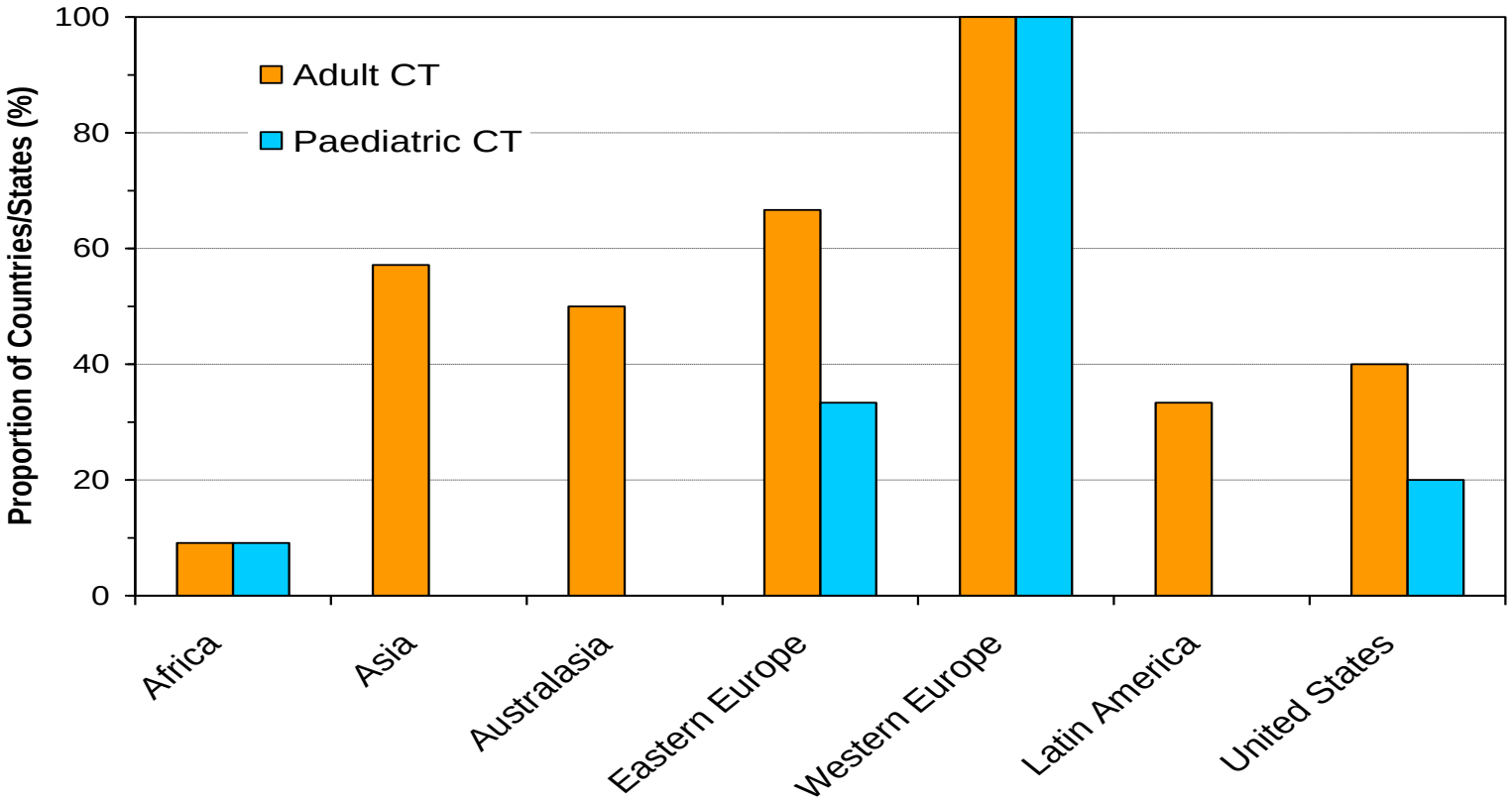
Diagnostic Reference Levels (DRLs)

- Surveys can be carried out of patient dose measurements
- To make judgements on dose levels, bench marks are required with which results can be compared
- Countries have been encouraged to set national DRLs for this purpose.

