

Radiation therapist perceptions on how artificial intelligence may affect their role and practice

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Direct participant Quotes

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| Enthusiasm | <p>(92) 'Excited about the scope of AI and how this can potentially improve practice and patient outcomes'</p> <p>(80) 'Overall I am optimistic about the use of AI, and I think generally it will be beneficial in radiotherapy in terms of safety, quality, and efficiency.'</p> <p>(78) 'In the medium term I see that AI will be used to either automate low value tasks or improve the quality of more challenging tasks. I think that most providers have adequate motivation to re-deploy productivity gains into further clinical/operational initiatives.'</p> <p>(74) 'I'm excited about the possibility of AI increasing base-line quality, and (74) freeing up more time for clinicians to focus on patient care'</p> <p>(64) 'I think this is the future-it will enable a smaller target volume to be treated, increasing the dose, decreasing fractionation. must be a positive thing'</p> <p>(55) 'I think it will make our work life (eventually) faster, more accurate with an extra layer of quality assurance and quality control.'</p> <p>(53) 'I think there are many ways we can utilise our time better and leave other more manual tasks to AI processes'</p> <p>(35) 'i am keen to see AI used for quality control/improvement and quality checking, and think it has massive scope in planning in QA'</p> <p>(20) 'Radiotherapy provides many opportunities for the application of AI due to the amount of data we routinely collect and the numerous decisions and processes we undertake. There are many areas we can introduce automation to remove repetitive tasks, and machine learning for aiding decision making.'</p> <p>(85) The world of RT is constantly changing and evolving but people who choose RT as a career do it for their passion to help cancer patients, that won't change.</p> <p>(82) Radiation therapy is becoming increasingly complex. Without AI we will not be able to continue to improve the service we deliver without becoming increasingly unproductive</p> |
| Apprehension | <p>(104) 'There are pros and cons. Process must be overlooked and there must be a backup plan should the system fail. '</p> <p>(79) 'I think it introduces the risk of systemic errors instead of one off errors. You tend to lose the benefits from randomisation.</p> |

(54) 'Has the ability to improve efficiency and quality of clinical practice. However, cannot become complacent and rely solely on AI.'

(52) 'AI promises great improvements but it need to be more than smartly packed templating'

(51) I am optimistic. An important factor though will be to keep the overall goal of AI as one that will improve patient outcomes, rather than using AI purely for achieving efficiencies to increase profits of providers. So this is where the ethics of AI really need to be thought through carefully.'

(47) 'There are definite advantages and disadvantages to the use of AI. I think there needs to be comprehensive research into its appropriate and safe use, appropriate methods established of being able to independently check the results achieved and increased professional understanding of its use.'

(44) 'I think it has to be rolled out in a logical progression. You need to get buy in from RTs but also ROs. In my experience ROMPs tend to be more keen.'

(26) 'AI has the ability to speed up the planning and online image matching processes, however decision making should not be left to the technology, and RT involvement should still occur to either approve or edit the AI's work, as the work is not always perfect.'

(24) 'So far, the automated technology I have used has been time-efficient, even if it tends to fail often. I think with improvement to the pre-existing automated technology plus the use of new AI technology the radiotherapy workplace may become more efficient.'

(22) 'Has wonderful benefits but i am wary of private companies squeezing the workforce and expectations of productivity'

(21) 'Working in private practice especially with typically smaller teams and big financially expectations with turn around time and quality, I see this helping but want education and training high in progressing it

(17) 'The potential is great however it really is dependant on its implementation, scope of use and how trustworthy the results will be, the old adage of 'shit in, shit out' comes to mind.'

(16) 'Excited for the prospect of improving outcomes and treatment for patients. However only if this comes with a neutral or positive impact on safety.'

(4) 'Without a more in-depth knowledge of the roles AI can genuinely play in the patient pathway, and how it can enhance our decision making and productivity, I do not really have any 'feelings' as such. I would hate to think that we lose the art of creative planning (despite it somewhat leaving us with modulated techniques). Obviously patient outcomes are the major

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| | <p>drive behind any technological advancement so with that in mind, I am somewhat optimistic as to what can be achieved. There is also a small amount of apprehension around the loss of professional autonomy, however this also may stem from a lack of understanding of the roles for AI in RT.'</p> <p>(97) It may be beneficial but could change it completely. Hard to be sure</p> <p>(87) If the organisation adapts to AI and embraces the efficiency to allow for other tasks to be completed by RTs ie patient communication rather than reducing the number of staff</p> <p>(64) anything that improves patients outcomes is a winner for staff, however it is a massive change from what we are currently doing so staff need to feel supported to learn about it at their own pace and at a time where other major department changes aren't happening (eg new planning system, new machines going in)</p> <p>(57) This will depend on how /what is implemented and which areas & people are impacted. If I don't have to spend hours manually contouring OARs then my job satisfaction might go up, but if I am made redundant or the AI does all the planning then my job satisfaction would go down. It very much depends on what areas are being talked about</p> <p>(54) Potential to make the job easier - whether that is positive or negative.</p> <p>(47) I think the result will be varied across the profession. Some people will experience increased job satisfaction and others will feel that their job satisfaction has been reduced.</p> |
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What aspects of AI are participants interested in learning more about.

| Building AI tools | Regulators / ethics / safety | Application of AI | Others experience of AI | Impact of AI |
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| <p>(83) 'It is important for the community and authorities to understand how do I validate my ML model, how can I build a good model and what are the limitations of a model'</p> <p>(24) 'The limitations of AI; what it could one day achieve,</p> | <p>(4) 'An appreciation of the health ethical implications would also be interesting'</p> <p>(55) 'Ethics of allowing computer based technology to adapt decision making techniques'</p> <p>(44) 'I'm also mindful there may be ethical and</p> | <p>(4) 'I like to be hands on with my learning so the application of AI is more interesting'</p> <p>(64) 'It's clinical application'</p> <p>(35) 'How AI can help quality control, planning and QA for Radiation Therapy'</p> | <p>(59) 'I want to know past learning, what other centres are doing, overreliance, how it impacts our clinical skills, ability to quality assure work, past mistakes and incidences'</p> <p>(24) 'Its role in radiation therapy and medicine in general'</p> | <p>(57) 'I believe AI is going to have a major impact on my profession & also more broadly in society, so would like to learn more for a variety of reasons. What those impacts are going to be, how they are going to be implemented & what it means for</p> |

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| <p>and what it would never achieve'</p> | <p>safety considerations;</p> <p>(24) 'Quality Assurance; how often will AI fail with their tasks, and what consequences will it have on patient safety'</p> <p>(83) 'How can the authorities make it easier to use ML in radiotherapy'</p> <p>(64) 'I am concerned that if these systems are so clever, that we RTs will lose the ability to know exactly how it gets to the treatment plan and therefore be open to errors that might not be obvious and might have been otherwise avoidable'</p> | <p>(53) 'I think there are many untapped potential uses for AI in the workplace'</p> <p>(44) 'I would like to see how AI can work to enhance RT roles and not replace them'</p> <p>(74) 'Real-world applications of AI for radiotherapy'</p> <p>(76) 'How the radiation treatment of the future will look'</p> | <p>(30) 'Limited knowledge at present, so anything would be great'</p> | <p>me and society in general '</p> <p>(55) 'How this will affect the job I do, how this will affect the level of care for patients'</p> <p>(70) 'Improve patient outcomes ultimately'</p> <p>(3) 'How we can improve efficiency utilising AI'</p> |
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AI Training

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| <p>Training inhibits</p> | <p>(101) 'Generally a lack of time and resources inhibits training'</p> |
| <p>Successful training</p> | <p>(92) 'New technology or processes are always accompanied by appropriate training and competency packages'</p> <p>(74) 'Staff training to use Varian's 'RapidPlan' knowledge-based planning optimiser'</p> <p>(57) 'See previous answer. Assuming we implement an AI driven process we would undertake sufficient training'</p> |

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| | <p>(51) 'As an academic this question is not entirely applicable to me, but I would say in the future, academic institutions will have to ensure that future practitioners are equipped with sufficient knowledge and training to understand AI technologies and their application to clinical practice.'</p> <p>(24) 'I'm aware of limitations, and I have been trained to know when to manually intervene when the technology is unable to do what it is designed to do eg. image fusion.'</p> <p>(20) 'The limitations of the automation used have been described and made aware to users so they can use them safely and understand when manual input or checking is required. More detailed training will be required as the level and complexity of AI technology is introduced.'</p> <p>(101) 'AI is an inevitable progression but it is so important that the staff get the right training and understanding of what it can do for us otherwise it is daunting'</p> <p>(64) anything that improves patients outcomes is a winner for staff, however it is a massive change from what we are currently doing so staff need to feel supported to learn about it at their own pace and at a time where other major department changes aren't happening (eg new planning system, new machines going in)</p> <p>69 AI is coming fast with a lot of vendors currently in regulatory approval stages with solutions. It will benefit patients but will mean a change in the way RT's view and use automation. A lot of training is required for RT's to embrace automation and AI and a certain level of trust in systems is required which will take time.</p> |
| Insufficient training | <p>(95) 'Training is provided but does that make you competent or confident? Experience makes you competent & confident'</p> <p>(80) 'Although I have not received specific training in AI processes, I have used automation (mostly in the context of planning and contouring) extensively to produce good quality plans. However, if the automated plan produces unexpected results, I would not have the knowledge to "effectively" troubleshoot the situation - as I do not know the underpinnings of how it works as opposed to manual planning'</p> <p>(55) 'We are given new tech told to use it and that's about all the help we get, I think if we had better training we could probably use the technology better'</p> <p>(54) 'Protocols and training on how to utilise the automated processes has resulted in their safe and efficient implementation. However, when new processes are implemented that differ from the standard, potential for errors to occur is introduced.'</p> <p>(50) 'We get taught how to use the technology basics and it takes a long period of trial and error to get that to work with our department procedures and protocols. The training is not really about safety beyond avoiding errors which isn't the same thing.'</p> |

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| | <p>(26) 'My experience has varied between departments, depending on how they utilise AI. Some have rapidplan modelling, which rationale and process has been explained. Some departments utilise AI more for online image matching using auto match functions as standard process, but further use of AI has had limited explanation.'</p> <p>(11) 'No training clinically, only personal studies'</p> <p>(21) 'Working in private practice especially with typically smaller teams and big financially expectations with turn around time and quality, I see this helping but want education and training high in progressing it</p> <p>20 I think there is a large misunderstanding of the term AI, particularly amongst RTs. A lot of the time AI is seen as synonymous with automation or scripting, which isn't true. As a result there may be some confusion around the expectations of technology that includes "AI". I think education about what AI technology can do, safe use of it, and the ongoing maintenance of the algorithms underpinning AI that is required would be helpful to our profession as it becomes available.</p> |
| Undergraduate training | <p>11 Will need to incorporate AI at the RT training stage.</p> <p>4 Only in the sense that it will need to be understood by the students, so an awareness must be had by myself and academic colleagues. When/If I return to clinical work, it will definitely impact me.</p> |

Positive Impact of AI on RT Profession

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| Expanding skills | <p>(69) 'It is early in the adoption of AI. Commercial solutions are becoming stronger very quickly and will soon replace large parts of contouring practice at a low cost. This will allow our RT's to begin learning new skills with the time savings from AI, especially skills in Adaptive RT like deformable Image Registration and dose accumulations.'</p> <p>(51) Yes, AI may change the traditional 'planning room' - but I don't see it ever replacing the role of a 'planner'. The planning RT may just be rostered on a linac instead of in the planning room, and be tasked with creating on-demand daily plans for patients before treatment delivery.</p> <p>(42) 'