

Radioprotection and radiation monitoring culture among Malaysian medical radiation workers:

A NATIONWIDE SURVEY



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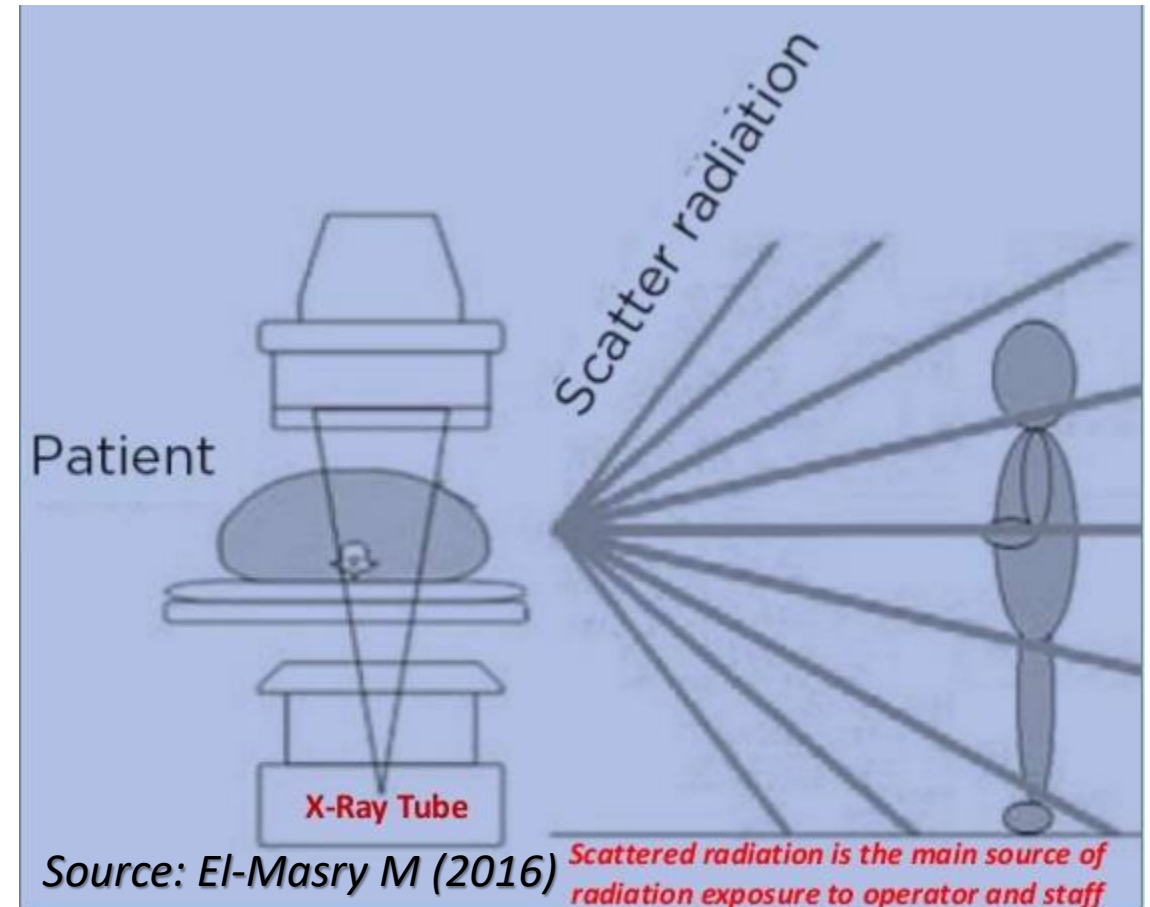
Position

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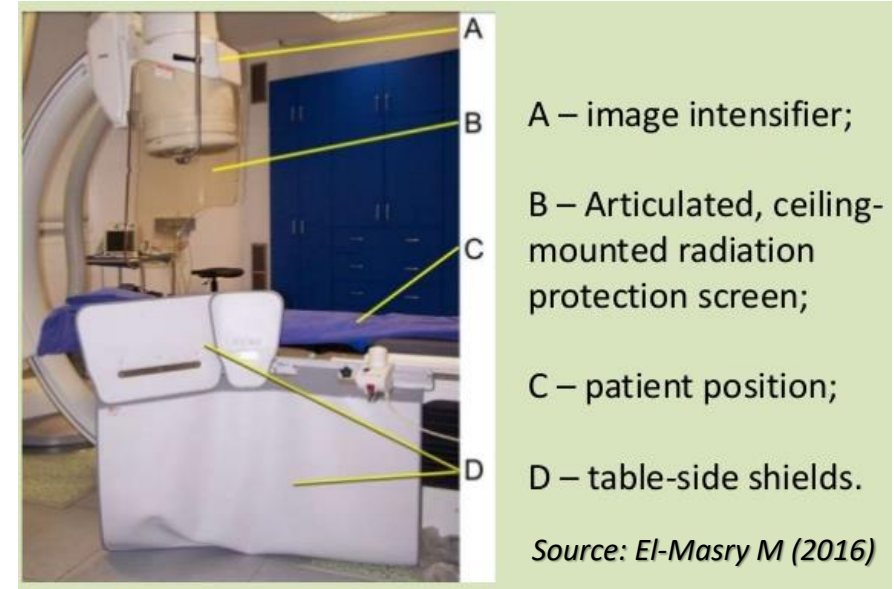
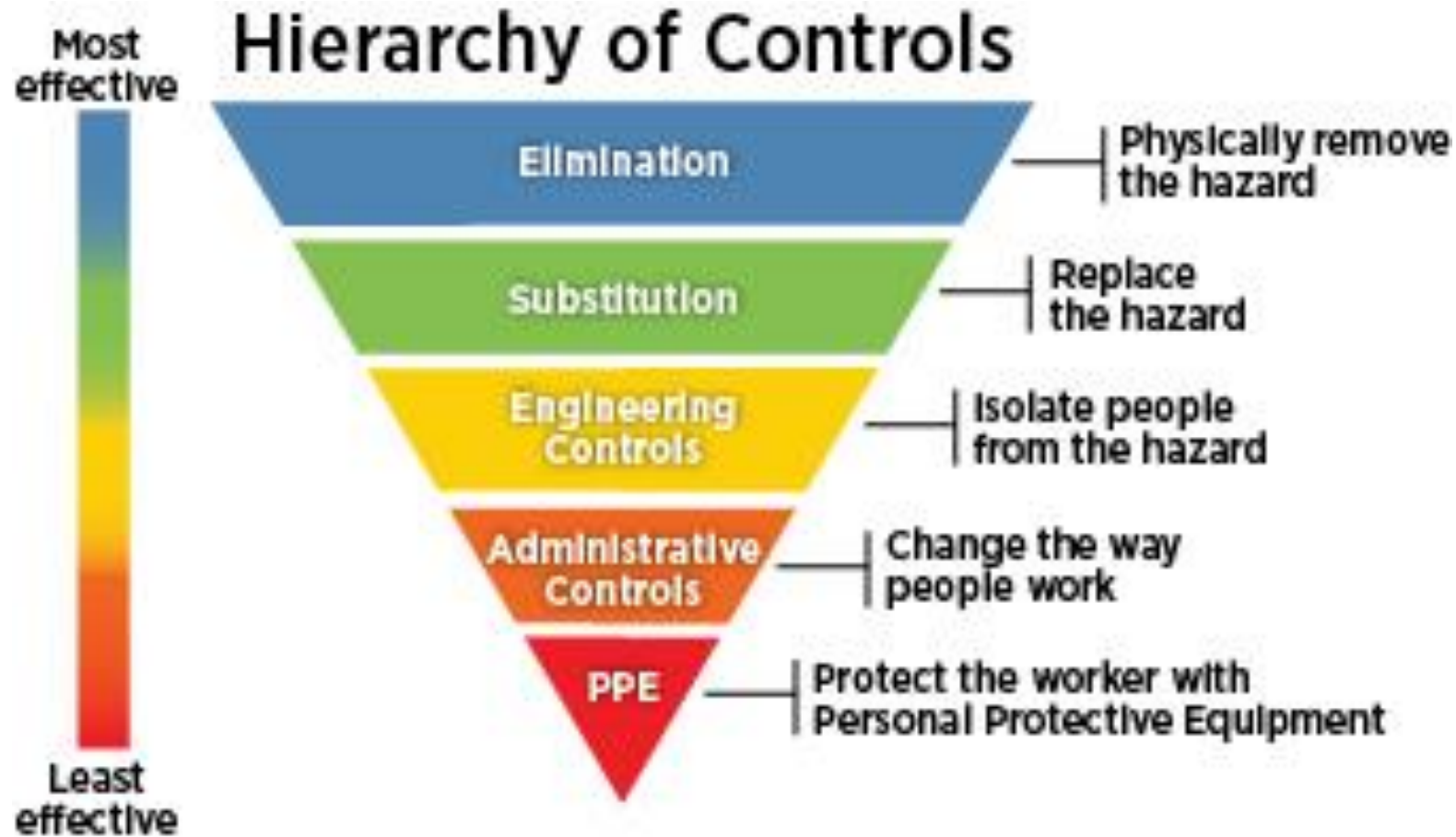


