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Advanced practice in radiotherapy across Europe: stakeholders' perceptions of implementation and evolution

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ABSTRACT

Introduction: Adapting radiotherapy services with workforce innovation using skills-mix or task-shifting optimises resources, supporting current and future demands. Advanced practitioners (APs) work at a different level of practice (beyond initial registration) across four pillars: clinical practice, leadership and management, education, and research. There is limited cross-country research on the advanced therapeutic radiographers/radiation therapists (TR/RTTs), particularly in Europe. This study aimed to investigate European radiotherapy stakeholders' perceptions regarding current and future advanced practice (AP).

Methods: From June to September 2022, one-to-one online semi-structured interviews were conducted in English, and audio and video were recorded. Full verbatim audio files were independently transcribed and checked by interviewer and interviewees. Braun and Clarke's seven steps guided the thematic analysis (using NVivo).

Results: Thirty-three interviewees working or studying in 16 European countries represented practitioners (n=14), managers (n=6), educators (n=4), professional bodies (n=4), students (n=3), and regulators (n=2). Four overarching themes emerged: "AP drivers and outcomes", "AP challenges *vs* enablers", "Current *vs* future AP", "Becoming and being advanced practitioner".

Participants identified research as the neglected AP pillar due to a lack of protected time, limited staff skills, no research culture, no funding, workload, and clinical priorities. Interviewees highlighted the importance of consistency in job titles, harmonisation of education models and curricula, definition of AP requirements, and support for all AP pillars through job plans and workforce planning.

Conclusion: Neither the profession nor education of TR/RTTs are harmonised across Europe, which is highly reflected in advanced-level practice. Advanced TR/RTTs should work across all pillars, including research, and these should be embedded in master's programmes, including leadership.

Implications for practice: This study highlights a policy gap in the education and practice of APs in radiotherapy.

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Introduction

One in four patients who need radiotherapy do not receive it[1] and, with increasing demand, radiotherapy capacity will be insufficient by 2025.[2,3] At a European level, efforts have been made to capture decision-makers attention on radiotherapy underinvestment.[4] Using the existing workforce at maximum capacity requires flexibility in service delivery models. Advancing practice in oncology by redesigning traditional staffing models is essential to ensure the sustainability of the healthcare system. Adapting radiotherapy services with workforce innovation, particularly in Europe because of the ageing population with higher cancer risk, enables addressing current and future demands.[5–9]

Internationally, focus on mid-level providers (also known as physician extenders or associates) has become increasingly important in healthcare policy. Two distinct pathways are accessible: (i) existing health profession qualification and license who train as an advanced practitioner (e.g. nurse practitioner) or (ii) higher education qualification to a non-physician clinician (e.g. physician associate).[10–13] Advanced practitioners (APs), including therapeutic radiographers/radiation therapists (TR/RTTs), work at a different level of practice (beyond initial registration) across all four advanced practice (AP) pillars: clinical practice, leadership and management, education, and research.[14] They play a key role in enhancing capacity and capability to streamline the patient pathway, with vast evidence of a positive impact on radiotherapy services and patient care.[15–19] APs in radiotherapy are professionally mature TR/RTTs and can be pioneers of new treatment techniques, leaders in implementing new technologies, educators of professionals and patients, and promotors of evidence-based practice.[20–22] Advanced TR/RTTs are recognised in some countries with an increase in salary and specific AP roles in their job description, while, in other countries, they perform AP roles but do not have official recognition.[23]

TR/RTTs struggle with recruitment, retention, and recognition, and many were trained to work in a different model of care from that required in the future.[24–29] AP among TR/RTTs may be a positive factor for staff retention due to increased motivation and recognition. However, advanced TR/RTTs face many challenges in their professional journeys, namely in the education and training of AP roles.[23,21]

There is limited cross-country research, on the advanced TR/RTTs regarding their professional profiles, regulation and governance, education, and support needs, particularly in Europe. Therefore, this study aimed to investigate European radiotherapy stakeholders' perceptions regarding the implementation and evolution of AP, mapping the four pillars in current practice and education. The following research questions are considered:

- To what extent are current AP roles in radiotherapy described in the European setting?
- What are the challenges to AP role implementation and sustainability?
- Which advanced skills and capabilities can enhance the work across all pillars?
- What is the future of AP roles among TR/RTTs?

Methods

Study design

Semi-structured interviews explored perceptions and experiences of key stakeholders across Europe as part of a larger multiphase mix-method design.[23]

In line with an interpretivism paradigm,[30] thematic analyses of interview transcripts examined perspectives on the profiles of APs in radiotherapy and respective master's programmes.

This study follows the consolidated criteria for reporting qualitative research (COREQ) checklist (see Appendix A).[31]

Ethics

Ethical approval was granted by the Institute of Nursing and Health Research Ethics Committee at Ulster University (Project Number: FCNUR-21-080).

Data collection and analysis were conducted in compliance with general data protection regulations.

Recruitment and sampling

A range of stakeholder groups were recruited: practitioners (TR/RTTs working in AP roles); employers (clinical department representatives); educators (radiotherapy lecturers or representatives of master's programmes); students (master or doctorate); professional bodies (representatives of associations); regulatory bodies representatives.