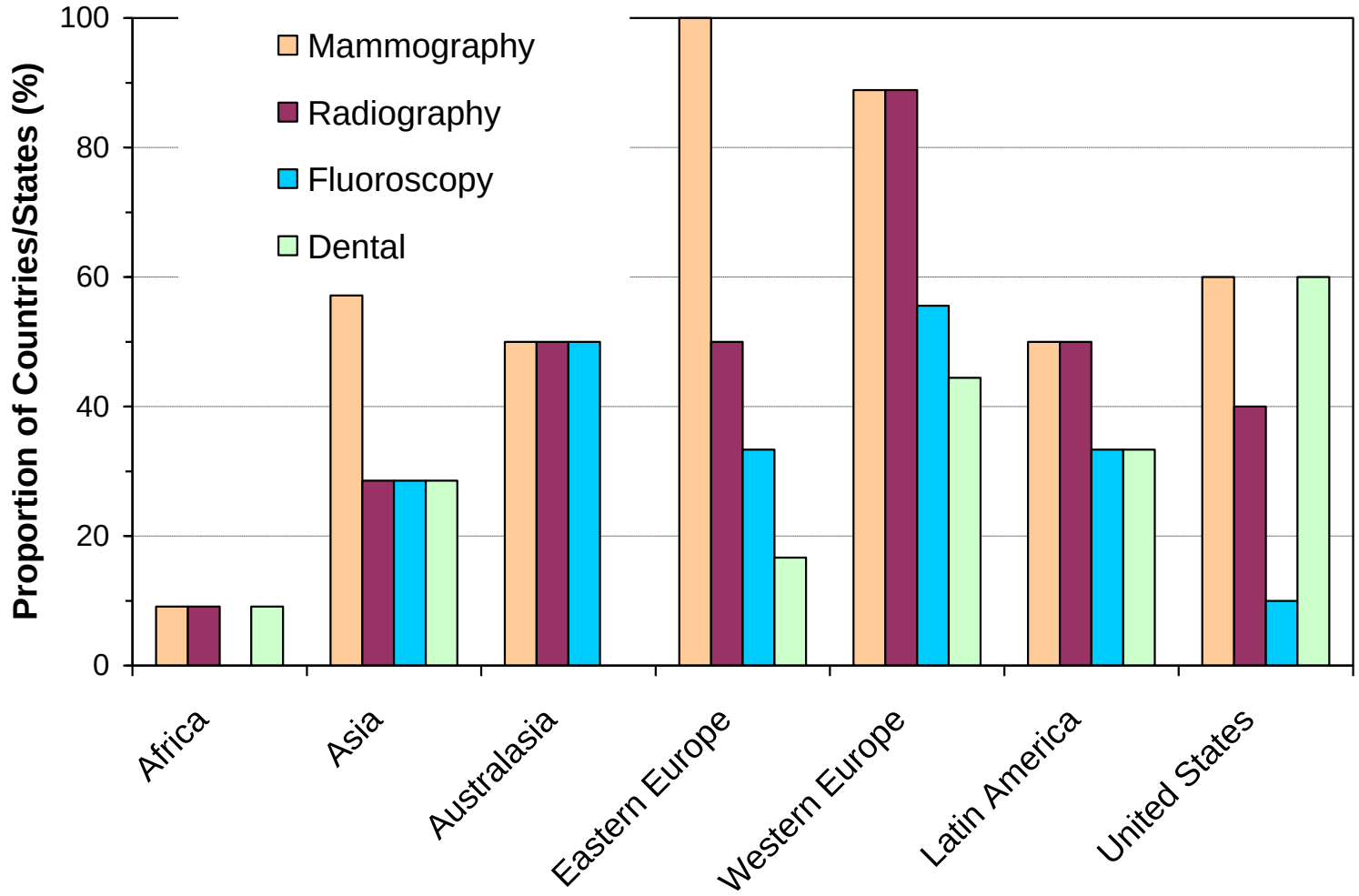
Countries / States with Diagnostic Reference Levels (DRLs) for CT Exams

