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Survey of research attitudes of RTTs working in Scotland: A Scottish radiographer research forum collaboration

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ABSTRACT

Purpose: Evidence-based practice (EBP) is associated with improved treatment outcomes and survival in cancer patients. Engagement from therapeutic radiographers/radiation therapists (RTTs) in research, has been identified as a challenge. The aim of this survey was to gain an understanding of RTT attitudes to research in Scotland.
Methods: This was a prospective study that used a mixed method cross-sectional survey, with an online survey tool (Webropol). The survey was developed with collaborators from all Scottish Radiotherapy Centres (n = 5) and piloted by 6 conveniently sampled RTT and validated by 8 experienced RTTs. The survey comprised 29 items, 7 selection-based demographic questions, and 18 statements with a Likert 5-point metric scale rating (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree). The validity was measured with the content validity index (CVI) and item-CVI by 8 experienced RTTs. Low scoring I-CVI (<0.78) questions were removed.
A total of 314 RTTs working in Scottish Radiotherapy Centres were invited to participate. Approvals were given by each Head of department (HoD), who also confirmed number of RTTs.
Results: A total of 102/314 (32.5 %) RTTs responded. The majority of RTTs agreed they were confident they had sufficient research skills to inform EBP (n = 58/102, 56.9 %), felt confident discussing EBP with colleagues (n = 67, 65.7 %) and felt research was important for role development (n = 89, 87.2 %). Low mean scores and standard deviation (SD) were observed for the following: "I know how to get involved in research" 3.2 (1.2), "I have been given the opportunity to get involved in research" 3.2 (1.1), and "I am well informed about current research projects in my department" 3.2 (1.1). 57.8 % (n = 59) of RTTs disagreed they were confident adequate time would be provided to be involved in research.
Conclusion: The survey results demonstrated a predominantly positive attitude to research amongst RTTs working in Scottish centres, with most common perceived barriers being access to protected time and staff; training, and support.

Introduction

Cancer caused nearly 10 million deaths worldwide in 2022, with cases predicted to reach 27.5 million globally by 2040 [1,2]. Radiotherapy (RT) provides a cure to 40.0 % of patients, with UK survival rates doubling in the last 50 years [2,3]. Advancements in the field of RT contribute to successful multi-modality treatments, utilising optimised techniques to target and kill tumour cells, whilst sparing healthy tissue [4].

In the UK, radiography has transitioned from a hospital and

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knowledge-based discipline to a university-linked degree and evidence-based practice (EBP) [5]. Evidence-based radiography is described by Hafslund et al. (2008) as, "Radiography informed and based on the combination of clinical expertise and the best available research-based evidence, patient preferences, and available resources" [6]. RT relies on technology-driven research and interaction with a multi-professional team (MPT), with both components being crucial to the fields progression.

In high-income countries, around half of all cancer patients will receive RT, yet this was not reflected in the worldwide budget for RT research in comparison to investments in medical oncology [7]. Data collated over a decade (2007–2017), established RT trials to be in the minority (5.3 %) of globally registered oncological trials (1378 out of 25,907). Furthermore, industry-sponsored RT clinical trials were significantly lower than oncological trials ($p < 0.01$, 43.4 %), highlighting the need to increase collaborations among oncologists, academia, industry leaders, funding agencies, and other organisations [7].

As key members of the MPT, therapeutic radiographer/radiation therapist (RTT) research engagement is paramount to the development of EBP, with many studies highlighting this as essential to improve treatment outcomes and service delivery [4,6]. RT progression relies on research and lifelong learning to maintain safe and effective standards of patient care, beginning at undergraduate level [6]. RTT engagement in these areas continues to be a challenge, with common perceived barriers including insufficient time, resource, knowledge, motivation, funding, support from colleagues and management, and heavy clinical workloads [4,8,9]. Other identified preconditions were competency, ability, attitudes, culture, and self-confidence [10]. Saukko et al. (2021) suggested that RTT attitudes towards research have improved, with increased RTT publications over the last decade [11]. Nonetheless, RTT research involvement remains low, e.g. < 10.0 % of research RTTs in UK centres had time in their job plan to contribute to publications or research proposals in 2013 [11–13].

The Society and College of Radiographers promote the development of the radiography profession in the UK, providing clear documentation on an education and career framework [14]. RTT roles and responsibilities are based on experience and practice, with annual development reviews that include opportunities for lifelong learning. The Agenda for Change (AFC) is a UK National Health Service (NHS) agreement that classifies RTT banding and pay scales, reflecting levels of experience [14–16]. To improve research engagement throughout Scotland, the Scottish Radiographers Research Forum (SRRF) was created in 2021. This consists of an annual research showcase (established 2021), and implementation of a forum to discuss the development and implementation of strategies aimed at increasing research activity. Following the 2022 meeting, a subgroup initiated this survey to inform future efforts to increase RTT research activity in Scotland.

The aim of this survey was to gain an understanding of RTT attitudes to research in Scotland. The primary objectives were to understand RTT attitudes and perceptions; and identify perceived barriers associated with research and development. Although beyond the scope of this report, any data collected would then be used to inform recommendations; implement initiatives that facilitate professional development; and, embed RTT-led research throughout Scotland.

Materials and methods

Study design and population

This was a prospective study that used a mixed method cross-sectional survey. A convenience, heterogeneous population with diverse RTT experience were voluntarily sampled. The survey was sent to all RTTs, including RTT managers (n = 314) working in Scottish RT centres (n = 5). Total number of RTTs working in each centre were clarified with each Head of department (HoD).

Survey design

Three major concepts were incorporated into the survey: EBP (3 items), research (14 items) and career (5 items), to investigate RTT perception and experience of research, see Appendix A, Table A1. Staff group selections were classified in accordance with designated radiography job title, including the NHS AFC banding descriptions, to help respondents with their classification selection [15]. Under the AFC, increasing responsibilities are associated with higher banding e.g. a band 5 is a newly qualified RTT, and typically a manager will be a band 8 [15].

The survey was designed by research RTTs with collaboration from each of the 5 centres, guided by previous studies and developed to be RTT specific [6–11]. The survey comprised 29 items, 7 of which were selection-based demographic questions, and 18 statements formatted using a Likert 5-point metric scale rating (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree). Higher scale ratings represent positive indicators and conversely, lower scale ratings represent negative indicators. Four questions were open, asking participants to answer using their own words; and additional open text comment boxes (optional) were available following each question. An open and optional feedback box was also added to the end of the survey, to allow participants to comment. An online survey tool, Webropol (version 3.0, 2023) was used to collect survey responses electronically [17]. Full survey available in Appendix B.

Piloting

The survey was piloted by 6 randomly sampled RTTs with diverse experience in clinical RT; to test the feasibility, practicality of the questions; and to ensure the questions addressed the study aims [18]. Open feedback allowed questions to be amended, e.g. if a word was felt to be ambiguous or could be taken out of context.

Validity was measured with the content validity index (CVI) and item level -CVI (I-CVI) by 8 experienced RTTs across Scotland, with experience in research, clinical trials, advanced practice, and clinical practice. Each observer scored the question relevance on a four-point scale (1 = not relevant, 2 = somewhat relevant, 3 = quite relevant and 4 = highly relevant). The answers were dichotomised as not relevant (1 or 2) or relevant (3 or 4), where a CVI of 0 or 1 was given, respectively. I-CVI were measured by dividing the sum of experts scoring the question as relevant (1), by the total number of experts. As per recommendations, modest disagreements were accepted when computing the CVI using greater than five experts [19]. Questions that scored a low I-CVI (<0.78) were removed.

Survey dissemination

The SRRF approved this collaboration between all 5 centres. NHS Greater Glasgow and Clyde Research and Innovation granted permission to proceed with the survey, with authorisation from each HoD obtained. Each HoD assigned a representative in their centre, responsible for distributing the survey recruitment email to all RTTs. This was accompanied by a participation information sheet, stating that consent was obtained through voluntary survey completion. To maintain confidentiality, the survey was anonymised, with data deletion one-year post-survey. Survey dissemination and data collection were from March to June 2023, with weekly email reminders distributed by each centres representative to their staff cohort.

Data analysis

Descriptive statistics were used to report agreement between the Likert scale statements. These were also presented visually to illustrate the incidence of positive, negative, and neutral answers. The participants were categorised into groups for data analysis and comparison,

based on designated job titles i.e. representative of experience, as described in Table 1.

Thematic analysis (TA) of qualitative data was conducted, using an adaption of the theoretical framework by Saunders et al. (2023) [20], and modified from the multi-phase TA approach described by Braun & Clarke (2006) [21]. The TA process was conducted by 3 coders and involved continuous familiarisation with the data, writing initial memos, and creating initial in-vivo codes. Categories and a code index were then developed; with repeated peer review and triangulation throughout the process by 3 research RTTs (Fig. 1**)** [20–22]. See Appendix B for survey, Appendix C for coding template, and Appendix D for group comparison results.

Statistical analysis was performed using IBM SPSS Statistics (Version 28.0.1.1 (15)). A One-way Anova analysis of variance (significance, $p \leq 0.05$, confidence interval (CI) of 95 %), and a Tukey HSD post-hoc (significance, $p \leq 0.05$, CI of 95 %) were conducted to compare the means, variations, and statistical significance of the 5-point Likert-scale statement results between groups 1–4. As the sample size was > 30, the risk of a type II error was reduced [23].

Results

The total number of respondents were 102/314 (32.5 %) of all RTTs working in Scottish centres. This survey reports a margin of error of $\pm$ 8 % at a 95 % confidence level. Of the participants 89.2 % (n = 91) were female and 10.8 % (n = 11) were male, all within defined age categories as per Table 2. Participants had a diverse range of experience, with 47.1 % being rotational in the clinic. Those answering "other" included clinical trials RTT, advanced practitioner (AP) in education and development, management/technical areas, brachytherapy planning and treatment.

97.0 % of RTTs had achieved under- or post-graduate education, with 2.0 % awarded a PhD, 32.3 % MSc, 8.8 % PGC or DCR(T), and 56.9 % BSc. 22.5 % of RTTs were working towards further education, including MSc (15.7 %), PhD (22.9 %) and other educational courses (44.9 %), see Table 2.

EBP and research

Participant responses to the 18 5-point Likert scale rating statements are shown in Fig. 2. The majority of respondents felt positively encouraged (62.7 %), confident (65.7 %) and had sufficient research skills (56.9 %) to discuss EBP.

Responses related to the benefit of research were positive. Highest positive agreement (99.0 %) was reached for the statement: "departmental research is important to improve patient outcomes", with 74.5 % strongly agreeing, and a further 24.5 % agreeing. 63.7 % of staff positively agree that they wanted to be more involved in research, and 87.2 % positively agree that research is important to the development of their role.

Just under 50.0 % of RTTs know how to get involved (48.0 %), or felt they had been given the opportunity (49.0 %). These statements observed low mean (standard deviation, SD) scores as follows: "I know how to get involved in research" 3.2 (1.2), "I have been given the opportunity to get involved in research" 3.2 (1.1) and "I am well informed about current research projects in my department" 3.2 (1.1).

Table 1
RTT group categorisation for comparison.

Group	RTT group (AFC banding)
1	Therapeutic radiographer (Band 5)
2	Senior therapeutic radiographer (Band 6) Team lead radiographer (Band 7)
3	Advanced practice radiographer (Band 7) Consultant radiographer (Band 8)
4	Lead radiographer/ management (Band 8)

Informed of local research

45.1 % felt well informed about current departmental research projects. A further six statements had a majority of positive responses when agree and strongly agree responses were summed, see Fig. 2.

RTT as a career

70.6 % of participants agreed that they see RTT as a lifelong career, with 51.0 % of staff in agreement that more involvement in research could improve their job satisfaction. 47.1 % of RTTs indicated they had considered a career change in the past 12 months.

Barriers to being involved

88.0 % of participants either disagreed or strongly disagreed they were confident they would be provided with adequate time to be involved with research. There were 30.0 % of participants who disagreed and 33.0 % strongly disagreed that they were supported by their colleagues and management, with mean scores (SD) 3.2 (1.0) and 3.1 (1.2) respectively.

The final themes identified from the TA of each open-box question are available in Table 3, which also displays supporting quotes. Coding represents the overall sample, with random selection of quotes to underpin themes.

Group comparison results

EBP and research

All groups displayed a majority positive attitude to research and EBP, however, groups 3 (advanced practice radiographer and consultant radiographer) & 4 (lead radiographer/ management) displayed higher mean scores than the other groups in the majority of statements, see Appendix D.

High mean scores were observed for all groups in the following statements: "Research is important to the development of my role" and "Departmental research is important to improve patient outcomes, see Appendix D, Figures A4.7.14 and A4.7.15.

Informed of local research

In the following statements, group 1 (therapeutic radiographers) displayed some of the lowest mean scores in comparison to the other 3 groups: "I am well informed about current research projects in my department", "I am involved in the implementation of new techniques and studies in the department", and "I am confident I will be provided with adequate time to be involved in research". See Appendix D, Figures A4.7.8–4.7.10 respectively.