A purposive sampling approach was followed, using multiple invitation strategies: invitation by email through the SAFE EUROPE project partners,[32] including the European Federation of Radiographers' Societies (EFRS) members and educational affiliates[33]; dissemination of leaflets at ESTRO 2022 and SAFE EUROPE conferences; recruitment of volunteers from a previous survey[23]; and invitation of regulatory bodies representatives through the European Commission's regulated profession database.[34]

One interview was cancelled due to sickness (COVID-19), and the recruitment stopped when the research team considered that a diverse representation of European countries and stakeholder groups had been reached. Since the analysis was performed after the end of all interviews, data saturation was confirmed after the end of the interviews.

Data collection

All invited participants were given an information sheet about the lead researcher's (TR/RTT and PhD student) interest in the topic and a consent form. Confirmation of consent was performed prior to the interview. Participants could withdraw from the study at any time.

Participants were interviewed from June to September 2022, and one-to-one interviews lasted 35–90 min (an average of 47 min).

The interview guide (see Appendix B) was designed based on the literature review[20] combined with survey findings[23] and adapted for each stakeholder group. The wider research team confirmed the relevance of each question to achieve the study aim. Two pilot interviews were conducted online. Each interview guide contained open-ended questions with follow-up probes. Time was provided for issues not anticipated to be raised and discussed.[35]

The lead researcher [CO], who is trained and experienced in interviewing, conducted all the interviews in English. Interviews were conducted online with audio and video recording using Microsoft TEAMS. Some field notes were made during and after the interviews. Moreover, the interviewer remained objective and neutral during the interviews despite knowing 11 participants.

Full verbatim audio files were independently transcribed and checked against recordings by the interviewer. More attention was given to non-native English speakers to improve veracity. A clean copy of the transcript was sent to interviewees for member checking with the request for feedback on authenticity, thus improving the credibility and quality of the data analysis.[35,36] The positivist method of member checking was used to enable participants to check information and allow the addition of new data or data deletion. The epistemological stance of this type of member

Table 1
Interviewee characteristics (n=33).

Stakeholders	Quotes code	Gender	Years of experience	Postgraduation[a,b]	Countries code[c,d]
Practitioners	P1-14	10F 4M	4-30 RTT/ 2–16 AP TR/RTT	MSc Radiotherapy	ENG, NLD,
Managers	M1-6	3F 3M	5-19 manager	MBA/MSc	BEL, PRT,
Educators	E1-4	1F 3M	13-35 educator	MSc Radiation	CHE, FIN,
Students	S1-3	2F 1M	4-18 TR/RTT	PhD Radiotherapy	NIR, ITA,
Professional body	PB1-4	2F 2M	4-40 TR/RTT	MSc Health	DNK, IRL,
Regulators	R1-2	1F 1M	4-5 regulator	Other MSc	NOR, MLT,
				Other PgD/C	LVA, POL,
					EST, DEU

[a] Some participants have undertaken more than one master.
[b] Some academic degrees are in progress.
[c] Some participants work or study in different countries.
[d] Country code according to Countrycode.org & ENG-England, NIR-Northern Ireland. AP-Advanced practice, F-Female, M-Male, MBA-Master of Business Administration, MSc-Master of Science, PgD/C-Postgraduate diploma/certificate, PhD-Doctor of Philosophy, TR/RTT-Therapeutic radiographer/radiation therapist.

checking is positivism due to implying there is a truth value in the spoken or written word.[37]

Data analysis

Since the two pilot interviews were performed in the same setting and a minor amendment was performed to the interview guide, these were included in the data analysis.

[CO] coded all the transcriptions, and three other researchers [JGC], [RK], and [HAMcN] independently coded three interviews each for cross-coding to check inter-coder reliability and congruence of interpretations. After triangulation, the coding of the lead researcher was consensual and accepted by all researchers.[35] Inductive iterative coding was conducted to investigate the perspectives of the stakeholders about AP dependent on context, and deductive to locate data aligned to the research objectives and the subthemes categorisation were literature-based.[20,23,38,39]

Braun and Clarke's seven steps[40] guided the thematic analysis of the interview transcriptions to draw out the main themes and subthemes using NVivo software (Release 1.0). After independent transcription (1); [CO] read and familiarised with the data, identifying relevant segments of data (2); assigned meaning to segments of data through coding all data (3); searched for themes (4); and then reviewed the themes by grouping codes, resulting in a thematic framework revised and approved by the research team (5); [CO] defined and named themes (with the subthemes' names based on pre-existing categories) (6); and finalised analysis through writing (7).

Results

Thirty-three individuals working or studying in 16 European countries (Table 1) were interviewed. Fourteen were APs with diverse job titles, often performing multiple roles; most (86%) held a master's degree, four to 30 years of professional experience as TR/RTT and between two and 16 years of AP. Four overarching and interlinked themes emerged: “AP drivers and outcomes”, “AP challenges *vs* enablers”, “Current *vs* future AP”, “Becoming and being advanced practitioner”. Fig. 1 shows the thematic framework.

Theme I: Advanced practice drivers and outcomes

This theme demonstrated the rationale for AP roles in radiotherapy and related the drivers with the outcomes of AP impact. Perceptions were categorised according to significance: clinical, professional, and organisational (Appendix C - table C.1).

Clinical significance

Participants considered the main driver for AP roles to be providing the best possible patient care and promoting high-quality treatment through continuity of care.

> *Makes it more interesting for the individual [AP], but also nicer for the patients … they keep meeting the same person. (P7 ENG)*

Professional significance

Several stakeholders mentioned that role development for this level of practice was shown to be a motivator among TR/RTTs to help them raise their professional aspirations and job opportunities. Some practitioners reported that skills-mix intervention in multi-professional teams (MPT) improves confidence and morale among APs, enabling the autonomy of the advanced practitioner in radiotherapy departments. Moreover, these new and evolved roles become new options or opportunities to enhance career pathways for TR/RTTs, improving job satisfaction and commitment to the profession and increasing staff retention.

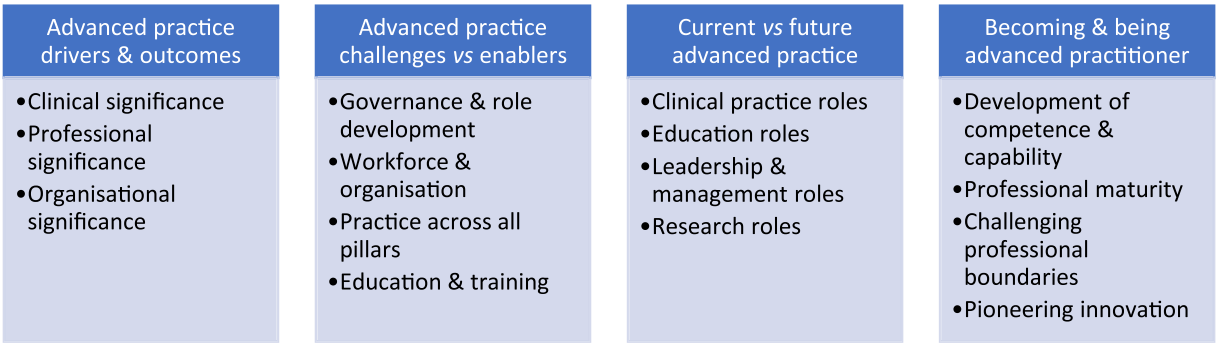

Figure 1. Themes and subthemes.

The programme I was undertaking was meant for people like me, who had been working for years. I was constantly able to implement and use the knowledge that I gained on my workplace, which was perfect! (P8 EST)

Organisational significance

Participants explained that service demands led to the creation of AP roles. Streamlined workflows through service redesign allowed APs to take on more responsibilities from the MPT, reducing workload pressures. The service development was supported by this level of practice, facilitating innovative processes such as implementing new technologies or techniques.

We really need them [APs] … Some of the treatments are getting less complex because it's daily routine. But other treatments are getting more complex … we need APs to implement these new techniques. (E3 NLD)

Theme II: Advanced practice challenges vs enablers

Interviewees identified several challenges in implementing and maintaining AP roles but also reported experiences of successful AP journeys with associated enablers (Appendix C- table C.2).

Governance and role development

A common concern among stakeholders was the lack of AP standardisation with limited role clarity. This lack of clarity is exacerbated by the inconsistency of job titles that hinders the recognition and acceptance of APs.

Everything depends on what "standard" is, and it's very variable between countries and even departments … if somebody would go into wound care or even dosimetry in our country, [they] would be considered AP [an advanced practitioner]. (P5 BEL)

Most participants have a standard job description without annual revisions. Practitioners taking on additional responsibilities should be acknowledged and remunerated according to participants. Discrepancy between current AP and regulation was mentioned. Some participants denoted concerns about the informal status of AP, which raises ethical and professional implications of working outside their scope.

Stakeholders agreed that AP posts should have prerequisites. Postgraduation education must underpin this level, with 73% of participants considering a master's degree as the standard. All agreed with previous radiotherapy experience; 58% of participants recommended five (or more) years of practice. Due to workforce shortages, some interviewees suggested some flexibility in this requirement.

A number of years is a good thing, before we develop a clinical practice that is advanced. The generations that enter the working environment now see things differently … [They] are not content with me telling them - "Well, you have to wait two or three years until we can develop and educate you in this direction"- because then they will simply find another job. (M5 DNK)

Participants highlighted that AP roles enhance career progression, offering alternative routes to management or education posts and enabling them to remain in clinical settings. Participants from the United Kingdom described structured pathways to the AP level.

Some participants mentioned the lack of annual appraisals of AP posts and limited evidence of impact.

I worked many years [as a] dosimetrist, but I wasn't recognised, and I wasn't evaluated. (PB4 ITA)

Non-standardisation of AP roles resulted from (i) *ad-hoc* development and implementation that were locally driven and reactive to service needs by TR/RTTs using expertise and working beyond their scope of practice or (ii) decision by employer to fill a need and add value to the service.

Workforce and organisation

Participants said that misconceptions and lack of clear definition of their innovative AP roles meant they had to start by proving to themselves and others the value of their work and legitimacy within the MPT. Some participants described that with time and perseverance the staff started to accept and support their AP roles.

*The major challenges [in] the beginning, […] were to convince the other profession [*physicians*] to trust [APs]; and after that it went quite smoothly [sic]. (M1 POL)*

Participants alluded to some tension between different professional groups with resistance to task-shifting of activities previously performed by other professionals, such as clinical tasks (physicians), treatment planning (medical physicists-MPs), and care management (nurses). According to participants, advanced TR/RTTs are not meant to replace other professionals but to complement them.

There are always the challenges of professional boundaries within a service, and different professional groups seeing what they've traditionally "owned" within their area of practice, so there is sensitivity to change. (PB1 ENG)

Even in countries with government-led AP, practitioners reported institutional and structural barriers to performing their roles (e.g., *difficulties in ordering tests -P4 ENG*).

Managers cited recruitment and retention challenges. Staff shortages and workload affected time allocation for other pillars beyond clinical practice.