All countries in Western Europe have DRLs for CT

Only a few, primarily in Europe had DRLs for paediatric CT



Countries / States with DRLs for Radiography and Fluoroscopy Exams



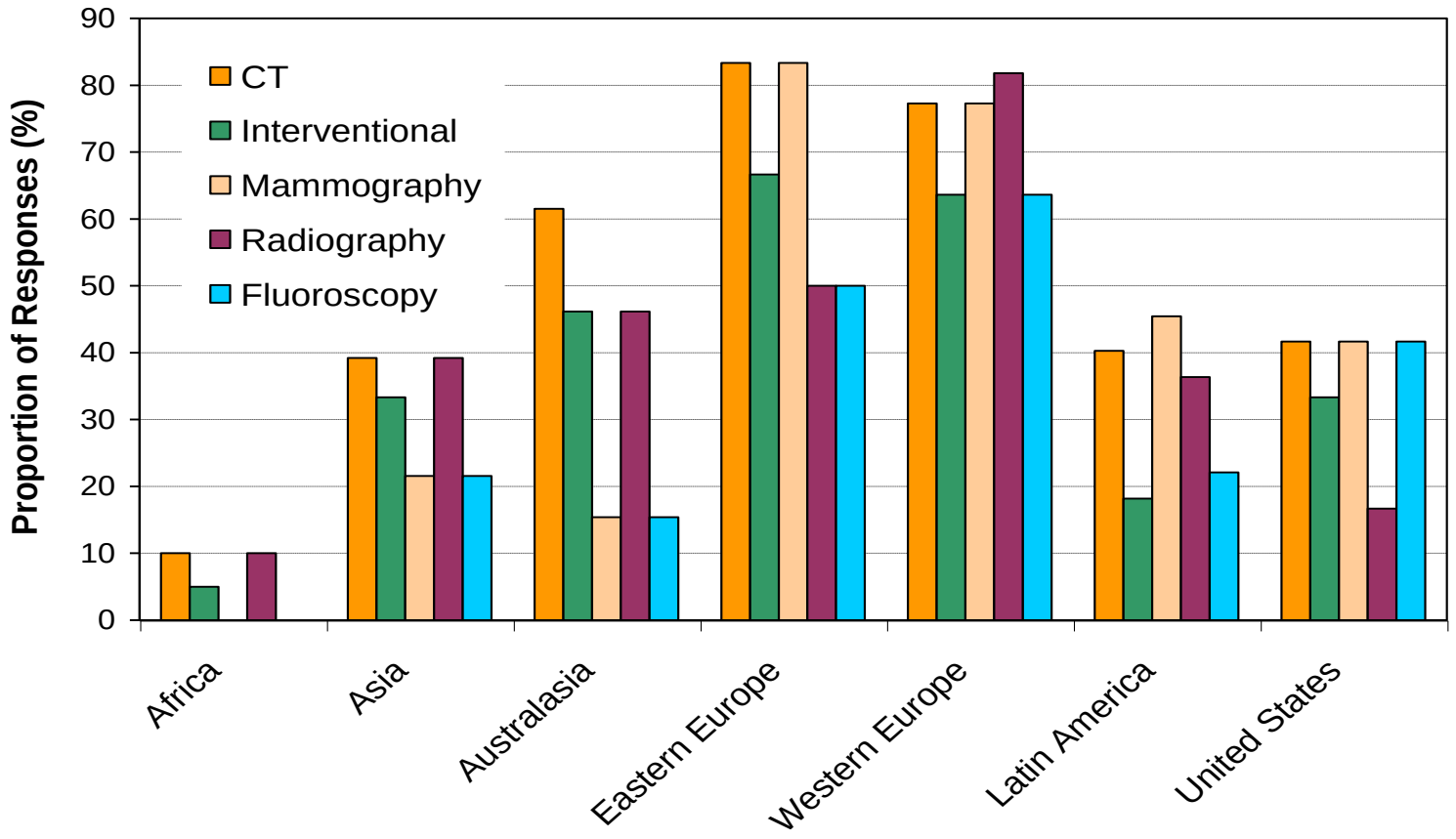
Summary of setting of DRLs

Africa	Few DRLs in place
Asia	Some DRLs in South East Asia and Iran. None in Israel and Nepal
Australasia	New Zealand has DRLs, Australia does not
Eastern Europe	Variable. Countries are introducing DRLs
Western Europe	Most countries have DRLs for CT (adult and paed.), mammo. and radiography
Latin America	Brazil has DRLS, many others do not
United States	Varies by state, but 60% have DRLs for mammo. and dental