The primary source of occupational exposure to medical radiation workers (MRWs) comes from...

- Scattered radiation - patients
- Necessary : MRWs to apply all radiation protection principles
 - ❑ justification and limitation, in order to avoid unnecessary exposure, and to maximise their occupational safety [1].
- These principles are combined with exposure-limiting factors - hierarchy of control measures



Controls are most effective when they address the hazard at its source, and least effective when they address the hazard at the point of the worker:



Source: National Institute for Occupational Safety and Health (NIOSH)
Occupational Safety and Health Administration (OSHA)

Using radioprotective garments and personal dosimeter should be a habit among MRWs, but this was not the case...

Year	Authors	Respondents	Study location	Personal Dosimeter	Radioprotective Apron	Thyroid Shield	Others reported
				Non-consistent use (%)			
2018	McCulloch et al	302 workers who assigned with dosimeter	Michigan	65.0	-	-	-
	Al-Sayyari et al	110 radiologic technologist students	Al-Qassim state, KSA	0.0	8.0	37.0	light beam, cone, grid, sign, gonad, glove
	Brun et al	90 surgeons and anaestetists	South of France	46.7	7.8	50.0	lead glass
	Bowman et al	517 orthopedic residents	The U.S. regions	-	6.0	13.0	lead glass
	Abdelrahman et al	62 radiologists and residents	Amman and Irbid, Jordan	6.5	1.6	80.0	lead glass, reduced time, avoid primary beam, reduce unnecessary exposure
2017	Alavi et al	413 medical radiation workers	Tehran, Iran	55.0	-	-	-
2016	Valuckiene et al	31 cardiologists	Lithuania	12.9	0.0	6.5	lead glass, cap, other shield/barrier
	Awosan et al	110 radiology, radiotherapy and dentistry staff	Sokoto, Nigeria	72.7	89.1	97.3	goggles, glove, gonad shield
2015	Tok et al	127 operating room personnel	Turkey	53.5	27.6	27.6	gloves, eye glasses
	Rania et al	75 radiographers	Taif City, KSA	32.0	28.0	64.0	light beam, cone, grid, sign, gonad, glove
	Jindal T	48 urology residents	India	100.0	-	54.4	-
	Botwe et al	50 radiographers	Ghana	86.0	-	-	-
	Borges et al	332 urologists	Brazil	76.4	15.6	46.1	-
2014	Bordoli et al	42 vascular surgery trainees	The U.S	52.4	71.4	4.8	goggles, bleeper, attend ALARA
2013	Soylemez et al	124 urology residents	European countries	71.8	25.0	69.4	gloves, eyeglass, distance, time
	Emmet Lynskey III et al	504 interventional radiologists	The U.S	-	1.0	6.0	eyeglass, glove, drape, other shieldings
	Friedman	165 urology residents and fellows	The U.S. regions	70.0	1.0	27.0	glass, glove, distance, low dose
2012	Soylemez et al	363 urologists	Turkey	73.9	24.8	53.6	eyeglass, gloves
2008	Rahman et al	28 cardiologists	Karachi	93.0	8.0	45.0	glasses

OBJECTIVES

Previous studies reported noncompliance to radiation protection (RP) and radiation monitoring (RM) based on radioprotective garments (RPGs) and dosimeter usage; which were not associated with other protection principles the workers might have occupied...