Our main challenge for this past five years has been to replace all the staff that have been hired on the particle treatment centre … I would say [that] approximately 30% of my staff has been hired within the past 5 years. (M5 DNK)

Some practitioners feel undervalued without recognition, and some managers are concerned about the existing barriers to providing incentives, compensation, or career development opportunities to APs to keep them motivated.

Practice across all pillars

An AP enabler mentioned by stakeholders is the importance of working across all pillars. This awareness can oppose the trend of working primarily clinically focused, with less scope for developing the other pillars. Participants agreed on the importance of protected time for each pillar and an annual appraisal process.

The biggest challenges to these roles are being able to prioritise the various pillars. The only way is to build time [sic] for yourself. The clinical aspect can take over, and it can be at the cost of other pillars

of practice … I find in my role […] that one of the key aspects of this is having a flexible job plan. (P4 ENG)

61% of participants reported the clinical pillar prioritisation. This clinical focus constitutes barriers for AP such as lack of protected time for each pillar-related activities, lack of staff confidence, limited research capabilities, no research culture, lack of management support, and workload pressures.

Students just need that direction on what the pillars mean to them; if employers just want to concentrate on the clinical pillar, they need that support and guidance on what they need to be doing to meet the other pillars. (E2 ENG)

Education and training

Participants discussed their educational pathways, supervision, and continuous professional development (CPD) to support AP. The diversity of educational curricula in the European landscape was highlighted, with various national programmes leading to unspecific educational pathways. Participants supported education harmonisation at the entry and advanced levels.

Funding and protected time for AP education or training were reported. Some TR/RTTs receive support to attend external courses; however, for postgraduate education, funding is limited and assigned according to the local needs of the institution.

There are challenges in ensuring the full master in AP is completed … in terms of funding and release of people to undertake the programmes … I suspect across Europe, access to appropriate education and training is also a challenge. (PB1 ENG)

Most participants (64%) identified postgraduate educational needs, namely the lack of radiotherapy-specific master's degrees or AP programmes for health professionals. Participants indicated that no accredited educational pathway for advanced TR/RTTs has been established in their countries. Participants acknowledged educational gaps even at a standard level (e.g., Belgium, Italy, Switzerland). Participants from the United Kingdom, Netherlands and Ireland recognised that they had an adequate offer for AP.

In terms of master's degrees, it was noted that radiotherapy-specific programmes have very tailored technical knowledge that will quickly be outdated. On-the-job project implementation and radiotherapy-focused research with professional networks were cited as advantageous. Non-radiotherapy master's programmes were considered broad-level with a wider scientific perspective but with the possibility of adding value to the workplace (e.g., management and healthcare programmes). However, these students can go into other research areas and leave the profession. The AP master's degrees for healthcare professionals were referred as generic and nursing-focused.

The major challenge to pursue radiotherapy-specific masters was their nonexistence at the national level, although participants identified that masters would be available in Italy and Norway next year. The alternative, access to international programmes, was described with geographical and linguistic barriers (multilingual countries, English programmes), costs and limited funding, lack of study leave, and unawareness of programmes existence. Programmes with elective modules to tailor the students' needs, flexible modes of delivery, and funding by employers or government, facilitated access to radiotherapy-specific masters.

Not all radiographers are aware of available master's programmes. People from other countries don't know we have [them] in the Netherlands, an international master's programme that's open for international students. Most of it is done in an online way, and limited traveling is involved with it. (E3 NLD)

Participants commented on the lack of support or supervision for the new AP roles, mainly due to workload.

Participants referred to CPD as a voluntary/informal mode independent of the level of practice undertaking activities such as journal clubs, external courses, and conference attendance. Some participants reported mandatory CPD every five years in radiation protection training. More than half of the participants had access to CPD funding, but they had to apply or "fight for it" *(P5 BEL).* Budgets and workload affected CPD opportunities, with some professionals giving up their time and money. Also, eLearning platforms were considered to be a helpful resource.

We have specific annotations to our register, mostly around … prescribing capabilities. But we don't store additional information about whether people are AP or not. We do have standard CPD requirements. (R2 ENG)

Theme III: Current vs future advanced practice

Interviewees described their departments' current and past AP with a focus on local specificities, clinical areas, and MPT changes. Future perspectives on AP roles were highlighted and categorised by pillar (Table 2).

Clinical practice roles

AP roles were wide-ranging in radiotherapy, with the most of interviewed practitioners working in direct contact with patients (n=9/14). Some AP roles were site-specific (e.g., breast cancer) or clinical area-specific (e.g., brachytherapy) and included activities

Table 2
Current and future advanced practice roles by pillar.

Subthemes	Current roles	Future roles
Clinical practice	Site-specific roles[a]	Site-specific[a]/consultant roles
	Pre-planning/pre-treatment lead	ACP in radiotherapy/ chemotherapy
	Advanced dosimetrist	Holistic care lead
	Brachytherapy lead	Technique-specific roles[b]
	Technique-specific roles[b]	Community lead
	Clinic reviewer	Precision oncology lead
	Wound care lead	
	Paediatrics lead	
	Palliative care lead	
Education	Supervisor/clinical demonstrator	Clinical-academic role
	(Post)graduation lecturer	
	Education manager TR/RTT	
	Trainer in IGRT/ART	
	Patient educator	
	CPD programmes lead	
Leadership & management	Care manager	Radiation protection officer
	Local risk manager	
	Quality manager	
	Project manager	
	Chair of working group	
	Recruitment leadTR/	
	RTT sub-chief manager	
Research	Research officer	*Artificial intelligence* expert
	Clinical trials investigator	
	Service development lead	
	Research and development lead	

ACP-Advanced clinical practitioner, CPD-Continuous professional development, TR/RTT-Therapeutic radiographer/radiation therapist.
[a] Site-specific roles: breast cancer, palliative care.
[b] Technique-specific roles: IGRT/ART-image guided radiotherapy/adaptive radiotherapy (adapters), SRS-stereotactic radiosurgery, SABR-stereotactic ablative radiotherapy, proton therapy.

across the patient pathway. Others were technique-specific (e.g., SABR), where the TR/RTT lead the technique implementation and development. Other reported advanced activities included contrast administration in pre-planning, simulation, wound care, target delineation, hybrid image registration, on-treatment review, and drug prescription.

In one department, TR/RTTs rotate in treatment and pre-planning units in all tumour sites, and in pre-treatment planning, they are specialist in two or three tumour sites. In other departments, APs work across all pillars but with limited scope in pre-treatment planning.

> *You have therapists … inserting [brachytherapy] cylinders, assessing patients before or after the treatment, advising them. Basically, having outpatient clinics with or without the clinician. (M4 IRL)*

Future AP roles mentioned by participants included adaptive radiotherapy ("*adapters*"), holistic care, precision oncology, and community liaison, among others.

Education roles

In addition to self-education and professional development, the education pillar included staff training and patient education.

Some APs were involved in the mentorship of students and staff. In some departments, this took place informally; in others, their role was formally recognised, including a contract with academic institutions.

> *I'm leading all the projects in education … getting the RTTs highly skilled with more sustainable knowledge for the upcoming artificial intelligence movement. (P10 NLD)*

One future AP role may be a clinical-academic post based in the hospital, developing students' and TR/RTTs' skills and encouraging TR/RTT-led research - bridging the academic and clinical worlds.

Leadership and management roles

APs referred to themselves as the liaison professionals who link the MPs, physicians, and TR/RTTs in MPT activities and interprofessional collaborations for protocol development, service evaluations, audits, staff coaching and promoting evidence-based practice.

One AP role implemented by law was a "quality manager", a career opportunity for TR/RTTs in some departments (Belgium, Estonia). Interviewees noted a lack of structure in the workplace when they started the new role.

The care manager, reported in different countries (Poland, Italy), is a mix-role where the practitioner is the "point of contact" responsible for the continuity of patient care, providing support to MPT and patient education.

> *They manage the whole radiotherapy path for the patient. The main task is CT scanning … contouring of organs at risk … [speaking] with the patient … (M1 POL)*

Research roles

University hospitals promote more AP research-based roles in radiotherapy departments, such as research and development posts, than smaller hospitals. In some countries (Denmark, Portugal, Germany, Finland), TR/RTTs engage in research but often do not lead the project.

> *Our roles as RTTs will probably change … from bench to bedside … from research to practice. That's where an advanced practitioner can help. (S1 BEL)*

Theme IV: Becoming and being advanced practitioner

This theme included the educational and training background in terms of skills and capabilities combined with professional experience to support the journey of becoming and being advanced TR/RTT. Common ground between the interviewees on becoming advanced practitioners was detected and schematised in four stages (Fig. 2), which co-occur in no particular order and feed back into each other to maintain the TR/RTT as an advanced practitioner ("being").

Development of competence and capability

When participants were asked about the skills and capabilities necessary to work as advanced practitioners in radiotherapy across the four AP pillars, participants mentioned some for each pillar. These were grouped under the four pillars (although many are transversal to various pillars) and into soft and hard skills. Fig. 3 presents the range of capabilities and specific skills for an advanced practitioner in radiotherapy according to the interviewee's perspectives as crucial skills for role development and high professionalism of advanced TR/RTTs.

According to participants, continuous training was essential to enable specialised skill and maintenance capabilities to advance practice.

Participants reported training needs on leadership skills, deepened knowledge of advanced treatment planning, multimodal technologies, image-guided radiotherapy/adaptive radiotherapy (IGRT/ART) skills, project management skills and tumour-site expertise.

> *When I moved to my site-specific role, I had already finished my master, but I needed to do more master's modules. (S3 NIR)*

Students and educators acknowledged that one radiotherapy-specific master's degree included leadership content (Netherlands), but others did not (England, Northern Ireland).

Professional maturity

Participants acknowledged that a confident, independent, and autonomous practice characterizes expert practice. Practitioners possess specialist skills combined with their experience working on the front line. APs use active listening, empathy, and compassion to provide the best care to patients through critical reflection and action through high-level decision-making and problem-solving. As role models, APs support others to realise their full potential.