Surveys of Patient Doses

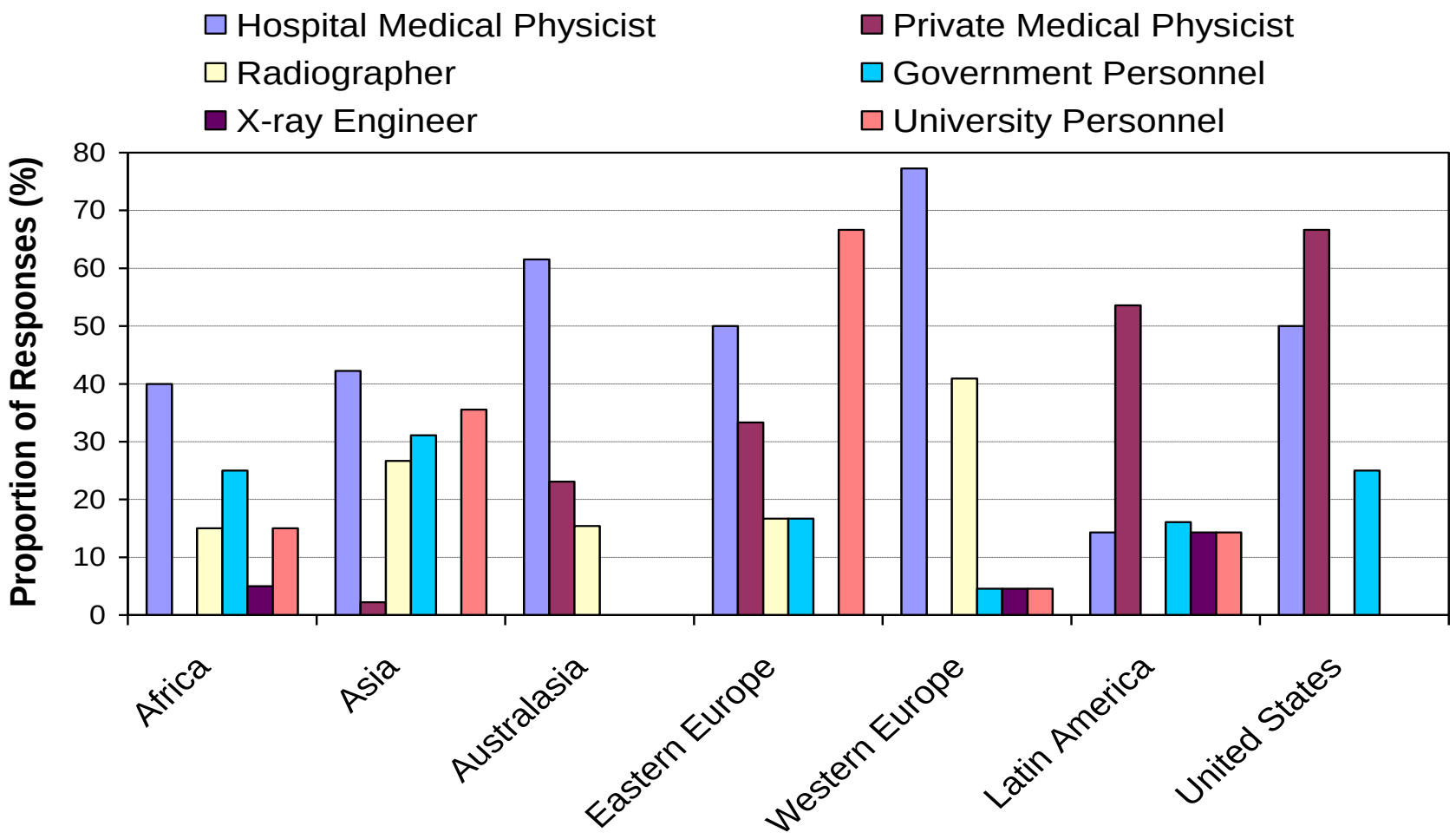
- Responders indicated that 60% of the countries had national requirements for patient dose surveys.
- Responsibility for ensuring these were carried out lay was considered to lie with the employer or licensee.
- Many respondents in other parts of the world said that no-one was given the responsibility.