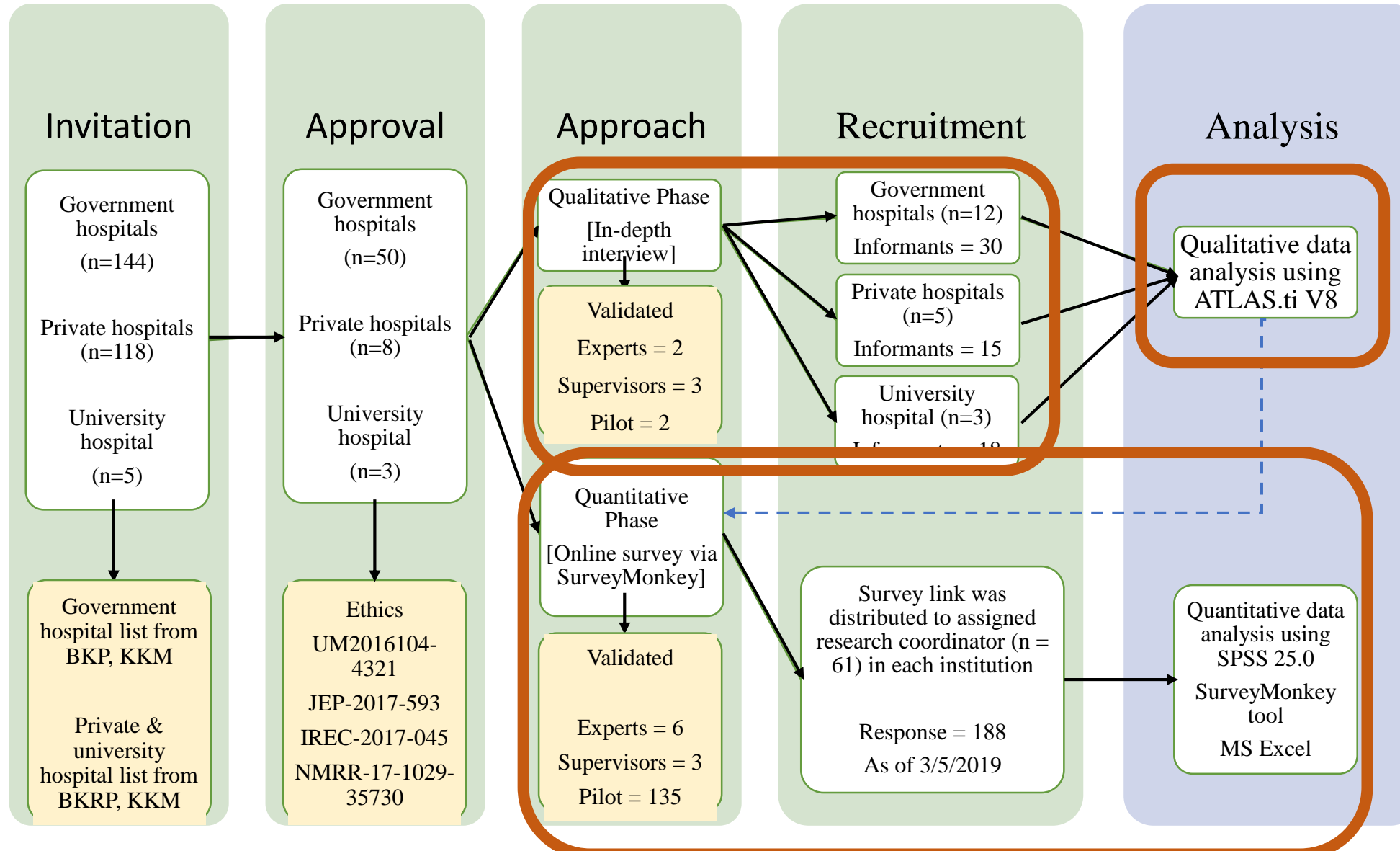
Research Objectives

To describe the holistic RP and RM practices among MRWs in Malaysia for the establishment of the national data

Research Question:

1. What is the level of radiation protection and radiation monitoring practice among MRWs in Malaysia?
 2. If it is recognized that the workers do not follow established standards in practice, what possible reasons could contribute to these actions?
-

This study practiced a *mixed-method* approach : exploratory sequential design



188 respondents completed the online survey in 4 weeks:

Characteristics (N=188)	n (%)
Gender	
Male	72 (38.3)
Female	116 (61.7)
Age group (years old)	
20-29	45 (23.9)
30-39	101 (53.7)
40-49	31 (16.5)
>50	11 (5.8)
Race	
Malay	158 (84.0)
Chinese	14 (7.4)
Indian	11 (5.9)
Others*	5 (2.7)
Highest level of education	
Certificate and lower	3 (1.6)
Diploma	87 (46.3)
First degree	56 (29.8)
Postgraduate and higher	42 (22.3)

Note: *Punjabi, Sarawakian ethnic, Sabahan ethnic

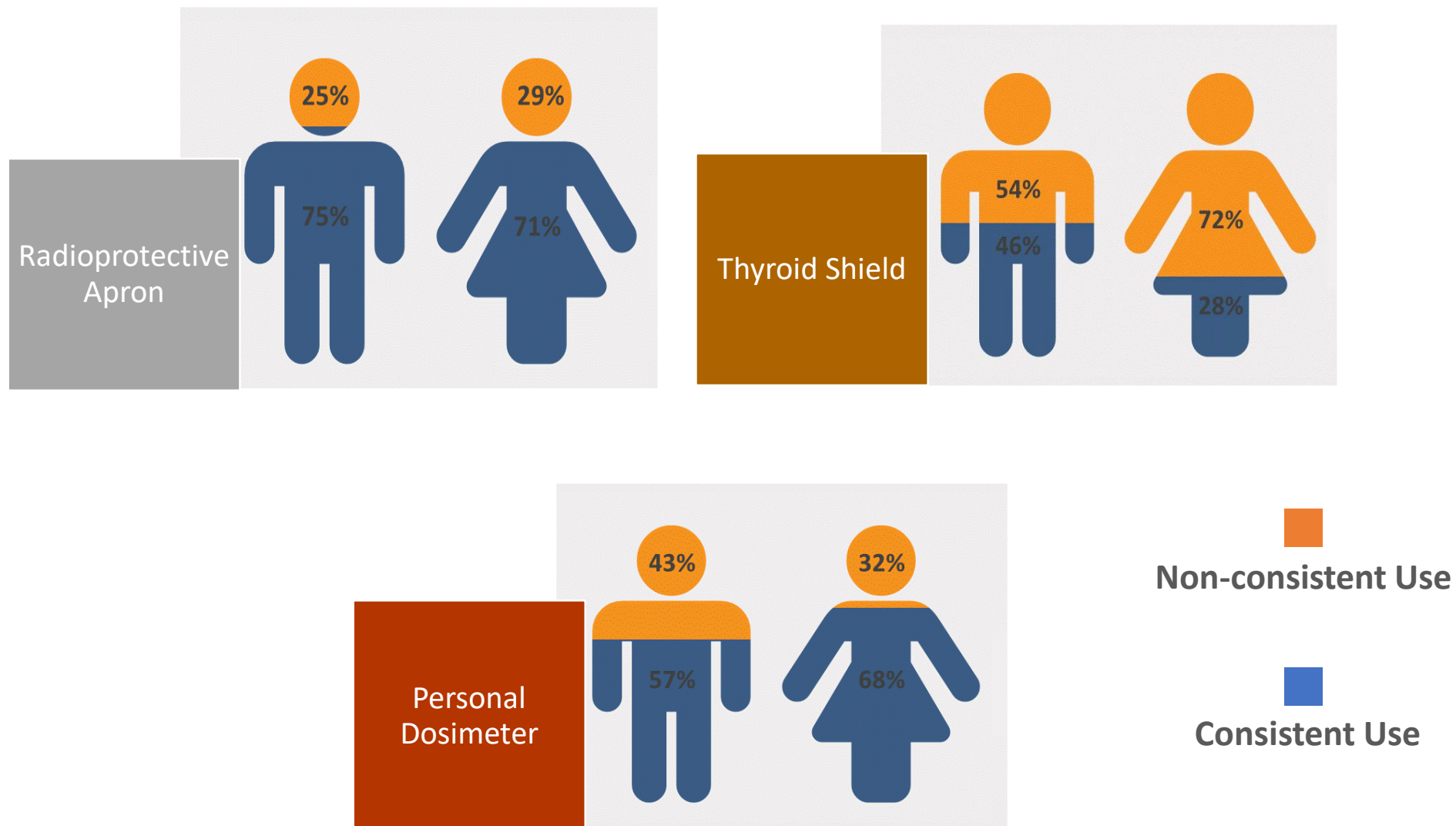
Characteristics (N=188)	n (%)
Job position	
Radiologist/Interventionalist	25 (13.3)
Registrar/Medical officer	12 (6.4)
Senior radiographer/Radiographer	126 (67.0)
Nuclear medicine technologist	2 (1.1)
Medical assistant/ Staff nurse/ Attendant	8 (4.3)
Others [£]	2 (1.1)
Primary practice[¥]	
General/Mobile/Dental	98 (52.1)
Computed tomography	85 (45.2)
Interventional/Fluoroscopy	65 (34.8)
Mammography	19 (10.1)
Nuclear medicine	9 (4.8)
Non-radiation (MRI, Ultrasound)	26 (13.9)
QC/QA/Radiation protection	20 (10.6)
Radiation therapy	1 (0.5)

Note: [£]Medical lecturer, [¥]More than one answer allowed,
MRI=magnetic resonance imaging, QC=quality control,

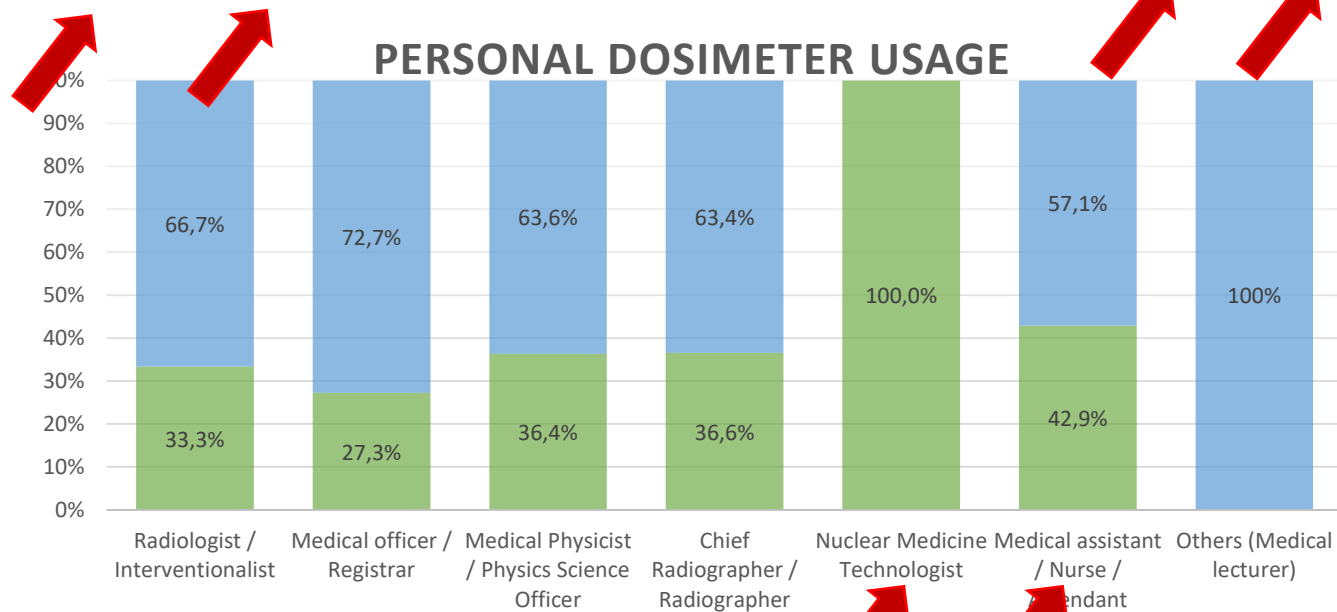
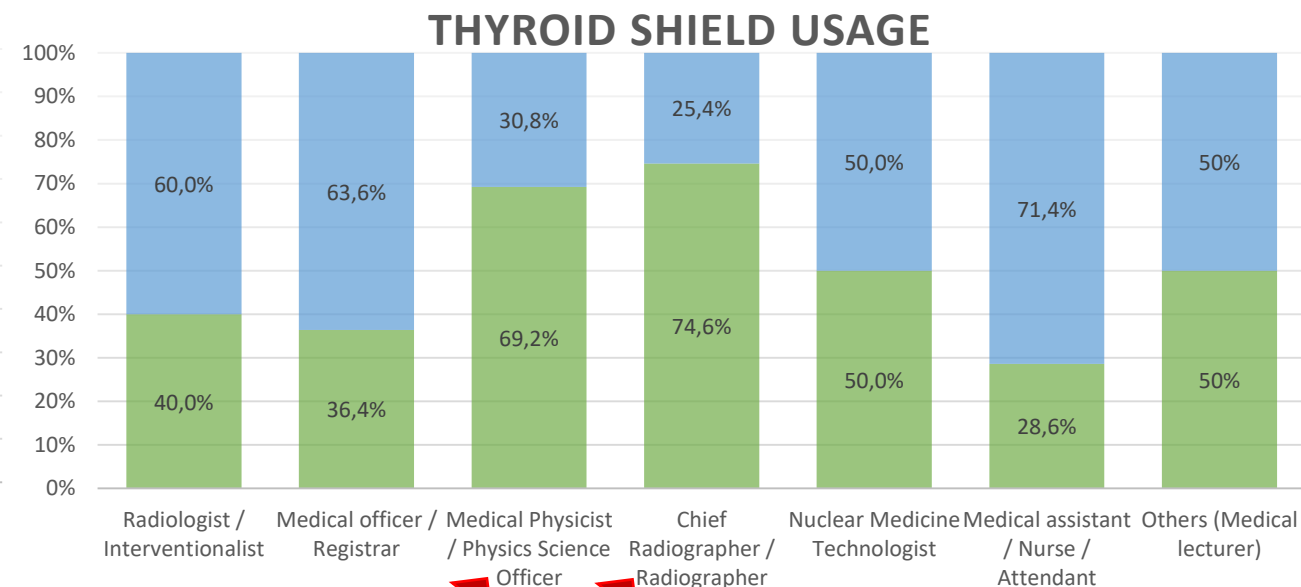
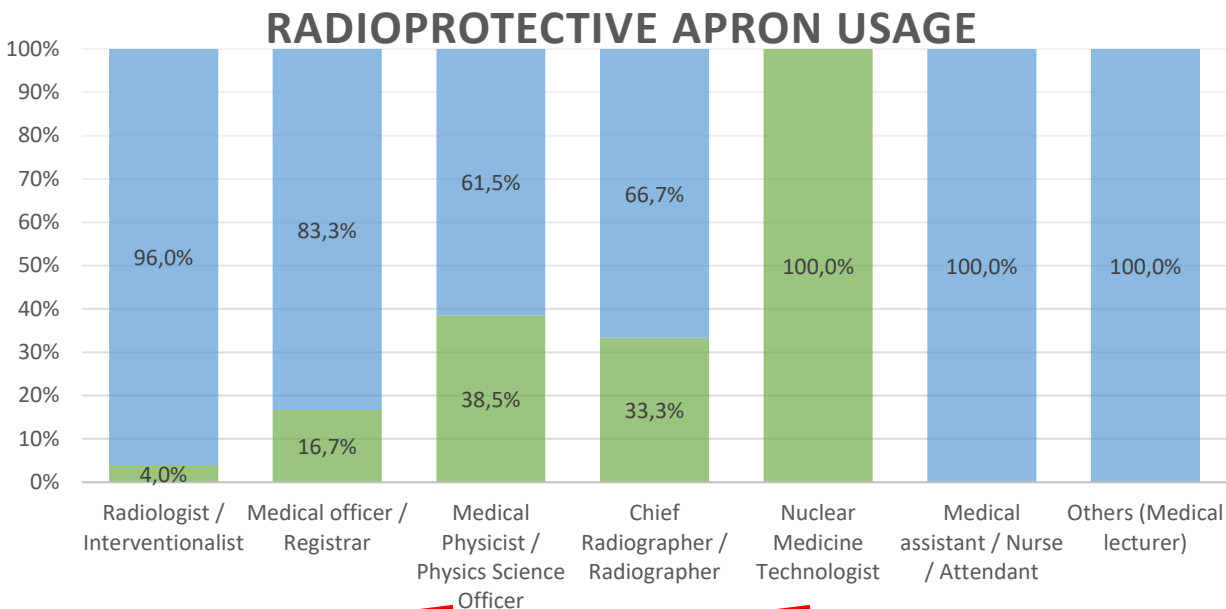
188 respondents completed the online survey in 4 weeks:

Characteristics (N=188)	n (%)
Organization	
Government hospital/health clinic	73 (38.8)
University hospital	95 (50.6)
Private hospital/clinic	20 (10.6)
Employment status	
Permanent	176 (93.6)
Contract	10 (5.3)
Part-time	2 (1.1)
Shift hours	
Yes	57 (30.3)
No	131 (69.7)
Experience with medical radiation (years)	
1-5	57 (30.3)
6-10	62 (33.0)
11-15	36 (19.2)
16-20	14 (7.4)
21-25	14 (7.4)
>25	5 (2.7)

Generally, the consistency of using the RPGs - PD vs Gender...

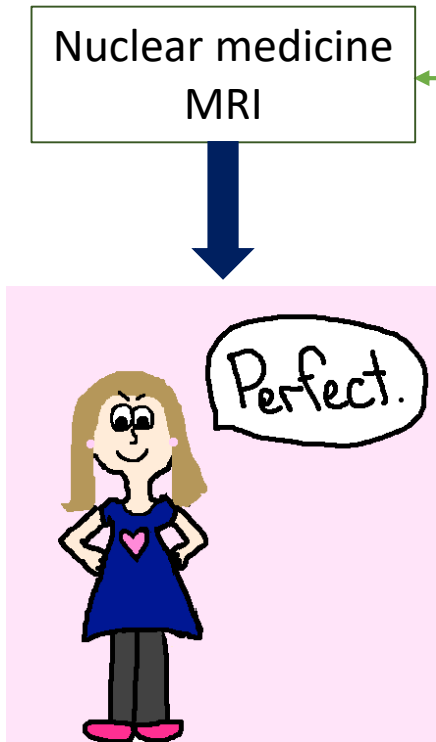


In general, the consistency of using the RPGs & PD vs Job title...



■ Not consistent ■ Consistent

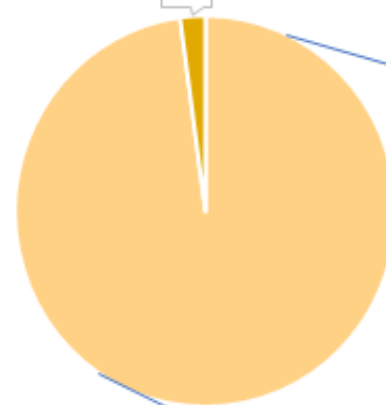
However, through qualitative explorations, a more holistic RP phenomenon was well described:



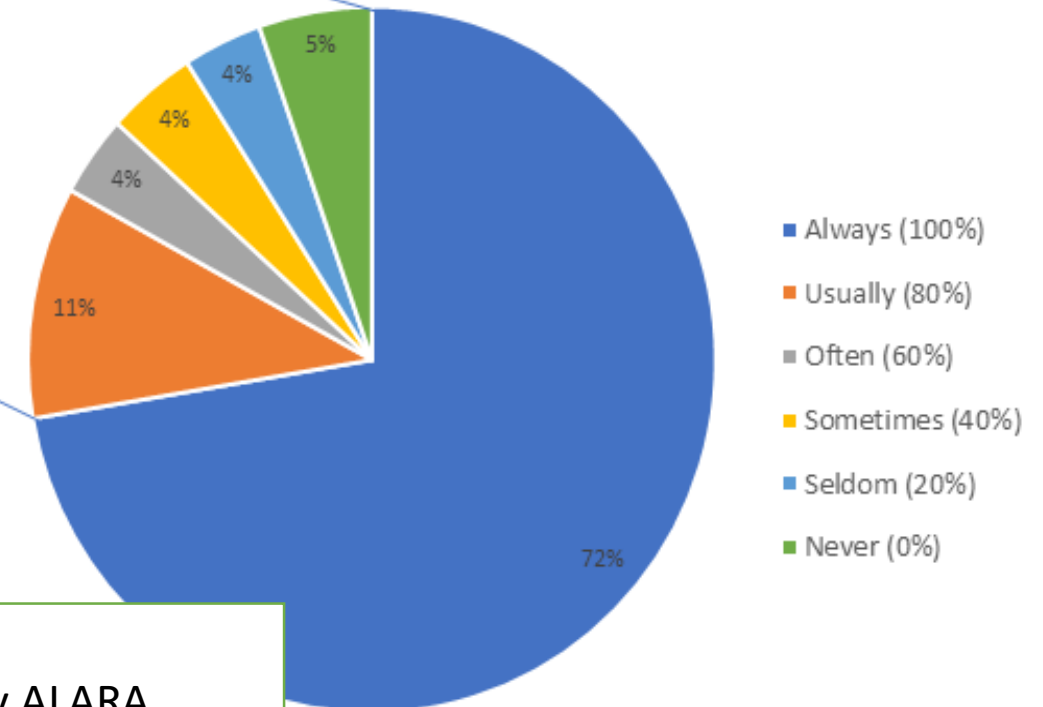
Other protection measures: Distance and/or other shielding