RTT as a career

The majority of participants reported agreement in the following statement: "I have considered a career change in the past 12 months", mean scores (SD) for groups 1, 2, 3 & 4 were 3.9 (1.3), 2.8 (1.3), 3.3 (1.7) and 3.1 (1.5) respectively. See Appendix D, Figure A4.7.17.

Barriers to being involved

Groups 1 & 2 (2 being senior radiographer and team lead radiographer) indicated less confidence and support, demonstrated through lower mean scores (SD) than groups 3 & 4 in the following statements: "I am confident I have sufficient research skills to inform EBP" with scores of 3.6 (1.0),3.3 (1.0), 4.0 (0.7) and 4.2 (0.7) for groups 1–4 respectively; "I am supported by colleagues to be involved in research and development" 2.8 (1.0), 3.1 (1.0), 3.4 (1.0) and 3.8 (0.9) groups 1–4 respectively; and "I am supported by my managers to be involved in research" 2.8 (1.0), 2.9 (1.2), 3.4 (1.1) and 3.6 (1.1) groups 1–4 respectively. See

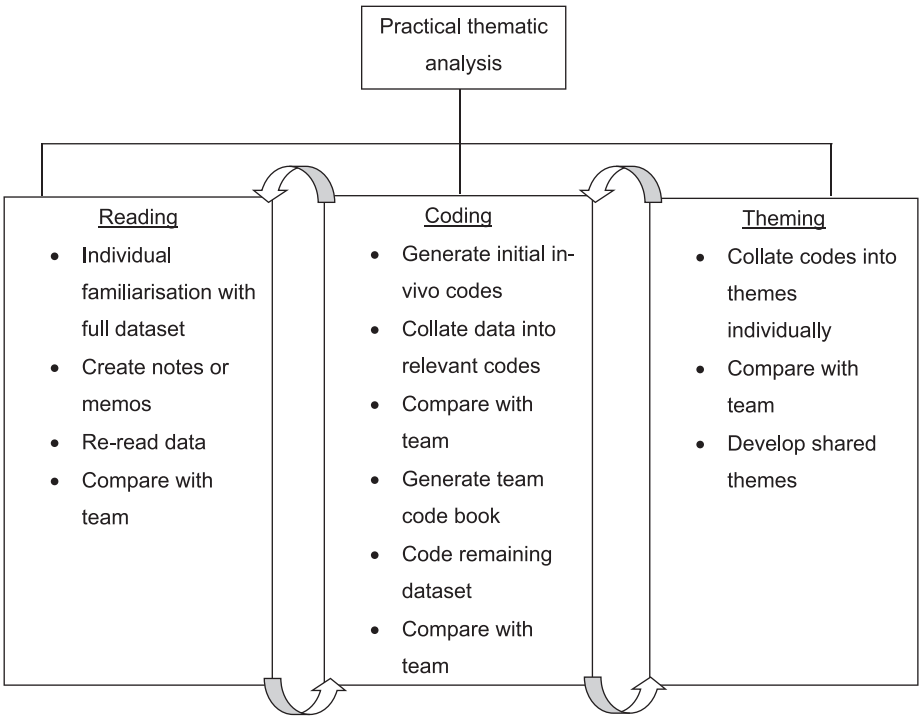

Fig. 1. Practical thematic analysis steps.

Appendix D for Figure A4.7.1, A4.7.11–4.7.12, respectively.

Table 4: Descriptive statistics, one-way Anova, and Tukey HSD results, a group comparison of 5-point Likert-scale statements.

Tables 4A, 4B, and 4C shows the results of the one-way ANOVA analysis and Tukey HSD, demonstrating there was statistical significance ($p \leq 0.05$) between the 4 groups. We found statistical significance ($p \leq 0.05$) in 9 out of 18 statements, and for 10 out of 18 statements between groups using the Tukey HSD.

Discussion

This survey aimed to explore RTT attitudes to research in Scotland, and successfully captured attitudes and perceptions of over 100 RTTs with diverse roles working in Scottish centres.

EBP & research

Participants agreed they felt confident, skilled and encouraged to discuss EBP, which is essential for career progression. This includes the transition to AP roles, where there is a requirement to meet the Society of Radiographers four core pillars: clinical practice; education; leadership and management; and research and development [16]. Group activities such as journal clubs may provide an environment for RTTs to develop critical thinking skills, appraise and investigate literature to identify gaps in practice and research, as described in a systematic review [24].

Participants indicated a positive desire to be more involved in research, but less positive in their knowledge to get involved, or provision of opportunity. There was high confidence in the benefits of departmental research improving patient outcomes. Departmental research projects are integral to RTT daily practice through clinical trials, consensus guidelines and emerging research. These protocols and guidelines allow audit of service, and help reduce variability in clinical practice [4]. When combined with technological advancements, research has led to improved patient outcomes, reduced toxicities and treatment times, smaller treatment volumes, and improved survival [25,26]. For example, clinical trials such as the Fast-Forward trial for operable breast cancer, and Conventional/Hypo-fractionated High Dose Intensity Modulated RT for prostate cancer (CHHIP), demonstrated hypo-fractionated treatments were non-inferior. Both trials resulted in a new standard of care with reduced fractionation schedules, more convenient, and substantially less expensive for patients and health services [27,28].

Respondents recognised the importance of EBP and research skills to address the successful integration of complex fields, such as artificial intelligence (AI) and deep learning [29]. Aspirations to drive RTT training and education were evident, identifying the changing roles demanded from staff, requiring education, training, development and lifelong-learning [30,31]. Emerging technological innovations should be viewed as a solution to addressing health care issues, and increasing patient empowerment. These advanced technologies involve time-consuming processes but may enable the integration of research into daily practice [31,32]. RTTs are in a position to apply their research skills in such developments and facilitate evidence based implementation.

The majority of respondents had a minimum qualification of a BSc, where participants should have completed at least one research module, including a research dissertation. Research is considered a core aspect of the RTT role, being instilled from student level to improve the ability to think critically and problem solve, as well as encouraging research interests and attitudes [33,34]. The high number of RTTs who had either completed, or were undertaking post-graduate research showed a willingness to improve research skills, even where funding and time are known to be an issue.

To improve the clarity, comparability, and portability of qualifications, the European Qualifications Framework for lifelong learning defined levels of national qualifications and principles in higher education [34]. These provide health care professionals (HCP) with job enrichment, opportunities for personal growth, career progression, and may impact directly on quality service delivery and improve patient outcomes [35]. However, concerns over opportunities to build on RTT research have been highlighted, where results from a survey showed small numbers were enabled to attend international meetings, inhibiting academic progress [36].

Table 2
Demographic characteristics of participants (n = 102).

Demographic	n (%)
Gender	
Male	11 (10.8)
Female	91 (89.2)
Age in years	
18–24	6 (5.9)
25–34	25 (25.5)
35–44	41 (41.2)
45–54	23 (22.5)
55–64	5 (4.9)
Centre (total number of RTT in centre)	
Glasgow (147)	47 (46.7)
Edinburgh (85)	12 (11.8)
Dundee (32)	23 (22.5)
Aberdeen (28)	14 (13.7)
Inverness (22)	6 (5.9)
Staff group	
Therapeutic radiographer (AFC band 5)	16 (15.7)
Senior therapeutic radiographer (AFC band 6)	38 (37.2)
Team lead radiographer (AFC band 7)	21 (20.6)
Advanced practice radiographer (AFC band 7)	16 (15.7)
Consultant radiographer (AFC band 8)	1 (1.0)
Lead radiographer (AFC band 8/management)	10 (9.8)
Area of expertise	
Rotational (clinical)	48 (47)
Treatment only	18 (17)
Simulator only	2 (2.0)
MRI only	3 (2.9)
Pre-treatment only	6 (5.9)
Site-specific specialist	9 (8.8)
Research radiographer	5 (4.9)
Management	5 (4.9)
Other	6 (5.9)
Highest education level	
Diploma of the college of radiographers (DCR(T))	3 (2.9)
Bachelors (BSc) or equivalent	58 (56.9)
Masters (MSc) or equivalent	33 (32.3)
Doctorate (PhD) or equivalent	2 (2.0)
Other: Professional graduate certificate (PGC)	6 (5.9)
Working towards	
Masters (MSc) or equivalent	15 (14.7)
Doctorate (PhD) or equivalent	3 (2.9)
None	79 (77.5)
Other	5 (4.9)

Lack of education standardisation for RTTs has resulted in discrepancies in competencies amongst graduates. National level competency regulation could ensure appropriate development of role-specific skills and encourage critical thinking and training [37]. Examples might include: learning about different types of uncertainties, set up evaluation, decision making, and dealing with unexpected situations. All of which improve quality assurance standards and patient care, in an increasingly complex environment [36].

Many existing reports and strategies discuss research integration to prepare RTTs for personal development, and improving clinical practice. The College of Radiographers (CoR) research strategy (2021) aims to drive quality RTT-led research, disseminated within the profession and beyond [16]. This was to maximise engagement, embed research and raise the impact and profile of RTTs. The strategy indicates that research time should be integrated into job plans by service managers. However, some UK centres reported excluding research from the business and development plan, which may be due to the resource challenges clinical duties [13].

High research interest amongst RTTs has been reported, where previous work identified 80.0 % of participants asserted the importance of involvement in research, 66.0 % regularly read scientific manuscripts, with 50.0 % stating these influenced their practice [38]. Similarities were identified in our results, where over half of participants expressed positive attitudes and the desire to become more involved in research. Nalweyiso et al. (2019) reported 37.0 % of RTTs demonstrated a positive attitude to research, and 57.0 % reported using EBP in daily work [39]. Other identified barriers were similar to the results of our survey, including lack of time and resources. RTTs in a Canadian research survey scored the highest agreement (57.0 %) that barriers were preventing involvement in research, this was more than other medical radiation HCPs [40]. Despite there being 23 years between these publications, barriers have remained the same over time. A well-developed evidence base has increased RTT commitment to research in the last century, but a more RTT-centred approach is required [41].

Saukko et al. (2021) found a positive reflection regarding RTT publications, showing that RTTs are contributing to clinical study data collection but may not be cited as an author, owing to absence in the research design, conduction or data analysis [11,40]. RTT science priorities differ from that of other HCPs, where health related problems are the focus, regardless of the focal point safe changes must be translated into clinical practice [12]. However, HCPs reported limited confidence in research, particularly in literature searching or applications in research funding, with level of interest correlated to participant's research experience [42].

Informed of local research

In our survey, <50.0 % of staff felt well informed about current departmental research projects, despite attempts to increase research activity through the creation of the SRRF and strategy implementation. Various methods and outlets to access research and departmental meetings were described in a UK study carried out in 5 RT centres. However, a lack of infrastructure to inform RTTs of research opportunities were identified, with 40.0 % of centres reporting an absence of a research strategy, and > 60.0 % of centres lacking formal funding procedures. There was disparity in access to a research RTT amongst centres, with a statement that research RTTs were appointed with "minimal formal training". Consequently, only 20.0 % of centres had research RTTs available for mentorship, lacked junior RTT training, negatively impacting publication outputs. Good infrastructure was found to be important for research and raising new project ideas [13].

As observed in our survey, group 1 (therapeutic radiographers) reported feeling less informed and supported, with limited opportunities to be involved in research compared to the other groups. This was despite reporting a positive attitude to research and role development, in their profession. Therefore it is important that future strategies implemented throughout Scotland should be inclusive of all levels of practice. With an intent on improving confidence and skills in research at all levels, as supported by professional guidance [14,16].