Countries / States undertaking Surveys of Patient Doses



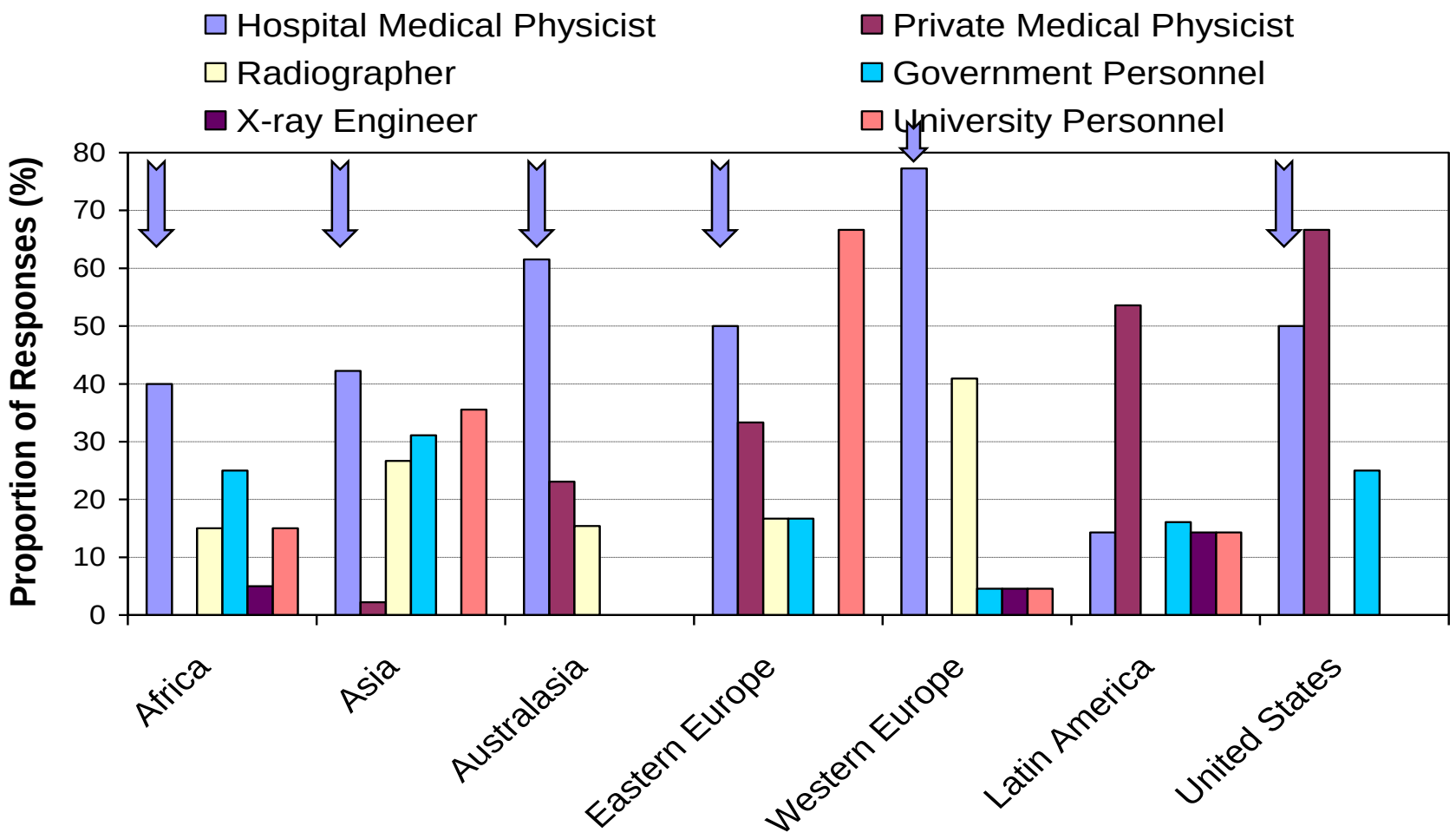
More radiology facilities in Europe undertook patient dose surveys

Who carries out Patient Dose Surveys?

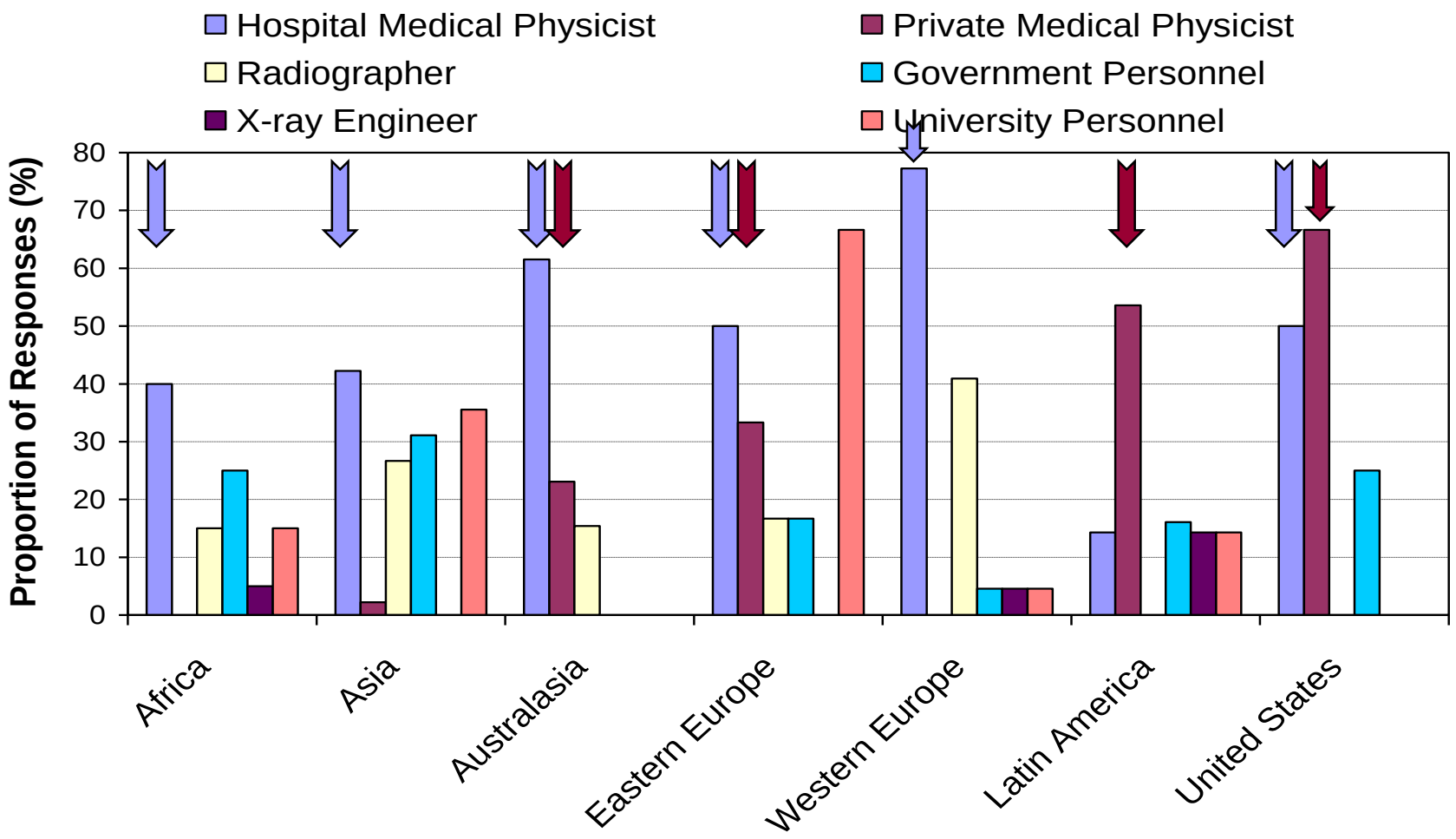


Who carries out Patient Dose Surveys?

Hospital Physicists

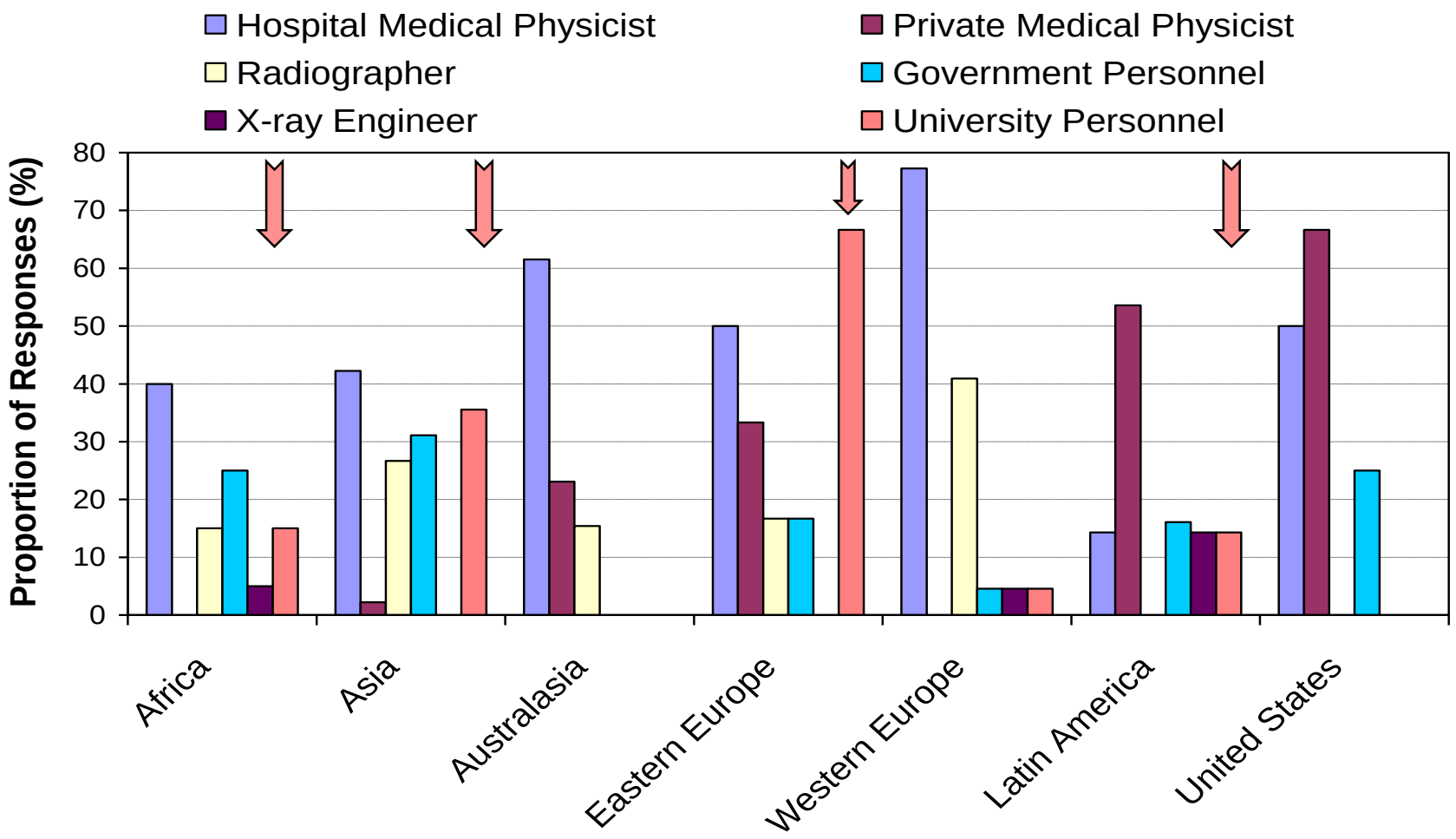


Who carries out Patient Dose Surveys?
Hospital and Private Physicists



Who carries out Patient Dose Surveys?