Yes No/Not applicable

2%



Consistency for using radioprotective apron

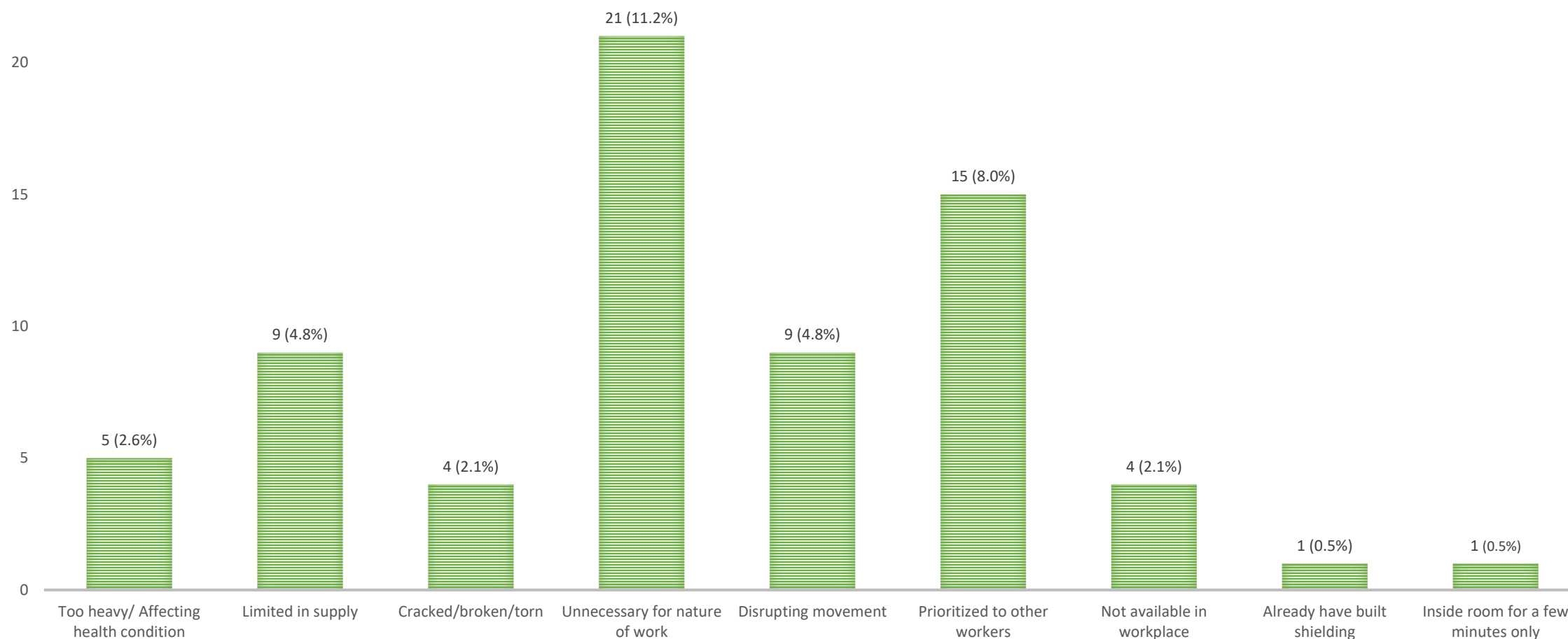


72% - Always use RP Apron

28% - Not always use RP Apron → 98% apply ALARA

In-line with the reasons for RP Apron non-use...

REASONS FOR NON-ADHERENCE TO RADIOPROTECTIVE APRON USE
(RESPONDENTS MAY CHOOSE 2 ANSWERS)



Reasons for RP Apron non-use from in-depth interviews...

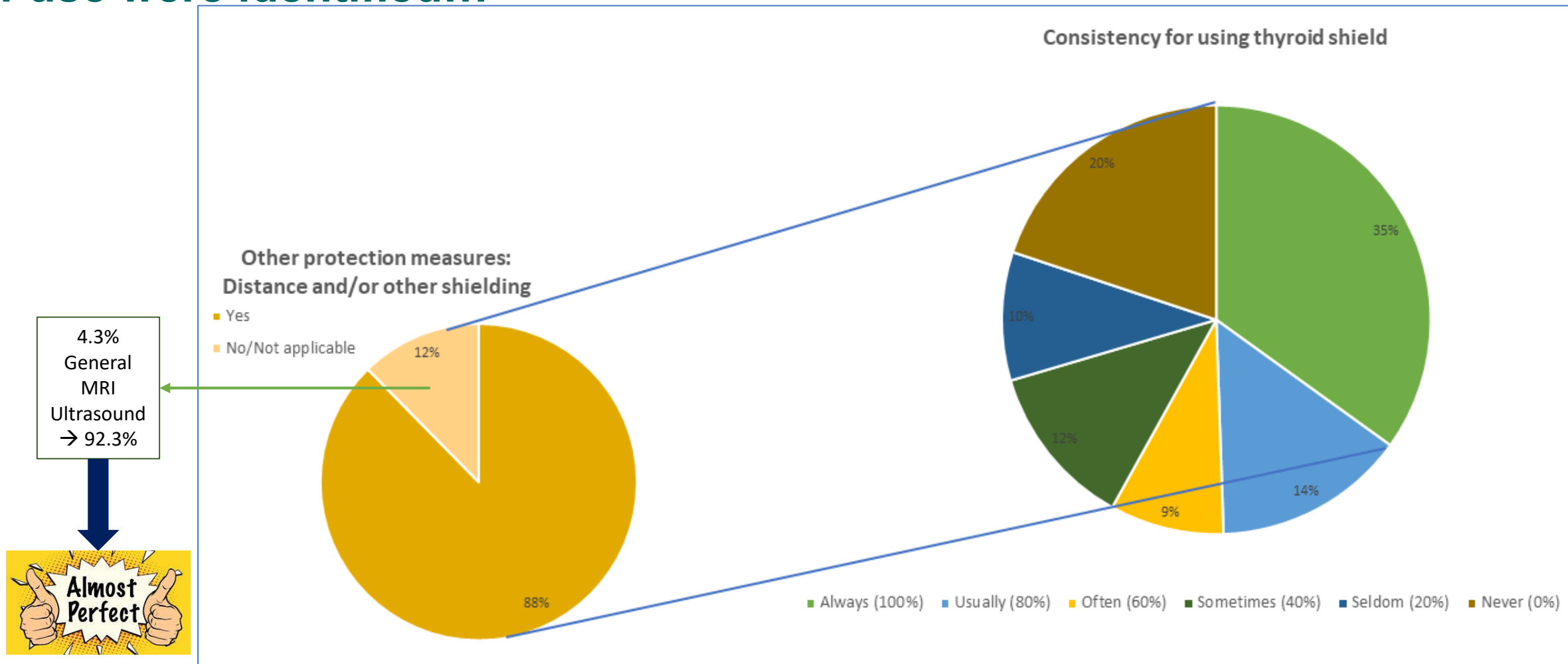
My attitude towards myself. Maybe we just take it lightly. For me, I want to work fast, and ... the apron is heavy. It affects the willingness to wear it... Maybe if there are fewer iodine patients, I can use it.'