RTT as a career

Despite high agreement that being a RTT was a lifelong career and research involvement could improve their job satisfaction, our survey reported that almost half of respondents had considered a career change in the past 12 months. Highlighting possible job dissatisfaction experienced by participants. Although capturing confounding factors were beyond the scope of this survey, further work is warranted for retention of the professional workforce. Other research carried out on 44 RTTs, assessed staff retention at different career stages and generations [43]. They reported confounding factors were: influence of life events, such as marriage, child birth, caring duties and geographical relocation. Further reasons varied depending on career stage and generation. Early-career

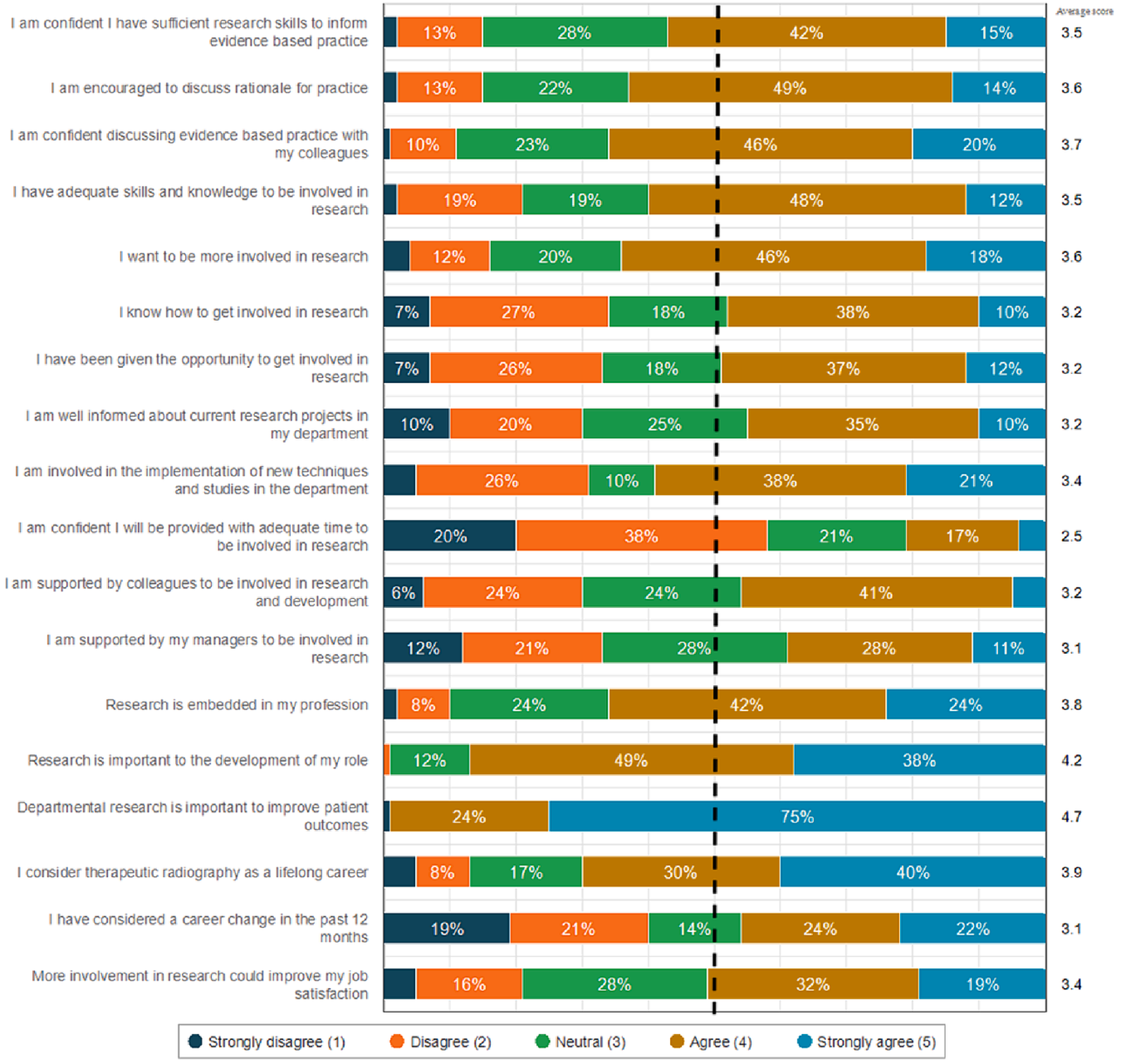

Fig. 2. Results of the 5-point Likert scale statements. Dotted line represents 50.0% of respondents.

factors were: career dissatisfaction, inability to progress, and lack of recognition. In comparison, mid-late-career retention was influenced by perceived poor pay, financial issues, limitations in progression, injury and burnout [43,44]. This indicated that employees might not align with theoretical frameworks and may benefit from creative and tailored strategies across groups to meet their expectations, ethics, and incentives [43].

Barriers to being involved

Other international surveys on RTT attitudes to research reported similar findings to our survey. A survey of 135 RTTs reported low research collaboration amongst Italian RTTs, with 38.6 % of respondents indicating lack of support as their primary reason for not becoming involved in research. This was followed by excessive workload (32.2 %), lack of training (16.6 %), funding (6.8 %) and time (3.7 %) [45]. These barriers were comparable in an Australian study of 208 RTTs, with 73.8 % reporting time, support (14.1 %), funding (11.7 %), education and confidence (11.7 %). Both of these studies also reported motivation as a barrier [46]. A Canadian study of 144 RTTs produced similar results, with 94.0 % of RTTs agreeing, or strongly agreeing that there is a link between EBP and research. Despite 39.0 % of RTTs expressing high knowledge levels in the development of research projects, 57.0 % expressed barriers impeding them from research participation, including lack of support (53.0 %) [40].

Our survey shows the importance of technical innovations, and the necessity for adequate research skills to implement effectively. Neep (2021) suggests experienced clinical leaders or mentors may support and encourage RTTs to develop research skills and build internal culture [41,47]. However, >40.0 % of UK research RTTs reported covering other duties, removing them from research activity [13].

Table 3
Identified themes with randomly selected supporting quotes from open ended statements.

Questions	1. What would make you feel supported to be involved in research? 2. In your own words, what are your perceived barriers to becoming involved in research? 3. In your own words, what opportunities do you think could improve your job satisfaction? 4. Which innovations do you think will change the future of your profession and which research skills will be key to their development?
Themes (Q1-3)	Access to protected time and staffAccess to opportunity, funding and resourcesAccess to information, training and peer supportAccess to managerial supportWork culture and environmentAttitudes, personal interest, and confidence in abilities
Themes (Q4)	Artificial IntelligenceImage guided adaptive RTMRI planningAdvancements in treatments or changes in practice
Example supporting quotes (Q1-3)	"Time earlier in my career""Improved access to funding for additional courses""In terms of management I think that a more robust training plan should be in place. I also think that equality to access of resources for advancements in techniques and the provision of care, would generate a more positive learning environment""I feel the support is here if you want it the research radiographers are always very supportive""Opportunity to progress. Time to get more involved in trials so I feel I am contributing to the wider research in radiotherapy, not just service development within my own department.Improved radiographer working groups across Scotland""Funding, networking opportunities, safe spaces without criticism, board level support and opportunities""I feel supported by my mentor, colleagues and management to be involved in research""Seems quite scary even the thought of it- more details of what would be involved or required to do"
Example supporting quotes (Q4)	"Artificial Intelligence""MRI and adaptive planning""Predictive models to anticipate response and tailoring this to individual patient's treatment""Image guidance for more techniques through better planning and treatment modalities to enable us to facilitate this. Adaption to patient-specific anatomy each fraction to help reduce long-term side effects and improve treatment outcomes.""Hypo fractionation and the role out of SABR will change the face of radiotherapy as we know it. Being able to accurately treat moveable tumours in shorter fractions will change the radiotherapy landscape.Imbedding research as a priority from early in the profession will help radiographers to see it as an integral aspect of the job""SGRT to minimise set-up errors and time. Further utilising daily CBCT imaging to minimise OAR dose to all patients with a moveable PTV."
Abbreviations	MRI – magnetic resonance imaging; SABR – stereotactic ablative radiotherapy; SGRT – surface guided radiotherapy; CBCT – conebeam computed tomography; OAR – organs at risk; PTV – planning target volume

Table 4A
Descriptive statistics, one-way Anova results, and Tukey HSD comparison of 5-point Likert-scale statements, by concept: EBP.

Concept: EBP

Statement 1: I am confident I have sufficient research skills to inform evidence based practice

Group (n)	**Descriptive statistics** Mean (SD)	**ANOVA** F, p value	**Tukey HSD** Group comparison	p value, (95 % CI)
1 (16)	3.56 (0.964)	5.154, 0.002*	1-2	0.625, (-0.36 to 0.98)
2 (59)	3.25 (0.939)		1-3	0.512, (-1.26 to 0.39)
3 (17)	4.00 (0.707)		1-4	0.308, (-1.59 to 0.32)
4 (10)	4.20 (0.919)		2-3	0.018, (-1.40 to -0.09)*
			2-4	0.015, (-1.76 to -0.13)*
Total 102	3.52 (0.962)		3-4	0.946, (-1.15 to 0.75)

Statement 2: I am encouraged to discuss rationale for practice

Group (n)	**Descriptive statistics** Mean (SD)	**ANOVA** F, p value	**Tukey HSD** Group comparison	p value, (95 % CI)
1 (16)	4.25 (0.775)	3.329, 0.023*	1-2	0.024, (0.07 to 1.38)*
2 (59)	3.53 (0.935)		1-3	0.636, (-0.44 to 1.18)
3 (17)	3.88 (0.781)		1-4	0.898, (-0.69 to 1.19)
4 (10)	4.00 (0.943)		2-3	0.467, (-1.00 to 0.28)
			2-4	0.406, (-1.27 to 0.32)
Total 102	3.75 (0.919)		3-4	0.987, (-0.89 to 1.13)

Statement 3: I am confident discussing evidence based practice with my colleagues

Group (n)	**Descriptive statistics** Mean (SD)	**ANOVA** F, p value	**Tukey HSD** Group comparison	p value, (95 % CI)
1 (16)	3.63 (0.957)	3.459, 0.019*	1-2	0.994, (-0.59 to 0.72)
2 (59)	3.56 (0.856)		1-3	0.503, (-1.24 to 0.38)
3 (17)	4.06 (0.899)		1-4	0.142, (-1.71 to 0.16)
4 (10)	4.40 (0.966)		2-3	0.181, (-1.14 to 0.14)
			2-4	0.034, (-1.64 to -0.05)*
Total 102	3.74 (0.922)		3-4	0.800, (-1.40 to 0.72)

Statements which show statistical significance are denoted by *
Abbreviations: CI – confidence interval

Group comparison

Statistically significant differences were observed most frequently between groups 2 & 4, suggesting potential disparities in priorities, or levels of knowledge and clinical experience. This aligns with findings from a previous study, reporting that 57.0 % of RTTs indicated that departmental culture primarily revolved around meeting patient service delivery benchmarks, commonly used as a measure of departmental success. Respondents expressed the need for a shift in managerial priorities, emphasising the importance of allocating time and support for staff to stay updated in their practice, rather than solely focusing on meeting patient benchmarks [50]. This discrepancy in perspectives among staff groups highlights variations in career stages, and incentives. Providing suitable incentives could encourage collaboration between researchers and clinical staff, thereby influencing the organisational culture within RT departments, towards a higher standard of practice [50].

Our survey demonstrated a predominantly positive staff awareness of the importance of research; improving patient outcomes amongst staff groups; whilst reporting low confidence they would be provided with adequate time to be actively involved in research. This supports the earlier stated narrative with staff groups across the board reporting similar barriers, despite expressing positive attitudes to research and development. According to studies, the barriers experienced by many HCPs is a universal experience [13,42–52], with tight clinical schedules and reluctance to adopt new protocols constraining development in RT.

Limitations in RT research funding hinders the availability of technology, reducing patient access [5]. These factors may prevent

Table 4B
Descriptive statistics, one-way Anova results, and Tukey HSD comparison of 5-point Likert-scale statements, by concept: Research.

Concept: Research				
Statement 4: I have adequate skills and knowledge to be involved in research				
Group (n)	**Descriptive statistics** Mean (SD)	**ANOVA** F, p value	**Tukey HSD** Group comparison	p value, (95 % CI)
1 (16)	3.13 (1.088)	6.648, <0.001*	1-2	0.901, (-0.86 to 0.50)
2 (59)	3.31 (0.969)		1-3	0.008, (-1.90 to -0.21)*
3 (17)	4.18 (0.529)		1-4	0.025, (-2.05 to -0.10)*
4 (10)	4.20 (0.919)		2-3	0.005, (-1.54 to -0.20)*
			2-4	0.029, (-1.72 to -0.07)
Total 102	3.51 (1.002)		3-4	1.000, (-0.99 to 0.94)
Statement 5: I want to be more involved in research				
Group (n)	**Descriptive statistics**	**ANOVA**	**Tukey HSD**	
	Mean (SD)	F, p value	Group comparison	p value, (95 % CI)
1 (16)	3.50 (1.095)	3.456, 0.019*	1-2	0.993, (-0.66 to 0.81)
2 (59)	3.42 (1.054)		1-3	0.585, (-1.35 to 0.47)
3 (17)	3.94 (0.827)		1-4	0.121, (-1.95 to 0.15)
4 (10)	4.40 (0.699)		2-3	0.242, (-1.24 to 0.20)
			2-4	0.026, (-1.87 to -0.08)*
Total 102	3.62 (1.034)		3-4	0.658, (-1.50 to 0.58)
Statement 6: I know how to get involved in research				
Group (n)	**Descriptive statistics**	**ANOVA**	**Tukey HSD**	
	Group (n) Mean (SD)	F, p value	Group comparison	p value, (95 % CI)
1 (16)	2.44 (1.263)	6.172, <0.001*	1-2	0.127, (-1.45 to 0.12)
2 (59)	3.10 (1.045)		1-3	0.032, (-2.00 to -0.06)*
3 (17)	3.47 (1.125)		1-4	<0.001, (-2.88 to -0.64)*
4 (10)	4.20 (0.632)		2-3	0.592, (-1.14 to 0.40)
			2-4	0.017, (-2.05 to -0.15)*
Total 102	3.17 (1.144)		3-4	0.320, (-1.84 to 0.38)
Statement 7: I have been given the opportunity to get involved in research				
Group (n)	**Descriptive statistics**	**ANOVA**	**Tukey HSD**	
	Mean (SD)	F, p value	Group comparison	p value, (95 % CI)
1 (16)	2.81 (1.047)	1.317, 0.273	1-2	0.694, (-1.21 to 0.50)
2 (59)	3.17 (1.191)		1-3	0.366, (-1.71 to 0.40)
3 (17)	3.47 (1.125)		1-4	0.336, (-0.50 to 1.21)
4 (10)	3.60 (1.174)		2-3	0.781, (-1.13 to 0.53)
			2-4	0.698, (-1.47 to 0.60)
Total 102	3.21 (1.163)		3-4	0.992, (-1.34 to 1.08)
Statement 8: I am well informed about current research projects in my department				
Group (n)	**Descriptive statistics**	**ANOVA**	**Tukey HSD**	
	Mean (SD)	F, p value	Group comparison	p value, (95 % CI)
1 (16)	2.94 (1.063)	1.230, 0.303	1-2	0.999, (-0.86 to 0.76)
2 (59)	2.98 (1.122)		1-3	0.508, (-1.53 to 0.47)
3 (17)	3.47 (1.281)		1-4	0.725, (-1.62 to 0.70)
4 (10)	3.40 (0.516)		2-3	0.378, (-1.28 to 0.30)
			2-4	0.685, (-1.40 to 0.57)
Total 102	3.10 (1.104)		3-4	0.999, (-1.08 to 1.22)
Statement 9: I am involved in the implementation of new techniques and studies in the department				
Group (n)	**Descriptive statistics**	**ANOVA**	**Tukey HSD**	
	Mean (SD)	F, p value	Group comparison	p value, (95 % CI)
1 (16)	2.69 (1.302)	7.270, <0.001*	1-2	0.259, (-1.41 to 0.24)
2 (59)	3.27 (1.157)		1-3	<0.001, (-2.63 to -0.58)*
3 (17)	4.29 (0.849)		1-4	0.012, (-2.60 to -0.23)*
4 (10)	4.10 (0.994)		2-3	0.007, (-1.83 to -0.22)*
			2-4	0.142, (-1.83 to 0.17)
Total 102	3.43 (1.223)		3-4	0.973, (-0.98 to 1.36)
Statement 10: I am confident I will be provided with adequate time to be involved in research				
Group (n)	**Descriptive statistics**	**ANOVA**	**Tukey HSD**	
	Mean (SD)	F, p value	Group comparison	p value, (95 % CI)
1 (16)	2.25 (1.125)	3.510, 0.018*	1-2	0.998, (-0.84 to 0.73)
2 (59)	2.31 (1.055)		1-3	0.611, (-1.43 to 0.51)
3 (17)	2.71 (0.985)		1-4	0.043, (-2.27 to -0.03)*
4 (10)	3.40 (1.174)		2-3	0.524, (-1.17 to 0.37)
			2-4	0.018, (-2.05 to -0.14)*

(*continued on next page*)

Table 4B (*continued*)

Concept: Research				
Statement 4: I have adequate skills and knowledge to be involved in research				
Group (n)	**Descriptive statistics** Mean (SD)	**ANOVA** F, p value	**Tukey HSD** Group comparison	p value, (95 % CI)
Total 102	2.47 (1.105)		3-4	0.365, (-1.80 to 0.42)
Statement 11: I am supported by colleagues to be involved in research and development				
Group (n)	**Descriptive statistics**	**ANOVA**	**Tukey HSD**	
	Mean (SD)	F, p value	Group comparison	p value, (95 % CI)
1 (16)	2.81 (1.047)	2.488, 0.065	1-2	0.806, (-1.00 to 0.49)
2 (59)	3.07 (1.015)		1-3	0.327, (-1.52 to 0.32)
3 (17)	3.41 (1.004)		1-4	0.079, (-2.05 to 0.08)
4 (10)	3.80 (0.919)		2-3	0.605, (-1.07 to 0.38)
			2-4	0.154, (-1.63 to 0.17)
Total 102	3.16 (1.032)		3-4	0.079, (-0.08 to 2.05)
Statement 12: I am supported by my managers to be involved in research				
Group (n)	**Descriptive statistics**	**ANOVA**	**Tukey HSD**	
	Mean (SD)	F, p value	Group comparison	p value, (95 % CI)
1 (16)	2.63 (1.088)	1.689, 0.174	1-2	0.779, (-1.15 to 0.54)
2 (59)	2.93 (1.244)		1-3	0.156, (-1.89 to 0.20)
3 (17)	3.47 (0.943)		1-4	0.602, (-1.79 to 0.64)
4 (10)	3.20 (0.919)		2-3	0.328, (-1.36 to 0.29)
			2-4	0.904, (-1.29 to 0.76)
Total 102	3.00 (1.160)		3-4	0.935, (-0.93 to 1.47)
Statement 13: Research is embedded in my profession				
Group (n)	**Descriptive statistics**	**ANOVA**	**Tukey HSD**	
	Mean (SD)	F, p value	Group comparison	p value, (95 % CI)
1 (16)	4.06 (0.854)	0.622, 0.602	1-2	0.657, (-0.40 to 1.03)
2 (59)	3.75 (0.975)		1-3	0.613, (-0.47 to 1.30)
3 (17)	3.65 (1.057)		1-4	0.976, (-0.86 to 1.19)
4 (10)	3.90 (0.994)		2-3	0.983, (-0.60 to 0.80)
			2-4	0.967, (-1.02 to 0.72)
Total 102	3.79 (0.968)		3-4	0.915, (-1.27 to 0.76)
Statement 14: Research is important to the development of my role				
Group (n)	**Descriptive statistics**	**ANOVA**	**Tukey HSD**	
	Mean (SD)	F, p value	Group comparison	p value, (95 % CI)
1 (16)	4.31 (0.704)	1.105, 0.390	1-2	0.847, (-0.35 to 0.67)
2 (59)	4.15 (0.715)		1-3	0.914, (-0.79 to 0.48)
3 (17)	4.47 (0.514)		1-4	1.000, (-0.72 to 0.75)
4 (10)	4.30 (0.823)		2-3	0.350, (-0.82 to 0.18)
			2-4	0.925, (-0.77 to 0.47)
Total 102	4.25 (0.696)		3-4	0.927, (-0.55 to 0.89)
Statement 15: Departmental research is important to improve patient outcomes				
Group (n)	**Descriptive statistics**	**ANOVA**	**Tukey HSD**	
	Mean (SD)	F, p value	Group comparison	p value, (95 % CI)
1 (16)	4.75 (0.670)	2.075, 0.108	1-2	0.813, (-0.27 to 0.55)
2 (59)	4.61 (0.332)		1-3	0.905, (-0.64 to 0.38)
3 (17)	4.88 (0.000)		1-4	0.687, (-0.84 to 0.34)
4 (10)	5.00 (0.569)		2-3	0.297, (-0.68 to 0.13)
			2-4	0.183, (-0.89 to 0.11)
Total 102	4.72 (0.569)		3-4	0.952, (-0.70 to -0.47)

Statements which show statistical significance are denoted by *
Abbreviations: CI – confidence interval

implementation of RT research programmes and infrastructure. Limited equipment and modernisation of practice may attribute to poorer patient outcomes and worse side effects. In contrast, pharmaceutical companies provide substantial investment in innovations with academic centres, helping to further their field [5]. Research capacity may be increased through funding initiatives that provide protected research time for staff. The transformational Cancer Research UK Radiation Research Network (CRUK RadNet) initiative has addressed this, by providing key investment to fund RT research infrastructure. Centres have successfully included RTT investigators in their award, increasing the opportunities for this discipline [52].

Table 4C
Descriptive statistics, one-way Anova results, and Tukey HSD comparison of 5-point Likert-scale statements, by concept: Career.

Concept: Career				
Statement 16: I consider therapeutic radiography as a lifelong career				
Group (n)	**Descriptive statistics** Mean (SD)	**ANOVA** F, p value	**Tukey HSD**	
			Group comparison	p value, (95 % CI)
1 (16)	3.44 (1.315)	2.570, 0.059	1-2	0.409, (-1.33 to 0.34)
2 (59)	3.93 (1.096)		1-3	0.577, (-1.53 to 0.52)
3 (17)	3.94 (1.298)		1-4	0.033, (-2.45 to -0.07)*
4 (10)	4.70 (0.483)		2-3	1.000, (-0.82 to 0.80)
			2-4	0.199, (-1.78 to 0.24)
Total 102	3.93 (1.154)		3-4	0.336, (-1.93 to 0.42)
Statement 17: I have considered a career change in the past 12 months				
Group (n)	**Descriptive statistics** Mean (SD)	**ANOVA** F, p value	**Tukey HSD** Group comparison	p value, (95 % CI)
1 (16)	3.56 (1.413)	1.238, 0.300	1-2	0.295 (-0.34 to 1.77)
2 (59)	2.85 (1.337)		1-3	0.950 (-1.04 to 1.58)
3 (17)	3.29 (1.724)		1-4	0.855 (-1.05 to 1.98)
4 (10)	3.10 (1.524)		2-3	0.672 (-1.48 to 0.59)
			2-4	0.955 (-1.54 to 1.03)
Total 102	3.06 (1.441)		3-4	0.986 (-1.30 to 1.69)
Statement 18: More involvement in research could improve my job satisfaction				
Group (n)	**Descriptive statistics** Mean (SD)	**ANOVA** F, p value	**Tukey HSD** Group comparison	p value, (95 % CI)
1 (16)	3.44 (0.892)	2.654, 0.053*	1-2	0.914, (-0.60 to 1.00)
2 (59)	3.24 (1.165)		1-3	0.893, (-1.26 to 0.72)
3 (17)	3.71 (1.105)		1-4	0.309, (-1.91 to 0.38)
4 (10)	4.20 (0.789)		2-3	0.403, (-1.25 to 0.31)
			2-4	0.053, (-1.93 to 0.01)*
Total 102	3.44 (1.113)		3-4	0.665, (-1.63 to 0.64)
Statements which show statistical significance are denoted by *				
Abbreviations: CI – confidence interval				

Future work

This data will inform a collaborative strategy to be implemented nationwide, finalised with the authors from all centres to ensure buy-in across a diverse geographical landscape. Investment is required to allow the integration of research into job plans, and to increase research RTT mentors who can encourage research activity and guide dissemination strategies. This unified national strategy will focus on both short and long term objectives. The survey could be carried out internationally to evaluate similarity of barriers in other countries.

Future initiatives will include RTT students, to ensure a streamlined research culture, recognising that interactive and clinically integrated student learning and evidence improves learning outcomes [6]. However, previous work found none of the responding students pursued research past graduation [53]. Furthermore, implementation of EBP into learning develops student information synthesis skills to inform active searching and analysis of the evidence base. It can also empower students with the ability to ask clinically relevant questions [6].

Strengths and Limitations

This research aligns with previously published literature and highlights similar barriers globally. The authors consider the survey participants to be a representative sample of RTTs in Scotland.

Limitations of this survey were, a lack of a validated questionnaire specific to RTTs. In the absence of this a survey was developed, which may introduce bias. Some of the RTTs involved in development of this survey are affiliated with the SRRF and their acknowledged partnerships are mentioned below. Attempts were made to reduce bias through validation methods and external authentication through national collaborative working, peer review and triangulation. Wording of statements to correspond with high scores being positive indicators may introduce acquisition bias.

Conclusion

RTTs working in Scotland held a majority positive attitude towards research and its benefit to patients and role development, with a desire to become more involved. The majority of participants responded positively to seeing RTT as a lifelong career, with over half agreeing that involvement in research would improve their job satisfaction.

The most commonly reported barrier was time and funding, an unchanged barrier in published research over the past two decades. Survey results will inform future nationwide collaborations and initiatives to strengthen research culture in Scottish RT centres, improve confidence in research, and increase job satisfaction. This will address lack of opportunity, feeling uninformed of local research projects, and improve knowledge of how to participate. Given the differences in attitudes found between levels of experience, strategies will be developed to ensure research skills are embedded and inclusive across all levels of experience.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: [This survey was initiated and conducted through a CRUK RadNet - Glasgow Radiation Centre of Excellence grant C16583/A28803. Aileen Duffton is funded by the Beatson Cancer Charity Lynsey Devlin is funded by the Beatson Cancer Charity and CRUK RadNet Glasgow Radiation Centre of Excellence Alice Paterson has research time funded through CoRIPS College of Radiographers Industry Partnerships Scheme Research Grant].