> *"We didn't decide if the therapists are going to be an extension of the machine or an extension of the doctor" … To be an AP RTT, you need to be an extension of both. (P13 CHE)*

Challenging professional boundaries

Stakeholders believe that interprofessional education and MPTs are crucial. However, working across professional boundaries may involve conflicts of interest due to territorialism between professions. Regular staff meetings with conflict resolution skills enhance role acceptance and recognition. A cultural shift in the understanding of AP roles and service redesign promotes skill-mix within MPT, affecting professional identity:

> *How far does somebody move from doing what is originally seen as part of that profession before they're no longer in that profession anymore? (R2 ENG)*

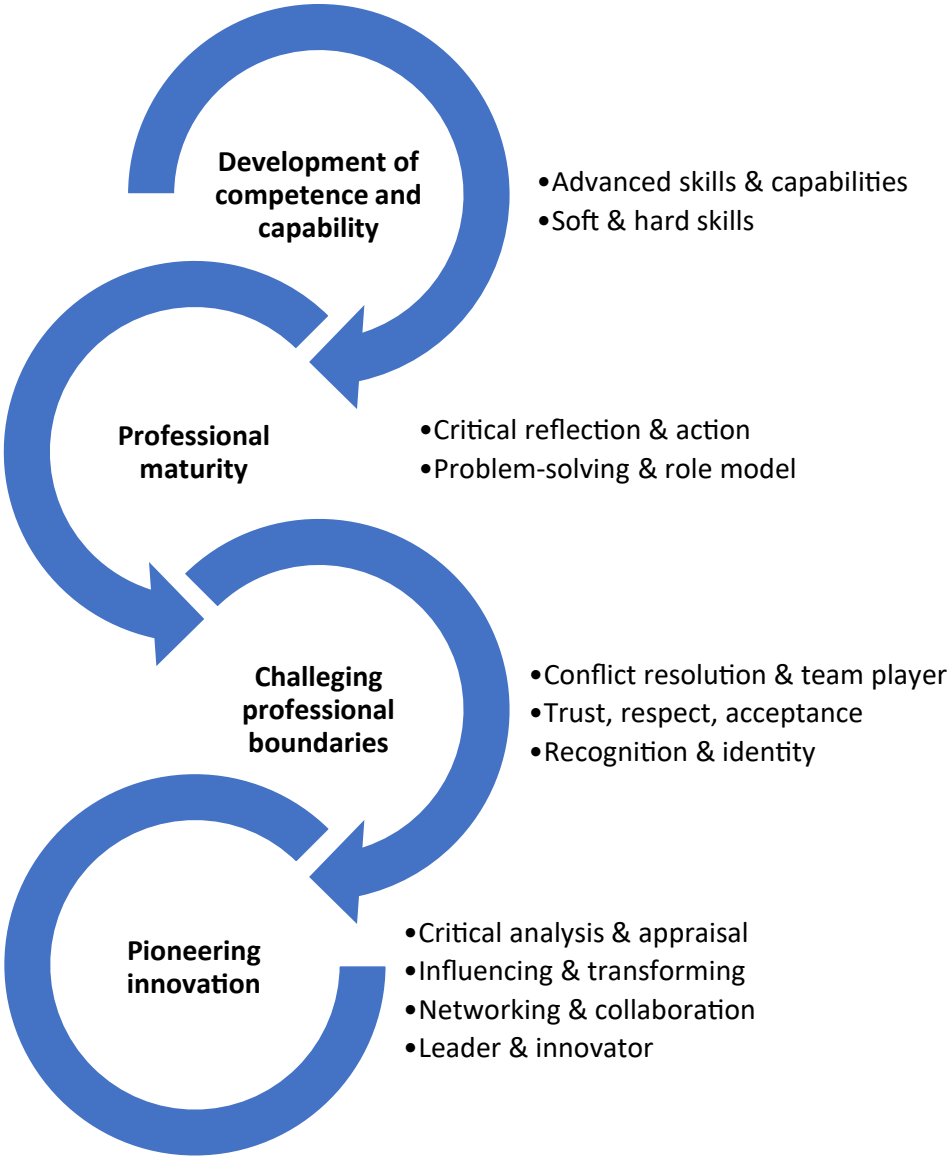

Figure 2. Diagram of becoming and being advanced practitioner in radiotherapy according to the perspectives of interviewees.

Pioneering innovation

APs who work across all pillars are described as innovative leaders and effective communicators capable of influencing and transforming services through active staff engagement. Known for their critical thinking and ability to "think outside the box", they use their critical analysis to improve their own and other's practices.

> *You need to have a different way of thinking about things, more problem-solving, critical, analytical way of looking at your practice. (P2 NIR)*

Discussion

We have not located another study in the field of AP in radiotherapy that has combined the views of APs, managers, educators, and regulators at a European level. This study provided an adequate sample size (n = 33) to examine patterns[35] and collected insights from participants across 16 European countries.

In the previous European survey study,[23] we identified factors perceived by TR/RTTs contributing to educational and training gaps in AP roles. The present study further investigated these factors and delved into challenges and respective enablers related to European and national governance, role development, workforce, and organisation. This study also examined barriers to improving the balanced redistribution of the working time of APs across the four pillars. Additionally, we have compiled a list of the advanced skills and capabilities by pillar based on stakeholders' perspectives.

There is no uniformity in the professional title of TR/RTTs nor harmonisation of education across Europe,[41–49] which is highly reflected in advanced-level practice. The level of AP widely differs between departments and countries, and roles tend to emerge in unstructured ways, reactive to contextual factors. The variability of AP roles in radiotherapy affects professional identity, denoted by the heterogeneity in job titles, job descriptions and remunerations.[50–52]

Informal and unrecognised AP was reported in line with previous findings.[23] Some countries have a mismatch between

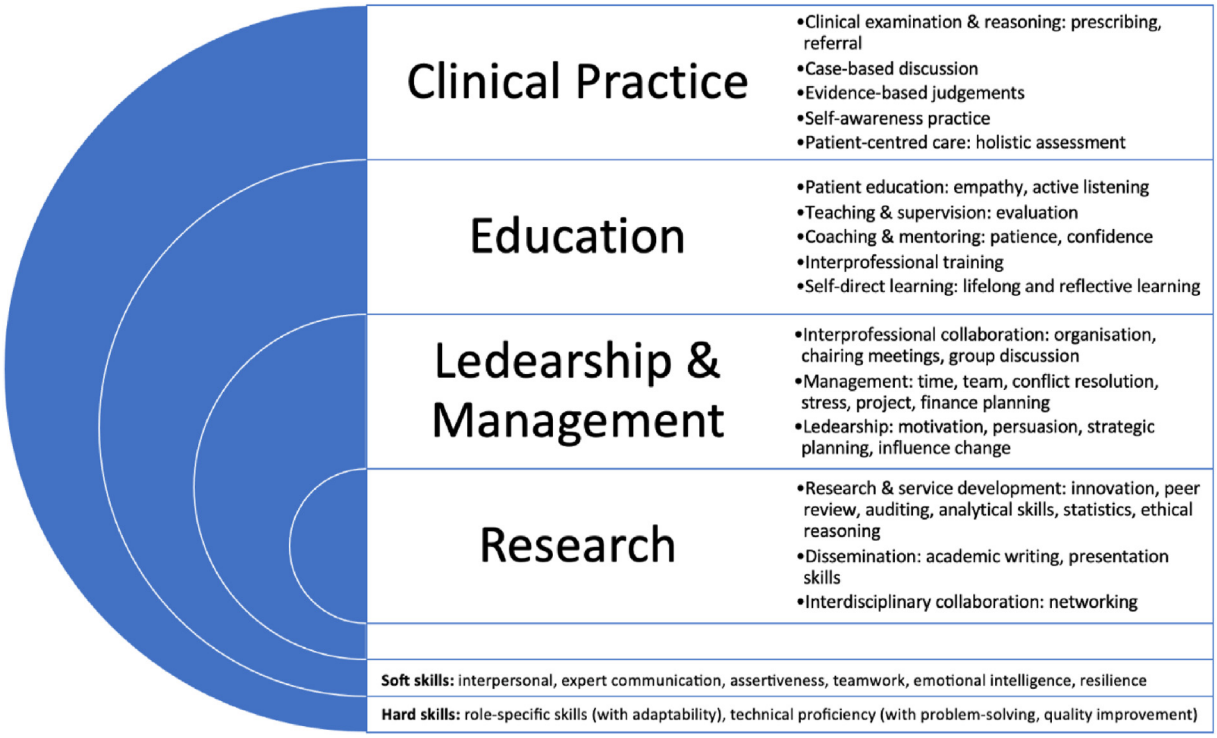

Figure 3. Required skills and capabilities to become an advanced practitioner in radiotherapy according to the perspectives of interviewees.

regulation and practice, with higher-skilled TR/RTTs without salary compensation for roles beyond their scope of practice. Informal practice is rarely studied,[53,54] despite patient and practitioner risks. With informal practice, there is no recognition or evaluation of APs' performance, and continued appraisal was considered vital in ensuring patient safety. This non-official AP is a red flag to policymakers to review the regulation of TR/RTTs' scope of practice at the national and European levels.

Many challenges and enablers to AP implementation and sustainability in radiotherapy were summarised. One concern was the workforce recruitment and retention of TR/RTTs. The lack of specialised staff and availability of MPTs has been investigated,[24,25,27,29] and some surveys[55,56] show a lack of specialized workforce to meet radiotherapy needs.

Participants described AP as clinically focused, with the education pillar often included but informally (e.g., training of other MPT members). Some participants acknowledged limited engagement in research, usually non-TR/RTT led research. The leadership and management pillar usually requires additional training (not included in the AP master's programme). The predominance of the clinical pillar was confirmed[23] (also reported across other healthcare professions),[23,57–60] and underdeveloped research, management, and leadership skills among TR/RTTs.[42,61,62]

Our findings show significant discrepancies between countries regarding AP role implementation due to the integration of the roles, which is often deemed complex and context-dependent. “Artificial intelligence expert” and “adapter” were the most identified future roles by the expectation of radiotherapy dependency on modern information technology in line with the rapidly growing role of data science in providing multidisciplinary cancer care.[63,64,15,65–70,16,19,6,71–73] Other technique-specific AP roles, such as “proton-based SABR expert”, might be developed for a broader spectrum of tumour sites since numerous new facilities that offer particle irradiation are being established in Europe.[6,74,75] “One-stop-shop-services” will also be common in multiprofessional setting with specialised tumour-site teams[6]; for this scenario, “care/case manager”[11] is a role with great potential for TR/RTTs.

Limitations

Participants were purposefully selected according to their AP roles and countries to represent diverse perspectives across Europe. Our recruitment strategy included different approaches to minimise sampling bias. We conducted recruitment and interviews in English, which hindered the recruitment of non-English speakers.

The lead researcher was the data collector and analyst; however, participants were involved in transcripts validation[37] to reduce the potential for researcher bias,[76] and three other researchers checked coding reliability.[35] Participants were not asked to provide feedback on the findings.[31]

The recruitment of participants interested in AP may result in bias. Further research should include the perspectives of other stakeholders, such as policymakers, other healthcare professionals, and patients.

Recommendations

The findings from the interviews, particularly about theme II of the thematic framework, “Advanced practice challenges *vs* enablers”, led to creating a list of recommendations to address the challenges in the four subthemes. In addition to being based on the thematic analysis, these recommendations were triangulated and supported with literature (Table 3).

Table 3
List of recommendations for highlighted challenges by subtheme.