P9, nuclear medicine technologist, 16 years in nuclear medicine

There was one doctor who said that lead aprons will reduce only 1% of the exposure in nuclear medicine, so 99% surely gets through to us. Using a heavy apron affects the back, so it is better to not use it ... just play with the timing and distance. One more thing, FDG is dispensed by the auto-dispenser, not manually.'

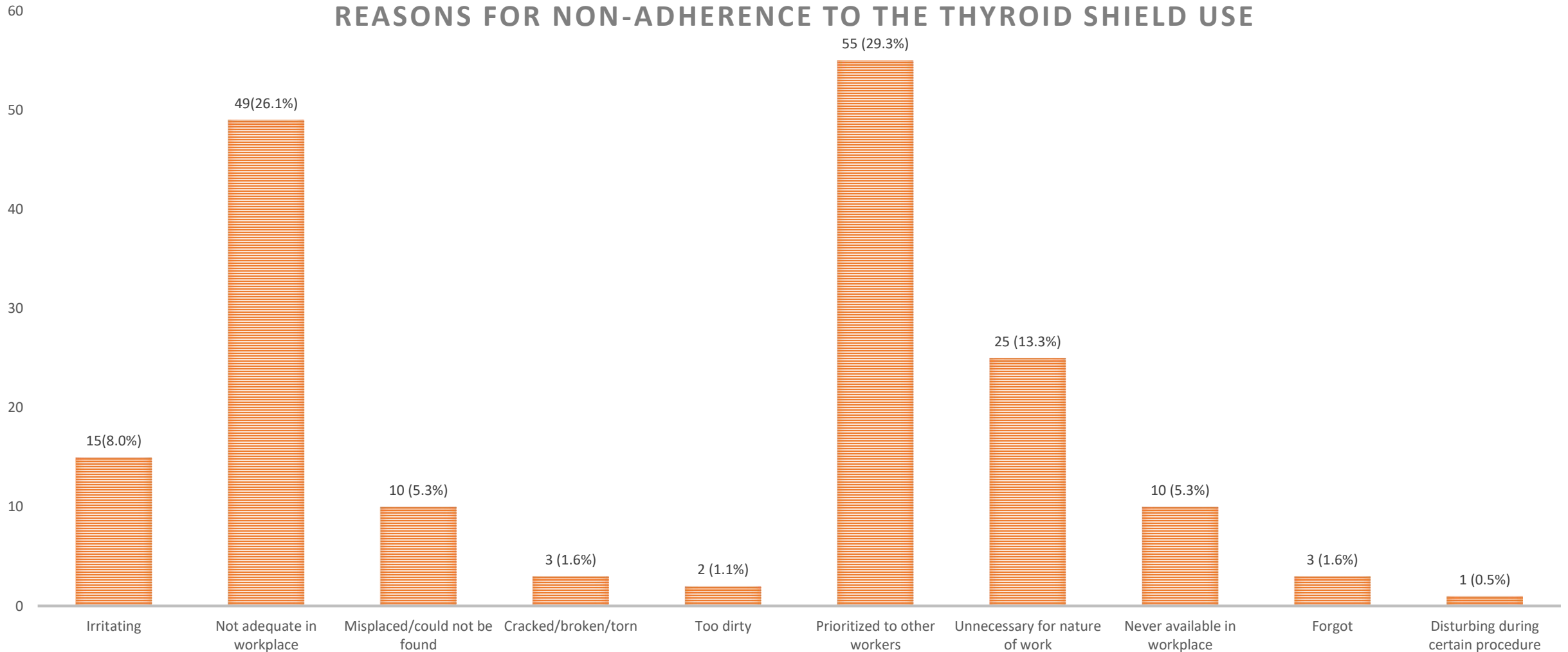
P10, nuclear medicine technologist, 6 years in nuclear medicine

A clear practice of using thyroid shield was well-defined and reasons for non-use were identified...



35% - Always use TS
65% - Not always use TS → 88% apply ALARA

Meanwhile, 7.7% of the MRWs who supposed to use the thyroid shield but did not, stated that the thyroid shield is *inadequate, missing, broken, dirty & irritating...*



Reasons for thyroid shield non-use from in-depth interviews...

When I'm left with no more thyroid shields, I have to be in the OT room with just a lead apron. We have to prioritize the thyroid shield for the doctors, as they are closer to the X-ray source.

P17, radiographer, 1 year in medical imaging

It is not comfortable at all. My neck here will get red and I get some marks...

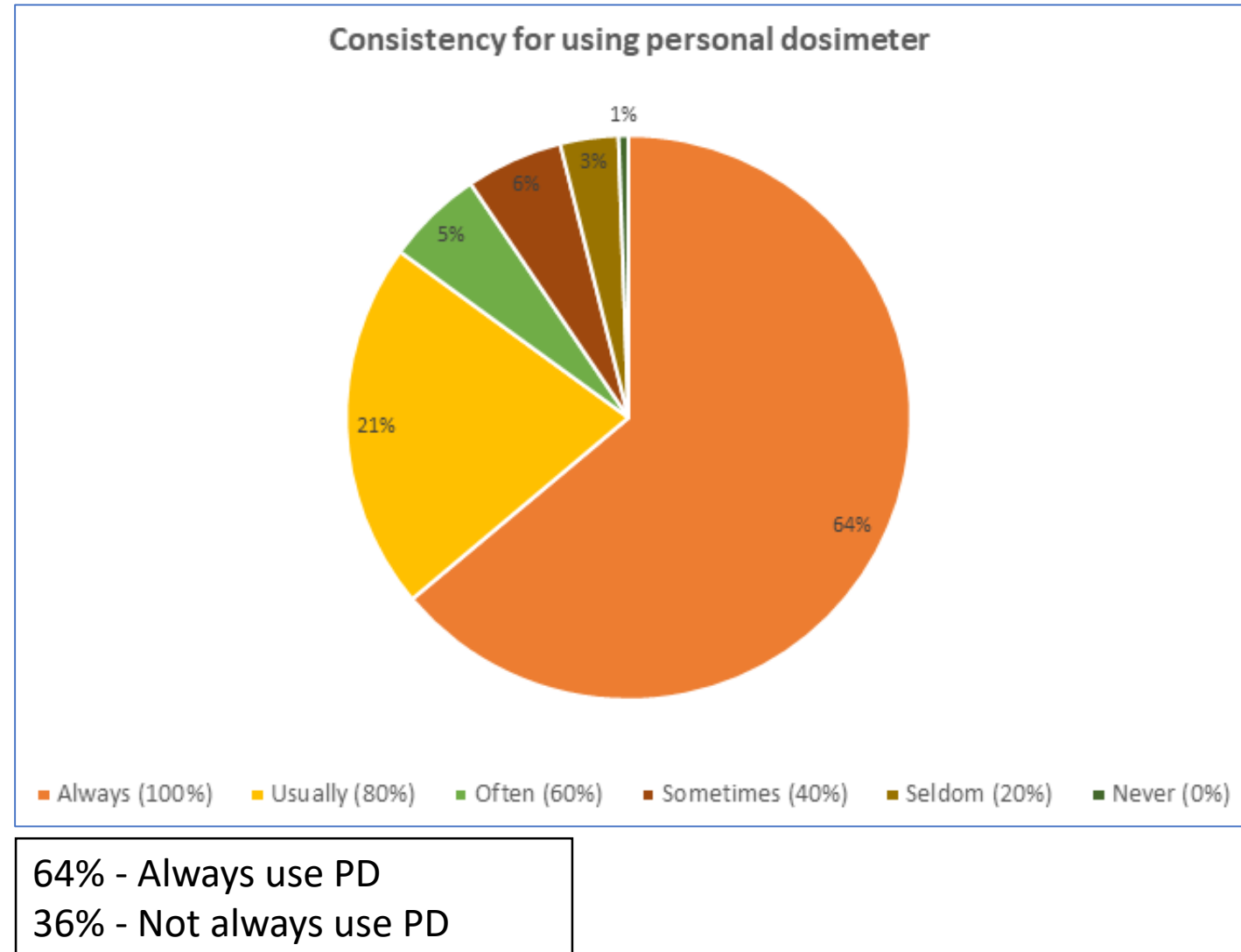
P4, radiographer, 7 years in medical imaging

When I first worked here, I did not use a thyroid shield, because everyone in the OT here did not wear one. I was affected, I was influenced ... despite the fact that I know it is not right.

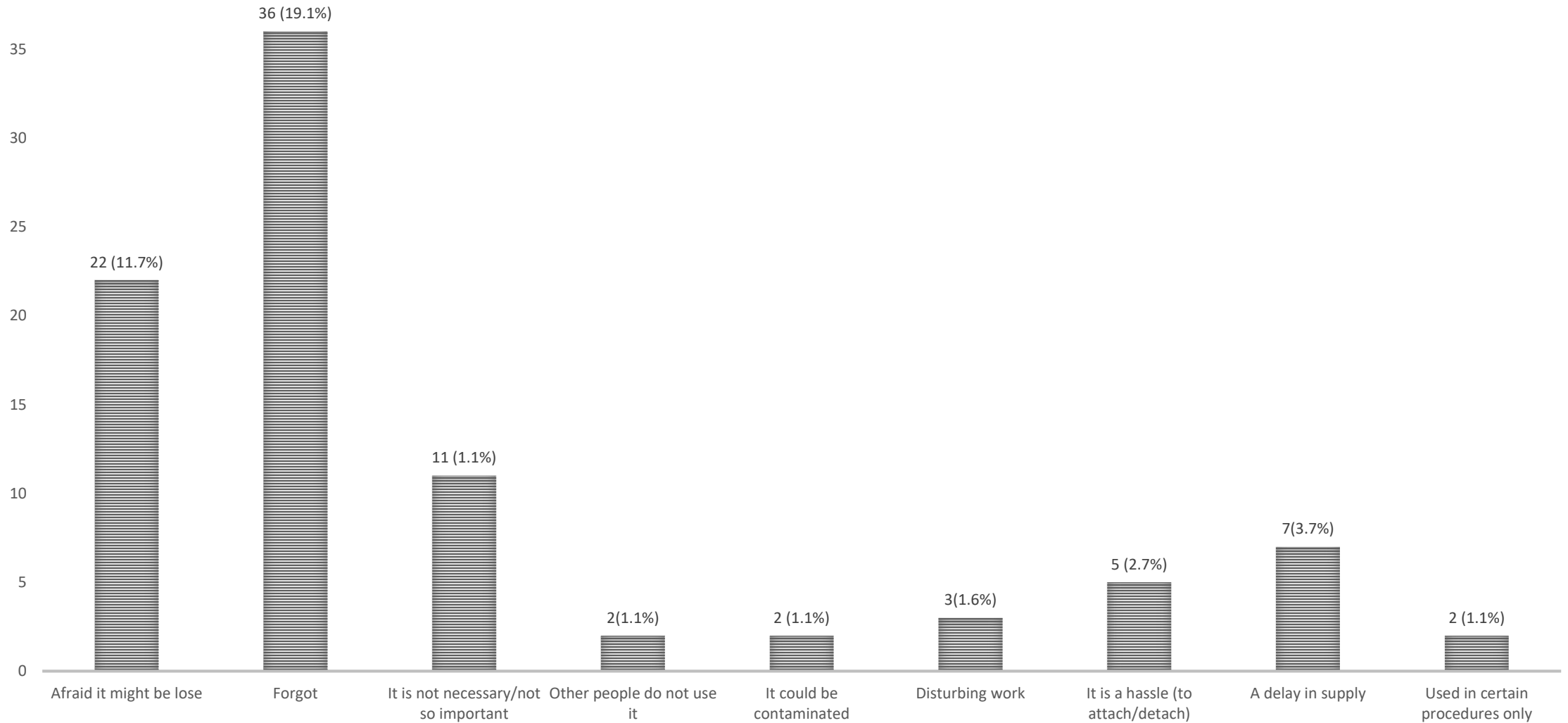
P16, radiographer, 1 year in medical imaging

While the radiation protection practice among MRWs in Malaysia is excellent, the radiation monitoring practice...

- The supplies of PD in Malaysia – outstanding
- However, the practice of using the PD was unsatisfactory
- Malaysian MRWs had exclusive issues for PD non-use



They were worried that the PD might be lose/missing – will be penalised...



Reasons for dosimeter non-use from in-depth interviews...

I'm afraid the dosimeter will get lost, because a replacement will be so expensive. That is the problem. That day, the officer said RM250 should be paid if the dosimeter is lost and I have to think so many times. I'm scared to use it.

Radiographer, 28, female, 7 years in radiology.

And the clip, hopefully they will design a more friendly-user clip. This type of dosimeter can easily get lost without us realizing because the clip does not hold it well

Staff nurse, 28, female, 6 years in radiology

It feels like... optimism-biased feeling... I feel like, "Oh, I'm sure it cannot be excessive" and "It will be alright". A very positive feeling. To be honest, we took the thing lightly.

Radiographer, 28, female, 7 years in radiology

RP culture in Malaysia was impressively satisfactory, but RM practice needs some interventions...

- Penalty for non-use instead of penalty for the lose
- Supervision for the usage
- MRWs status – re-evaluation
- Profiling of dosimeter users – financial implication

As for the highlights:

- PPE use: a latter approach in the protection hierarchy.
- Reporting non-usage: over-exposure estimation.
- The utilization of PD: must be strongly encouraged
- *Tracking MRWs' RP cultures qualitatively & quantitatively : holistic understanding of the practice*