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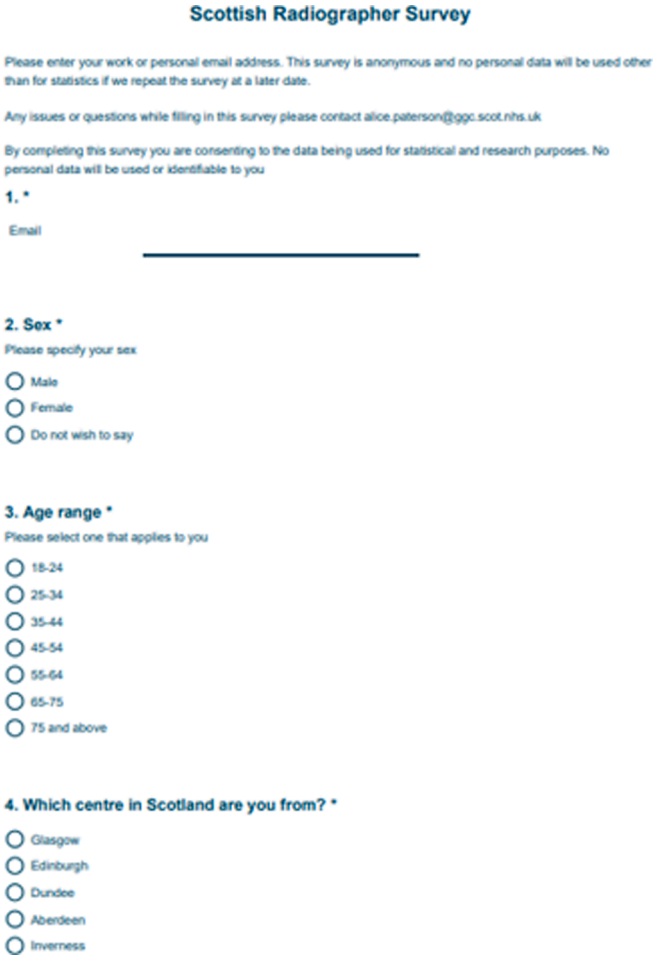
Appendix A. Concept and corresponding questions and statements

Table A1

Concept (number = n)	Question or statement
EBP (3)	I am confident I have sufficient research skills to inform evidence-based practice
	I am encouraged to discuss rationale for practice
	I am confident discussing evidence-based practice with my colleagues
Research (14)	I have adequate skills and knowledge to be involved in research
	I want to be more involved in research
	I know how to get involved in research
	I have been given the opportunity to get involved in research
	I am well informed about current research projects in my department
	I am involved in the implementation of new techniques and studies in the department
	I am confident I will be provided with adequate time to be involved in research
	I am supported by colleagues to be involved in research and development
	I am supported by my managers to be involved in research
	Research is embedded in my profession
	Research is important to the development of my role
	Departmental research is important to improve patient outcomes
	In your own words, what are your perceived barriers to becoming involved in research?
	What would make you feel supported to be involved in research?
Career (5)	I consider therapeutic radiography as a lifelong career
	I have considered a career change in the past 12 months
	More involvement in research could improve my job satisfaction
	In your own words, what opportunities do you think could improve your job satisfaction?
	Which innovations do you think will change the future of your profession and research skills will be key to their development?

Appendix B. Survey



Scottish Radiographer Survey

Please enter your work or personal email address. This survey is anonymous and no personal data will be used other than for statistics if we repeat the survey at a later date.

Any issues or questions while filling in this survey please contact alice.paterson@ggc.scot.nhs.uk

By completing this survey you are consenting to the data being used for statistical and research purposes. No personal data will be used or identifiable to you

1. *

Email

2. Sex *

Please specify your sex

- Male
- Female
- Do not wish to say

3. Age range *

Please select one that applies to you

- 18-24
- 25-34
- 35-44
- 45-54
- 55-64
- 65-75
- 75 and above

4. Which centre in Scotland are you from? *

- Glasgow
- Edinburgh
- Dundee
- Aberdeen
- Inverness

5. Please select which staff group applies to you *

Please select one that applies to you

- ○ Therapy radiographer (band 5)
- ○ Senior Therapy radiographer (band 6)
- ○ Team Lead radiographer (band 7)
- ○ Advanced Practice radiographer (band 7)
- ○ Consultant radiographer (band 8)
- ○ Lead radiographer (band 8)/ management
- ○ Other (please expand)

6. other (please expand)

_____

_____

_____

_____

_____

7. Please select your area of expertise *

Please select one that applies to you

- ○ Rotational (clinical)
- ○ Treatment only
- ○ Simulator only
- ○ MRI only
- ○ Pre-treatment only
- ○ Site specific specialist
- ○ Research radiographer
- ○ Other (please expand)
- ○ Management

8. other (please expand)

9. Highest education level *

Please select one that applies to you

- ○ HND
- ○ HNC
- ○ Diploma of the College of Radiographers (DCR(T))
- ○ Bachelor's (BSc) or equivalent
- ○ Master's (MSc) or equivalent
- ○ Doctorate (Phd) or equivalent
- ○ Other (please specify)

10. other (please expand)

11. Are you currently working towards any of the following *

Please select one that applies to you

- ○ Bachelor's (BSc) or equivalent
- ○ Master's (MSc) or equivalent
- ○ Doctorate (Phd) or equivalent
- ○ Other (please specify)
- ○ None

12. Other

_____

_____

_____

_____

_____

13. Therapeutic radiographers' attitude to research and development: Please select one box from the following options that best describes how you feel

The numbers in brackets under the options are for admin only.

Any additional comments can be entered into the text boxes below (optional)

	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)
I am confident I have sufficient research skills to inform evidence based practice *	○	○	○	○	○
I am encouraged to discuss rationale for practice *	○	○	○	○	○
I am confident discussing evidence based practice with my colleagues *	○	○	○	○	○
I have adequate skills and knowledge to be involved in research *	○	○	○	○	○
I want to be more involved in research *	○	○	○	○	○
I know how to get involved in research *	○	○	○	○	○
I have been given the opportunity to get involved in research *	○	○	○	○	○

	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)
I am well informed about current research projects in my department *	○	○	○	○	○
I am involved in the implementation of new techniques and studies in the department *	○	○	○	○	○
I am confident I will be provided with adequate time to be involved in research *	○	○	○	○	○
I am supported by colleagues to be involved in research and development *	○	○	○	○	○
I am supported by my managers to be involved in research *	○	○	○	○	○
Research is embedded in my profession *	○	○	○	○	○
Research is important to the development of my role *	○	○	○	○	○
Departmental research is important to improve patient outcomes *	○	○	○	○	○
I consider therapeutic radiography as a lifelong career *	○	○	○	○	○
I have considered a career change in the past 12 months *	○	○	○	○	○
More involvement in research could improve my job satisfaction *	○	○	○	○	○

14. What would make you feel supported to be involved in research? *

15. In your own words, what are your perceived barriers to becoming involved in research? *

16. Which innovations do you think will change the future of your profession and research skills will be key to their development? *

17. In your own words, what opportunities do you think could improve your job satisfaction? *

18. Feedback

This question is optional.

By submitting this survey you are consenting to the data being used for statistical purposes. No personal data will be used or identifiable to you. Any personal data stored will automatically be deleted 1 year after completion of this survey.

Appendix C. Coding template

Coding: Individually code data set then compare with team.

Coder 1: Draft codes	Supporting quotes	Notes/memos
Coder 2: Draft codes	Supporting quotes	Notes/memos

Individually draft themes and then compare with team.

Code number:	Draft themes	Supporting quotes	Notes/memos
1			
2			
3			

Generate shared themes then individually code remaining dataset (may fit into more than one code).

Coder 1:		Coder 2:	
Assigned code:	Supporting quotes	Assigned code:	Supporting quotes
1		1	
2		2	
3		3	

Individually code reaming dataset with agreed shared themes and then compare with team.

Theme	Supporting quotes
1	
2	
3	
4	
5	
6	

Appendix D. Group comparison results

Total number of respondents: 102.

Table A4.1
Sex per group.

	n(%)				
	Group				
	1	**2**	**3**	**4**	**Total**
Sex					
Male	1(6.2)	6(10.2)	1(5.9)	3(30.0)	11
Female	15(93.8)	53(89.8)	16(94.1)	7(70.0)	91
Do not wish to say	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0
Total	**16**	**59**	**17**	**10**	**102**

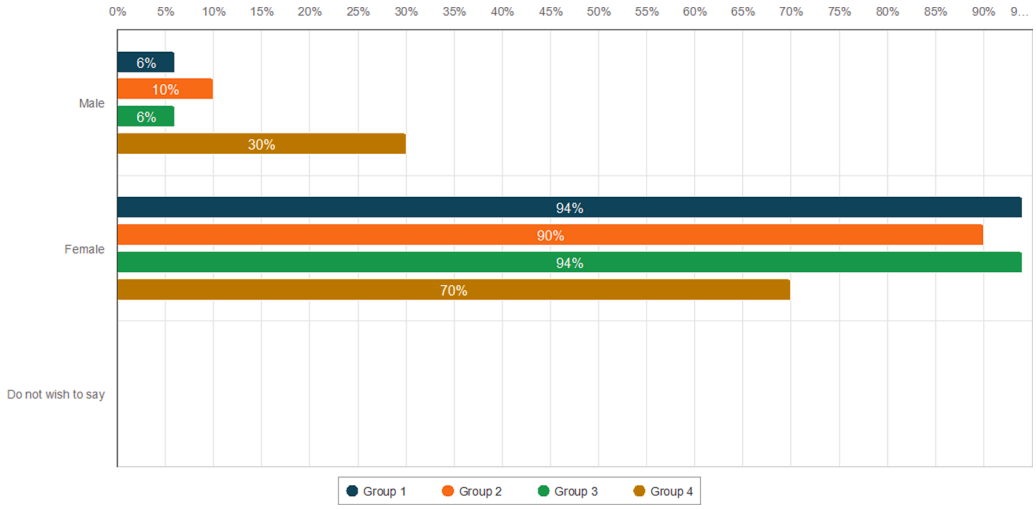


Fig. A4.1. Sex per group

Table A4.2
Age range per group.

	n(%)				
	Group				
	1	2	3	4	Total
Age range (years)					
18–24	5(31.2)	1(1.7)	0(0.0)	0(0.0)	6
25–34	8(50.0)	17(28.8)	1(5.9)	0(0.0)	26
35–44	2(12.5)	25(42.4)	10(58.8)	5(50.0)	42
45–54	1(6.3)	14(23.7)	4(23.5)	4(40.0)	23
55–64	0(0.0)	2(3.4)	2(11.8)	1(10.0)	5
65–75	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0
75 and above	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0
Total	**16**	**59**	**17**	**10**	**102**

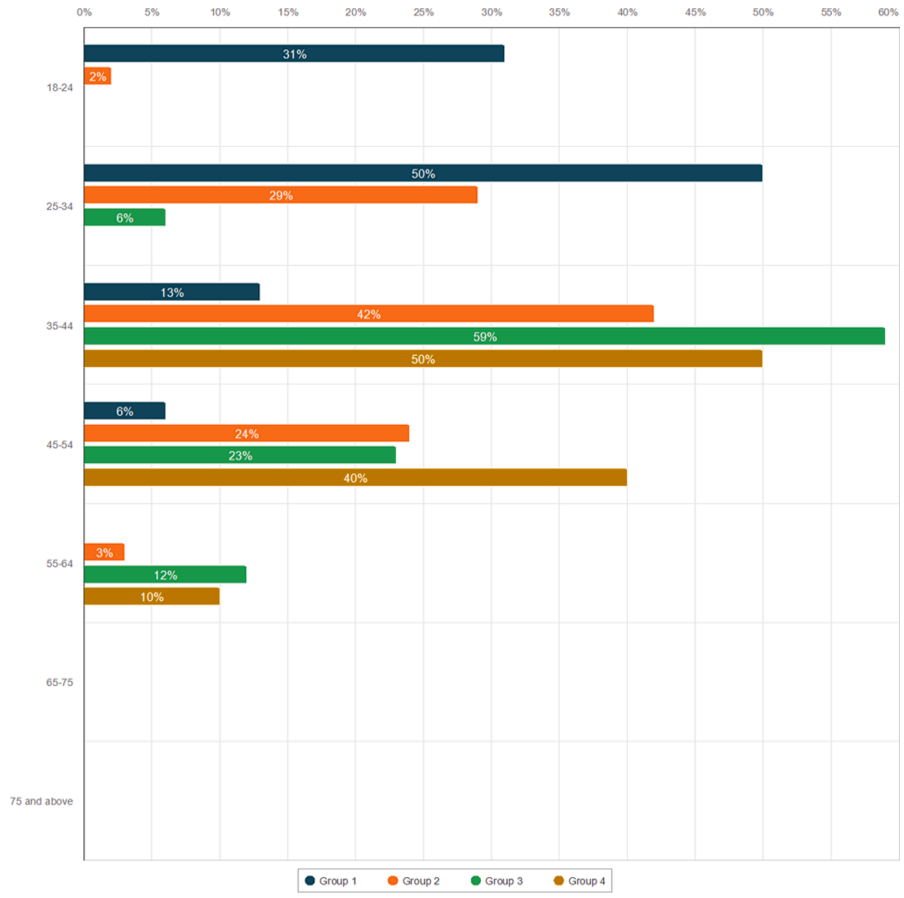


Fig. A4.2. Age range per group

Table A4.3
Scottish Radiotherapy centre per group.

	n(%)				
	Group				
	1	2	3	4	
Scottish Radiotherapy Centre					**Total**
Glasgow	9(56.3)	29(49.1)	4(23.5)	5(50.0)	47
Edinburgh	1(6.3)	5(8.5)	5(29.4)	1(10.0)	12
Dundee	3(18.7)	15(25.4)	3(17.7)	2(20.0)	23
Aberdeen	3(18.7)	6(10.2)	4(23.5)	1(10.0)	14
Inverness	0(0.0)	4(6.8)	1(5.9)	1(10.0)	6
Total	**16**	**59**	**17**	**10**	**102**

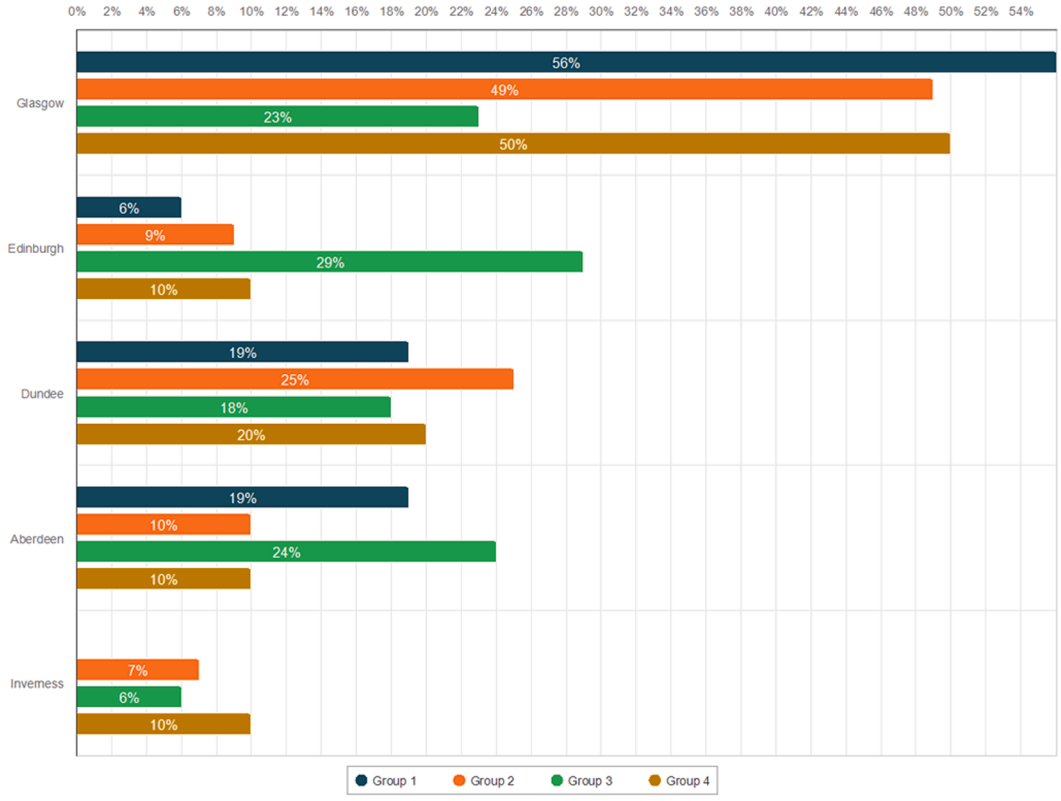


Fig. A4.3. Scottish Radiotherapy centre per groups

Table A4.4
Numbers of RTT per group.

	n(%)				
	Group				
	1	2	3	4	Total
Staff group (AFC banding classification)					
Therapeutic radiographer (band 5)	16(100.0)	0(0.0)	0(0.0)	0(0.0)	16
Senior therapeutic radiographer (band 6)	0(0.0)	38(64.4)	0(0.0)	0(0.0)	38
Team lead radiographer (band 7)	0(0.0)	21(35.6)	0(0.0)	0(0.0)	21
Advanced practice radiographer (band 7)	0(0.0)	0(0.0)	16(94.1)	0(0.0)	16
Consultant radiographer (band 8)	0(0.0)	0(0.0)	1(5.9)	0(0.0)	1
Lead radiographer (band 8)	0(0.0)	0(0.0)	0(0.0)	10(100.0)	10
Total	**16**	**59**	**17**	**10**	**102**

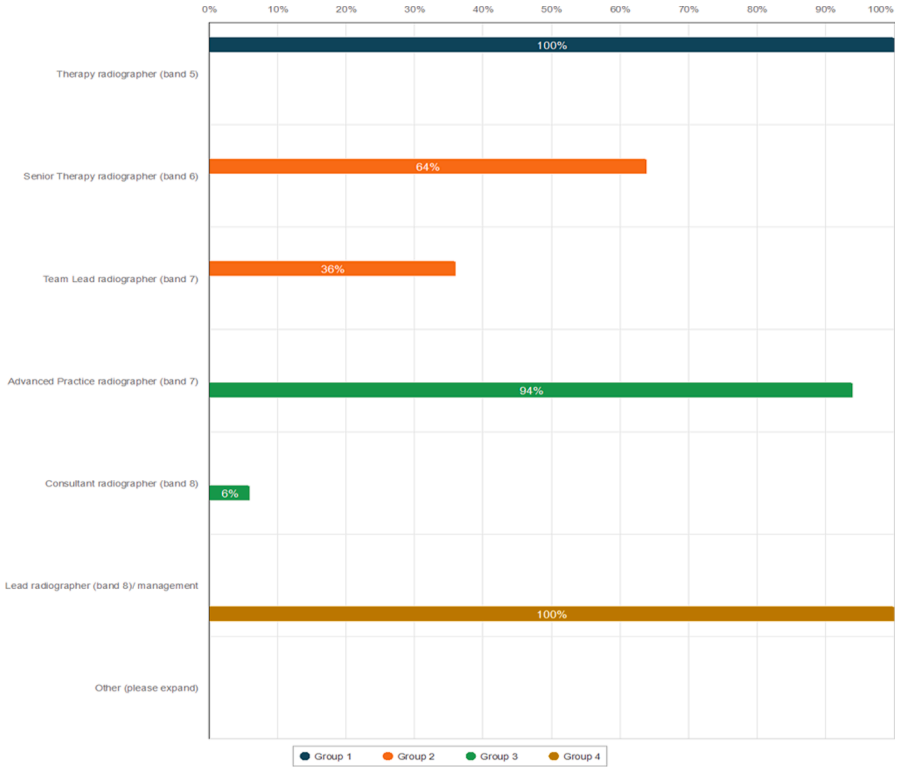


Fig. A4.4. Numbers of RTT per group

Table A4.5
Area of expertise as per group.

	n(%)				
	Group				
	1	2	3	4	Total
Area of expertise					
Rotational (clinical)	11(68.8)	35(59.3)	1(5.9)	1(10.0)	48
Treatment only	5(31.2)	13(22.0)	0(0.0)	0(0.0)	18
Simulator only	0(0.0)	1(1.7)	1(5.9)	0(0.0)	2
MRI only	0(0.0)	3(5.1)	0(0.0)	0(0.0)	3
Pre-treatment only	0(0.0)	4(6.8)	1(5.9)	1(10.0)	6
Site specific specialist	0(0.0)	2(3.4)	7(41.2)	0(0.0)	9
Research radiographer	0(0.0)	0(0.0	3(17.6)	2(20.0)	5
Other (please expand)	0(0.0)	1(1.7)	4(23.5)	1(10.0)	6
Management	0(0.0)	0(0.0)	0(0.0)	5(50.0)	5
Total	**16**	**59**	**17**	**10**	**102**

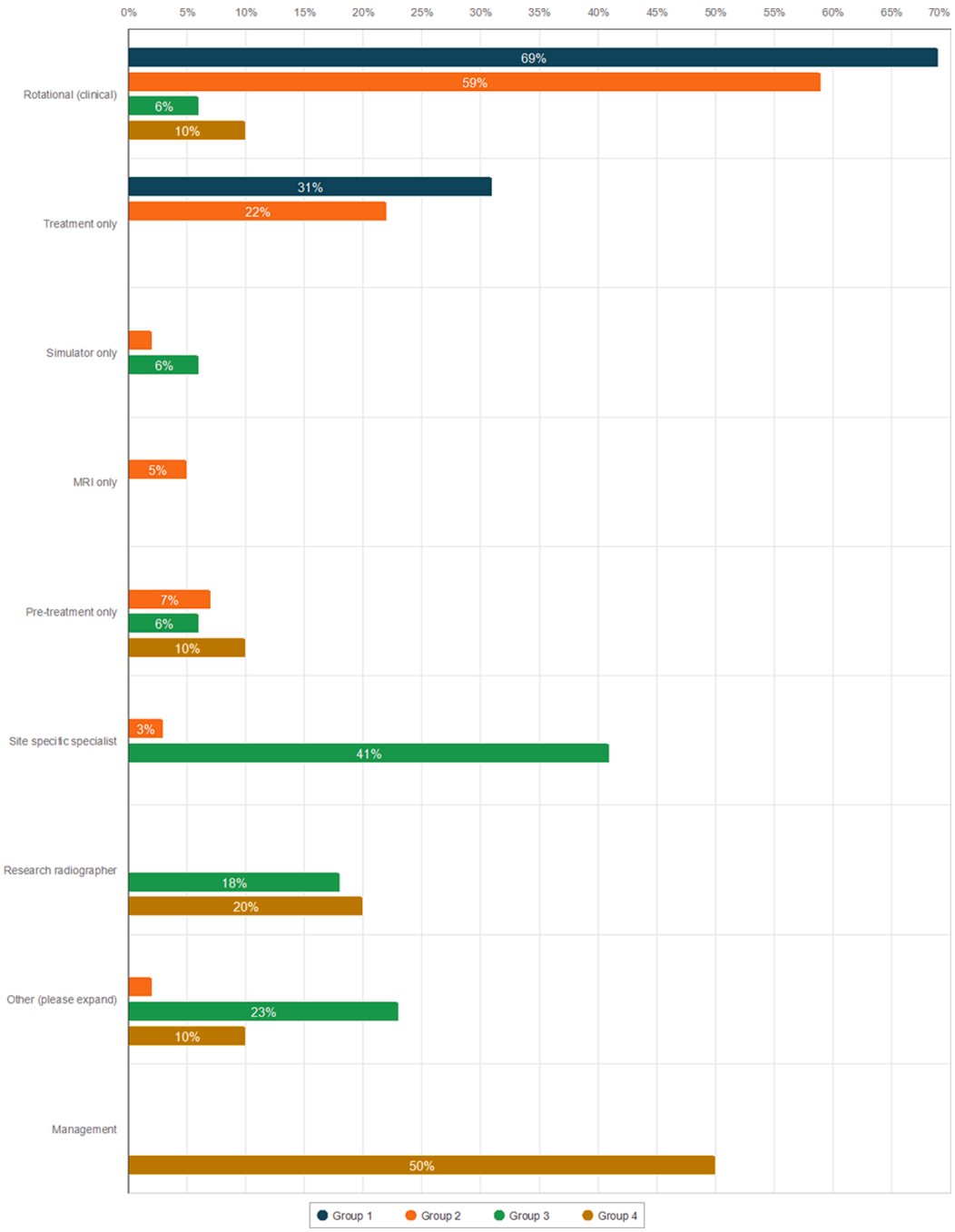


Fig. A4.5. Area of expertise as per group

n(%)					
Group					
	1	**2**	**3**	**4**	**Total**
Area of expertise					
Rotational (clinical)	11(68.8)	35(59.3)	1(5.9)	1(10.0)	48
Treatment only	5(31.2)	13(22.0)	0(0.0)	0(0.0)	18
Simulator only	0(0.0)	1(1.7)	1(5.9)	0(0.0)	2
MRI only	0(0.0)	3(5.1)	0(0.0)	0(0.0)	3
Pre-treatment only	0(0.0)	4(6.8)	1(5.9)	1(10.0)	6
Site specific specialist	0(0.0)	2(3.4)	7(41.2)	0(0.0)	9
Research radiographer	0(0.0)	0(0.0	3(17.6)	2(20.0)	5
Other (please expand)	0(0.0)	1(1.7)	4(23.5)	1(10.0)	6
Management	0(0.0)	0(0.0)	0(0.0)	5(50.0)	5
Total	**16**	**59**	**17**	**10**	**102**

Fig. A4.6. . Highest education level per group

Table A4.7
Education currently working towards per group.

	n(%)				
	Group				
	1	2	3	4	
Education					**Total**
Bachelor's (BSc) or equivalent	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0
Master's (MSc) or equivalent	1(6.2)	12(20.3)	2(11.8)	0(0.0)	15
Doctorate (Phd) or equivalent	0(0.0)	0(0.0)	1(5.9)	2(20.0)	3
Other (please specify)	1(6.3)	4(6.8)	0(0.0)	0(0.0)	5
None	14(87.5)	43(72.9)	14(82.3)	8(80.0)	79
Total	**16**	**59**	**17**	**10**	**102**