Governance and role development
Development of a structured national/European framework of AP for TR/RTTs to support educational curriculum and commissioning by professional bodies and national/European organisations:
- Clear definition of AP level and roles specification (scope of practice)[77–80,57,81,14,82,83]
- Minimum requirements in education (master's degree - EQF7) and professional experience (years of radiotherapy practice/relevant professional journey to AP role)[84,10,21,21,85,86,53,87]
- Consistent job titles and updated AP job descriptions to ensure recognition[23,78,88–92,53]
Permanent funding through agreed business plans for service development/improvement, including the budget for AP posts[93]
Development of national clear AP pathways and establishment of opportunities for career progression at the local level to maximise retention and job satisfaction[88,91,94,95]
Focus on AP evaluation and impact:
- Annual appraisals of AP posts, including job description and job plan/objectives review by employer[14]
- Development of evaluation systems with defined outcomes (e.g., value-based care, staff satisfaction) to measure the impact of AP roles[23,93,79,89,91,18,52,96,14]
- Creation of accountability mechanisms/performance appraisal of advanced TR/RTTs to ensure legitimacy and local acceptance[14,79]
Clinical governance with strategies to reinforce AP level in radiotherapy with the collaboration of regulators, employers and professional bodies[10,91]
Workforce and organisation
Awareness raising of AP roles and the benefits among healthcare professionals and the public to enhance understanding and acceptance[77,89,91,57,14,95]
Coping mechanisms to enhance the contextual legitimacy of the advanced practitioner within the workplace to increase support from colleagues, MPT members, managers, and other staff[78,95]
Support professional role boundary flexibility and service transformation through skill-mix implementation with MPT cooperation and structural and institutional support[97,10,53,98,12,95,99]
Interprofessional collaborations in larger organisation context or promotion of networking in smaller organisation context to mitigate professional isolation[79]
Define a strategic integrated workforce planning in collaboration with stakeholders to implement AP roles in radiotherapy through governance (or organisation of contractual arrangements)[79,91,14,82,11]
Address recruitment and retention issues with targeted, co-designed interventions, such as the implementation of motivation strategies by employers[55,99,100]
Practice across all pillars
Encourage the allocation of adequate resources and support for advanced TR/RTTs to work across all four pillars
Set up a job plan with allocation of working time to non-clinical AP pillars[23,89,57,52,14]
Awareness of the value of evidence-based AP in radiotherapy among stakeholders to raise professional profile and share best practices to enhance long-term progress and sustainability[79,97,101]
Promote a culture of research and scholarship in radiotherapy departments to engage MPT staff through partnerships and collaborations with other professions, organisations, patients and the public[88,97,101–104]
Creation of opportunities to develop research and leadership skills alongside clinical skills of advanced TR/RTTs through innovative peer networks and translational research platforms[61,105,14,6,92,52]
Education and training
Harmonisation of education model and curricula for TR/RTT registered qualification[41,46]
Protected time for AP education/training to enhance role development and support AP roles[88,94]
Funding for practitioners to undertake AP education/training (including budgets, grants, fellowships) in national/international context[14,88,106]
Development of a national accreditation framework based on minimum levels of AP to set educational and practice requirements to reduce variability[53]
National and European efforts to establish credentialing systems with clear AP pathways or standardised educational routes into AP in radiotherapy to enhance clarity for stakeholders[57]
Creation/strengthening of accredited master's programmes with the assurance that the four pillars are embedded, namely research, leadership and management skills[84,107,105,102,6,82]
Advanced TR/RTT should establish a personal development plan being self-directed, reflective life-long learner to assess and address learning needs[102,103,14]
Promotion of coaching systems to provide structured and formal mentorship and supervision in practice for (trainees) advanced TR/RTTs[88,80,91,89,103,14,95,106]
Development of inter-professional education programmes and formal specialist training modules to enhance advanced TR/RTT skillset and professional mobility[108,14,109,110]
Liaison between clinic, academy, and industry to update curriculum to reflect changing radiotherapy advances[111,78,89,70,71,14,87]
Support provision of and access to specific CPD for advanced TR/RTTs and provide work-integrated learning with MPT support to improve professional confidence and capability[88,14,112,87,113]

AP-Advanced practice, CPD-Continuous professional development, EQF-European qualifications framework, MPT-Multi-professional team, TR/RTTs-Therapeutic radiographer/radiation therapists.

Conclusions

This study has identified significant issues in the practice and education of AP roles across Europe in radiotherapy. It contributes to the growing body of evidence that advanced TR/RTTs are operating across Europe as APs, and this requires standardisation of education and training, responsibility, and accountability with the assurance that the AP roles performed across the four pillars are embedded in relevant master's programmes.

The TR/RTT profession faces workforce shortages and underrepresentation in decision-making. Regulators, employers, and governments must recognise the value of TR/RTTs from newly qualified to APs. AP increases job satisfaction, retention, better patient care and improved services. Therefore, it is in the interest of every stakeholder to implement AP. Key stakeholders have recommended a standardised AP framework to support the future workforce and service redesign of radiotherapy across Europe.

Author contributions

Conceptualization & methodology: CO, BB, JGC, IB, CH, SMcF, RK, HAMcN. Data curation: CO. Thematic analysis & validation: CO, JGC, RK, HAMcN. Writing- original draft preparation: CO, RK, HAMcN. Writing-review and editing: CO, BB, JGC, IB, CH, SMcF, RK, HAMcN.

Conflict of interest statement

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.radi.2024.03.013.

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