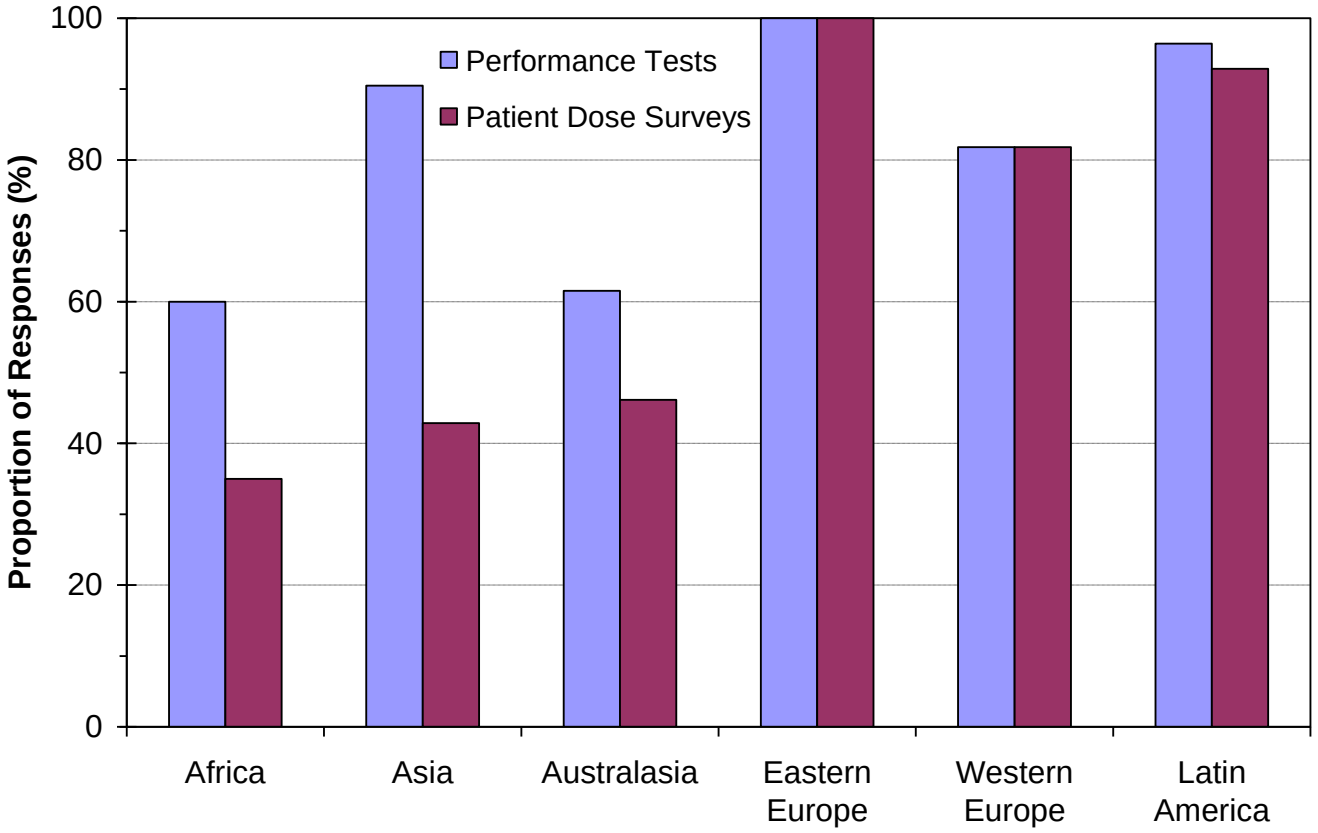
University Personnel



Patient Dose Surveys

- Most dose surveys undertaken by medical physicists
- Western Europe and Australia: 60%-80% of physicists were employed by the radiology facility
- USA, Latin America, Eastern Europe and New Zealand: 65% of physicists from private organisations.
- Eastern Europe: Surveys performed by university personnel (67%) and hospital medical physicists (50%).
- Africa and Asia: Hospital physicists (40%) and university staff (15%-20%) are groups likely to carry out surveys.
- Africa, Asia and USA: Government staff may be also involved

Results from Tests used in Optimisation



Europe, Latin America and New Zealand use performance and patient dose results.

This was more variable in Africa, Asia and Australia, where there are fewer dose surveys.

Optimisation – collaborative process

Responses indicating those involved

- Western Europe: medical physicist (82%), radiographer (78%) and radiologist (50%).
- Australia: medical physicist (67%), radiographer (22%) and radiologist (22%).
- New Zealand: private medical physicist (50%), radiographer (50%) and radiologist (50%).
- Latin America: private medical physicist (54%), university personnel (29%), no indication of radiographer involvement
- Eastern Europe: university personnel (67%), hospital medical physicists (50%) and radiographers (33%).

Optimisation – collaborative process
Responses indicating those involved

- Thailand: radiographer (100%)
- Other parts of Asia: radiographer (59%), private medical physicist (41%), government personnel (31%)
- USA: radiographer (42%), hospital medical physicist (33%), private medical physicist (25%), government personnel (25%)
- Africa: radiographer (40%), medical physicist (35%)
- 30% of respondents in Africa and Australasia stated that no optimisation was performed.

Patterns in Different Regions

Western Europe and Australia	Lead by hospital medical physicists with radiographer involvement.
USA, Eastern Europe, New Zealand, and Latin America	Private medical physicists more likely to be the ones who tested equipment (N.B. no. of diagnostic physicists in Latin America is small.)
Eastern Europe	University involvement, but uncertain how wide coverage might be
Thailand	Radiographers provide all services
Africa and Other Asian Countries	Government personnel and X-ray engineers have significant role in testing equipment.

Summary of Models for Service Provision

- Medical physicists based in the radiology facility have close links with the radiographers and radiologists, and so there is a greater opportunity for collaboration in optimisation.
- Private medical physicists have the potential to provide the same link, but uncertain how well this works in practice.
- Radiographers could provide many aspects of service, but would need more in depth scientific training.
- University physicists can contribute through the undertaking of patient dose surveys, but researchers must ensure that action is taken to complete the optimisation process. Disadvantage may be that numbers of hospitals involved are limited.

Requirements for Successful Optimisation

- Physics / scientific support to advise on strategy
- Close links between those testing equipment, measuring doses, and performing examinations
- Infrastructure to enable collaboration between radiologists, radiographers and physicists
- If groups outside the hospital are involved, strenuous efforts must be made to ensure that there is good communication and feedback
- Provision of services to all hospitals

We hope that you are having a pleasant stay in Scotland

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Data is still being collected and anyone who is willing to complete a questionnaire should contact colin.martin@ggc.scot.nhs.uk.