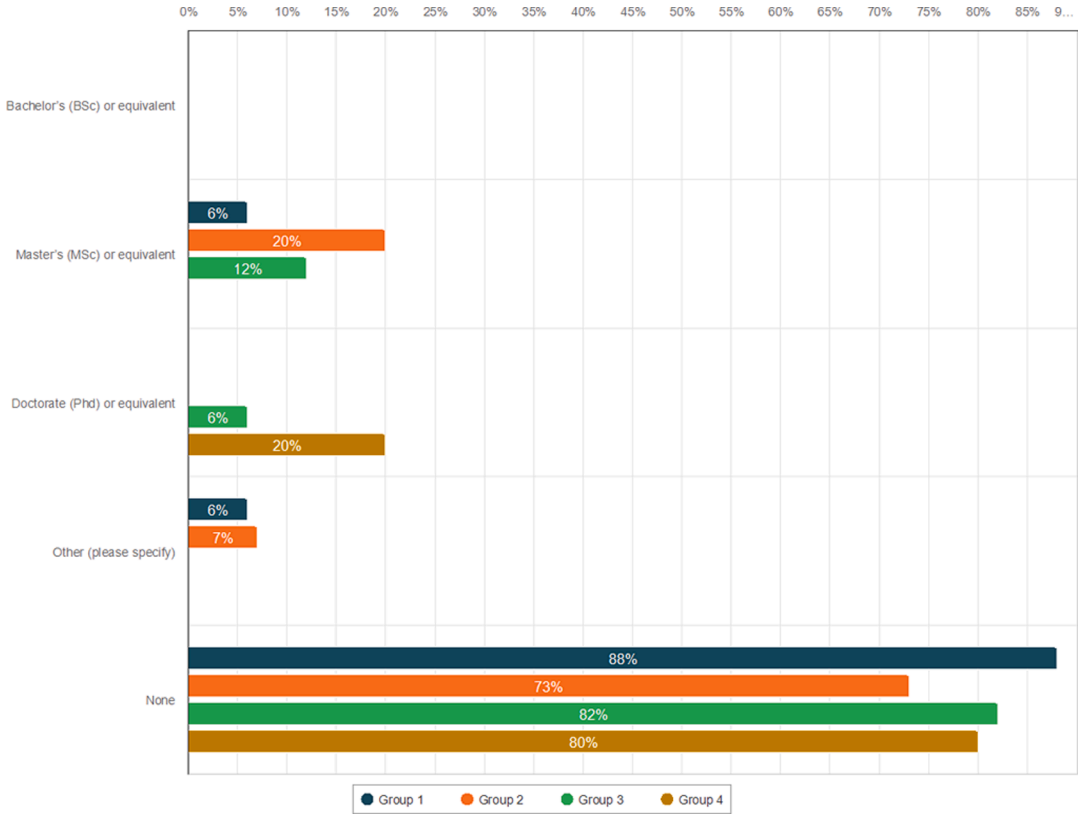


Fig. A4.7. Education working towards per group

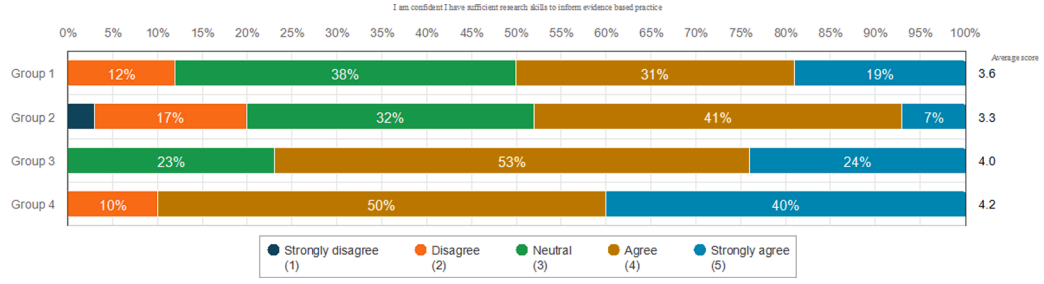


Fig. A4.7.1. Statement answer per group

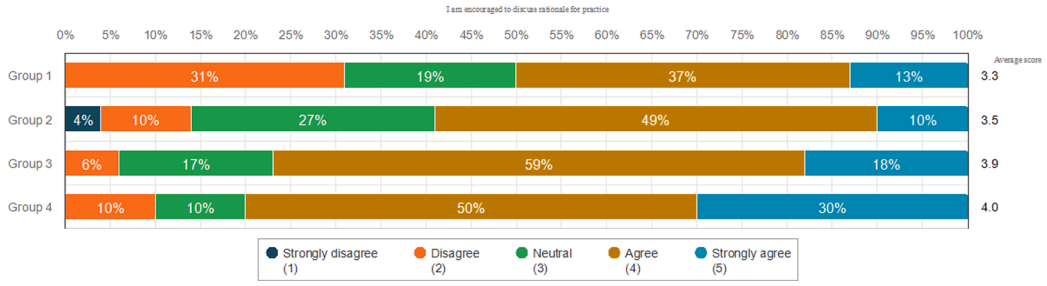


Fig. A4.7.2. Statement answer per group

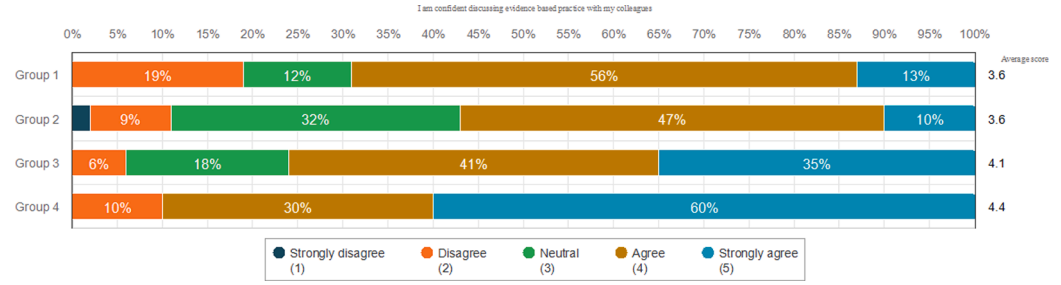


Fig. A4.7.3. Statement answer per group

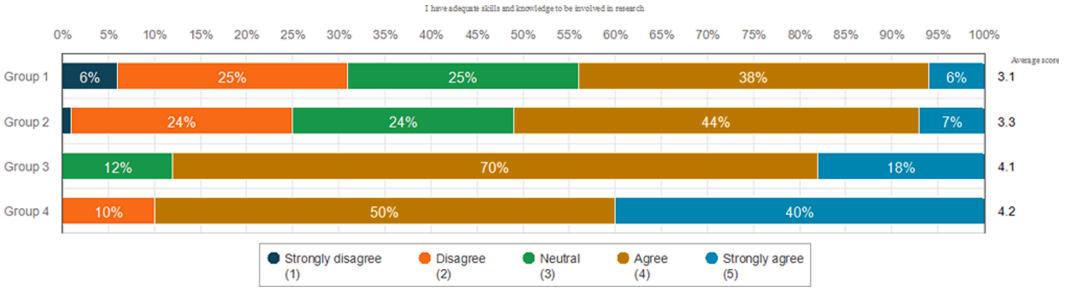


Fig. A4.7.4. Statement answer per group

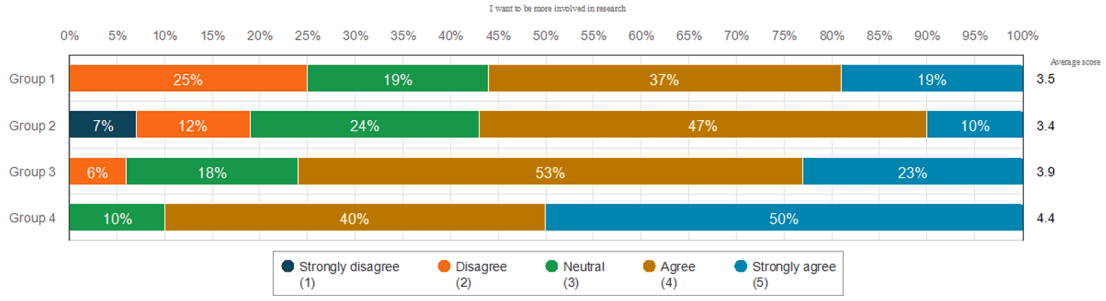


Fig. A4.7.5. Statement answer per group

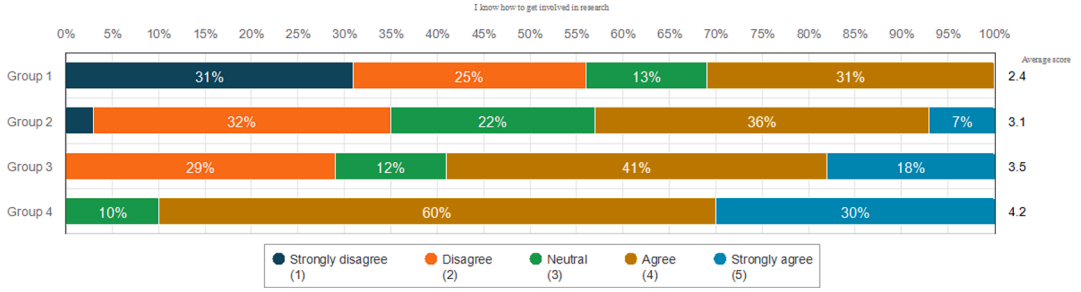


Fig. A4.7.6. Statement answer per group

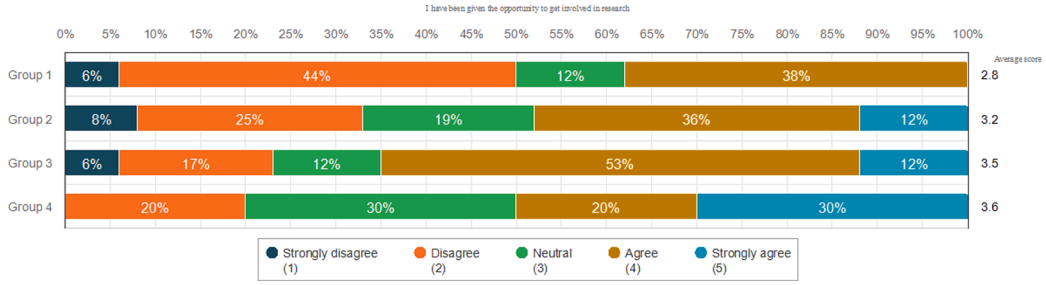


Fig. A4.7.7. Statement answer per group

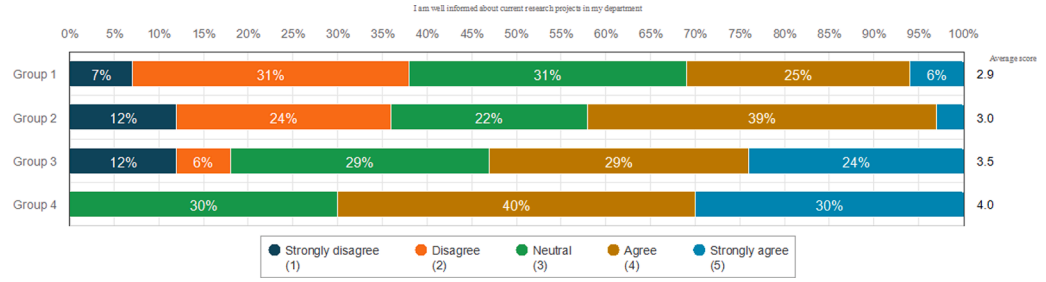


Fig. A4.7.8. Statement answer per group

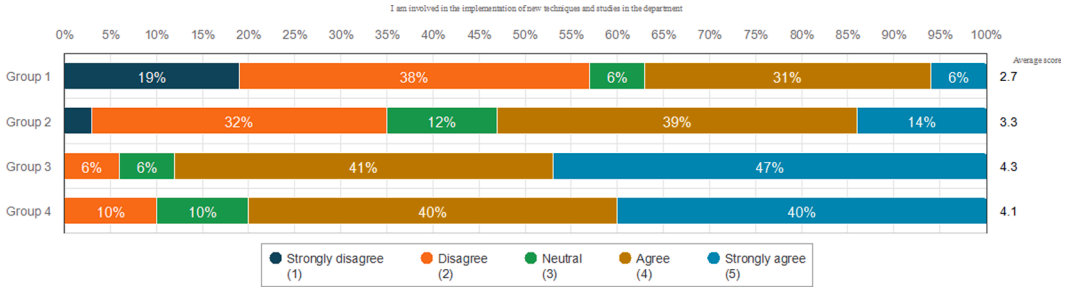


Fig. A4.7.9. Statement answer per group

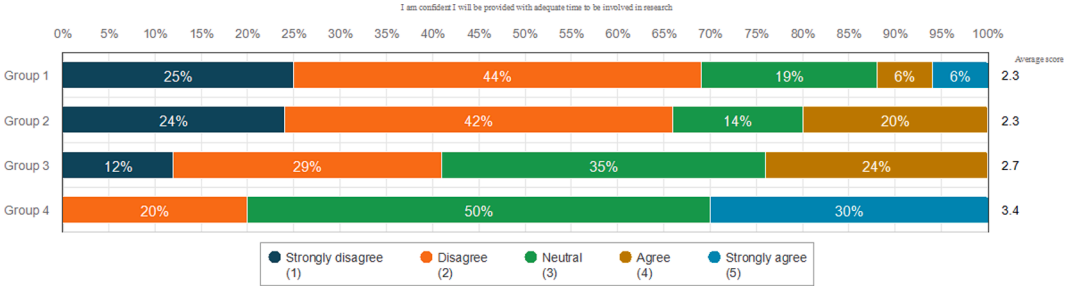


Fig. A4.7.10. Statement answer per group

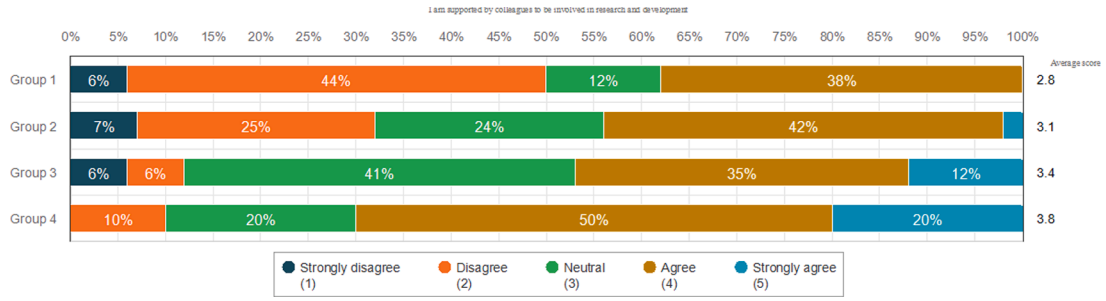


Fig. A4.7.11. Statement answer per group

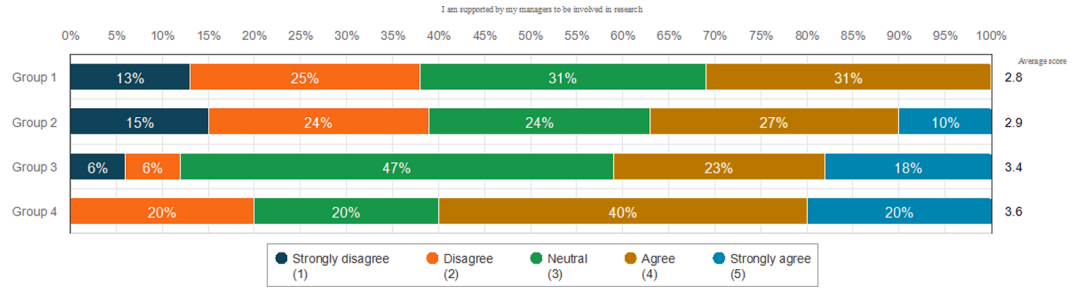


Fig. A4.7.12. Statement answer per group

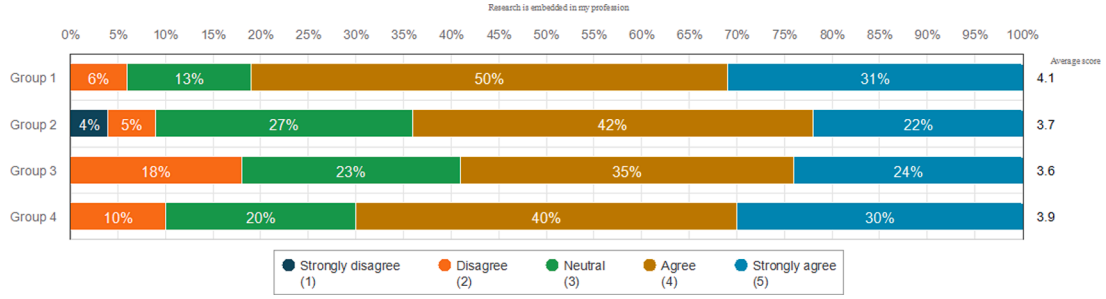


Fig. A4.7.13. Statement answer per group

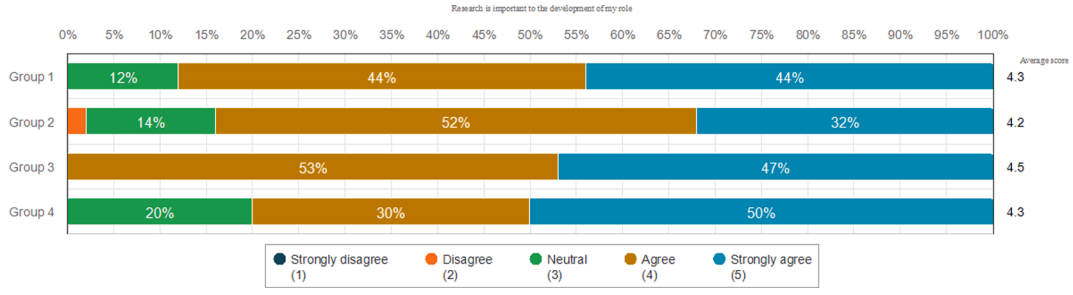


Fig. A4.7.14. Statement answer per group

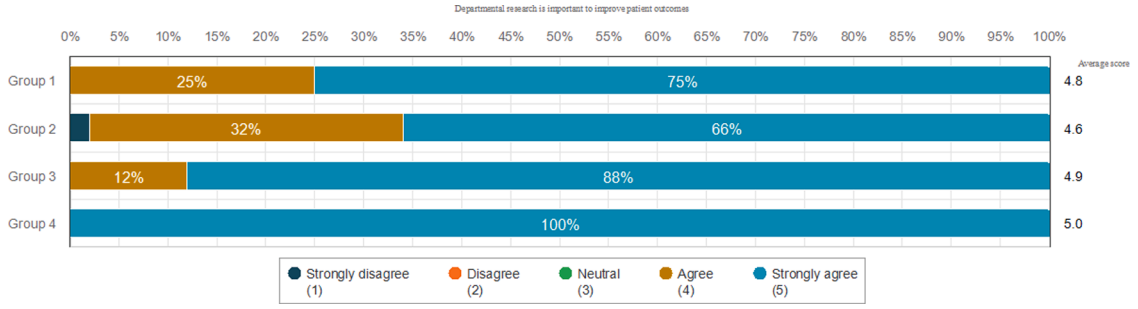


Fig. A4.7.15. Statement answer per group

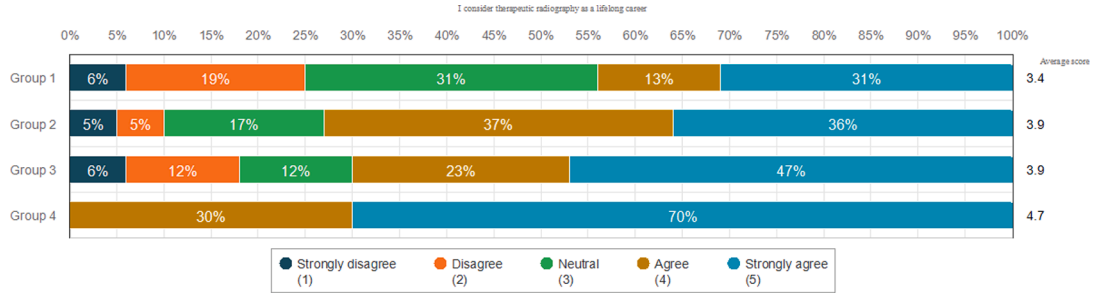


Fig. A4.7.16. Statement answer per group

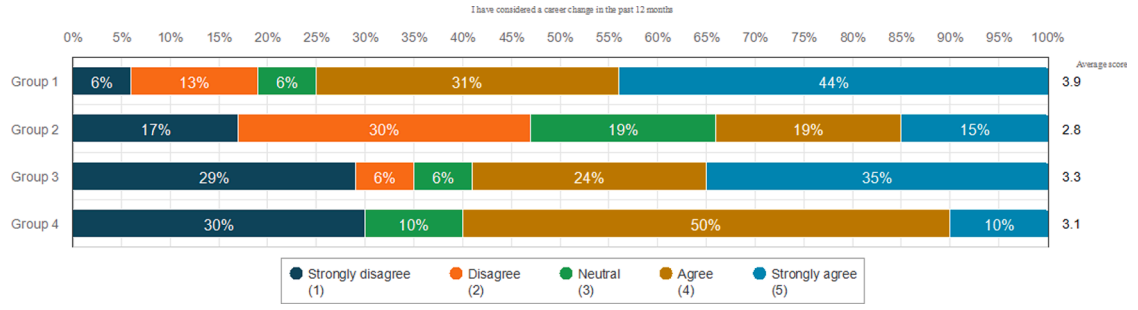


Fig. A4.7.17. Statement answer per group

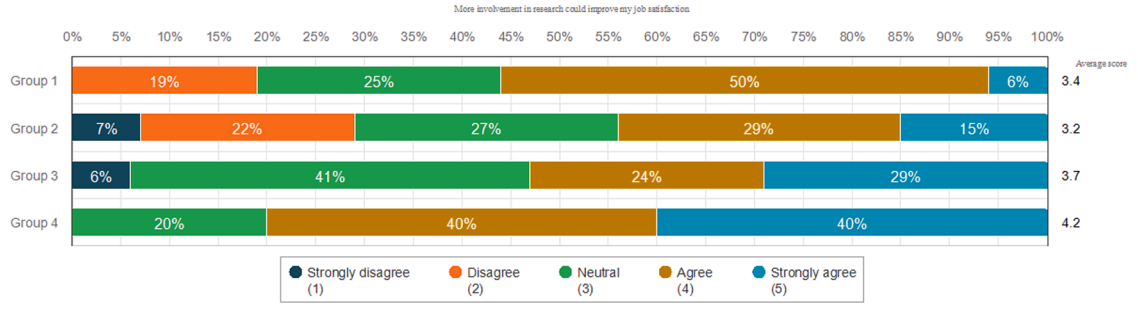


Fig. A4.7.18. Statement answer per group

Table A4.8
Therapeutic radiographers' attitude to research and development per group.

	Mean (SD)			
	Group			
	1	2	3	4
Statement				
I am confident I have sufficient research skills to inform evidence based practice	3.6(1.0)	3.3(1.0)	4.0(0.7)	4.2(0.9)
I am encouraged to discuss rationale for practice	3.3(1.1)	3.5(0.9)	3.9(0.8)	4.0(0.9)
I am confident discussing evidence based practice with my colleagues	3.6(1.0)	3.6(0.9)	4.1(0.9)	4.4(1.0)
I have adequate skills and knowledge to be involved in research	3.1(1.1)	3.3(1.0)	4.1(0.6)	4.2(0.9)
I want to be more involved in research	3.5(1.1)	3.4(1.1)	3.9(0.8)	4.4(0.7)
I know how to get involved in research	2.4(1.3)	3.1(1.0)	3.5(1.1)	4.2(0.6)
I have been given the opportunity to get involved in research	2.8(1.0)	3.2(1.2)	3.5(1.1)	3.6(1.2)
I am well informed about current research projects in my department	2.9(1.1)	3.0(1.1)	3.5(1.3)	4.0(0.8)
I am involved in the implementation of new techniques and studies in the department	2.7(1.3)	3.3(1.2)	4.3(0.8)	4.1(1.0)
I am confident I will be provided with adequate time to be involved in research	2.3(1.1)	2.3(1.1)	2.7(1.0)	3.4(1.2)
I am supported by colleagues to be involved in research and development	2.8(1.0)	3.1(1.0)	3.4(1.0)	3.8(0.9)
I am supported by my managers to be involved in research	2.8(1.0)	2.9(1.2)	3.4(1.1)	3.6(1.1)
Research is embedded in my profession	4.1(0.9)	3.7(1.0)	3.6(1.1)	3.9(1.0)
Research is important to the development of my role	4.3(0.7)	4.2(0.7)	4.5(0.5)	4.3(0.8)
Departmental research is important to improve patient outcomes	4.8(0.4)	4.6(0.7)	4.9(0.3)	5.0(0.0)
I consider therapeutic radiography as a lifelong career	3.4(1.3)	3.9(1.1)	3.9(1.3)	4.7(0.5)
I have considered a career change in the past 12 months	3.9(1.3)	2.8(1.3)	3.3(1.7)	3.1(1.5)
More involvement in research could improve my job satisfaction	3.4(0.9)	3.2(1.2)	3.7(1.1)	4.2(0.8)

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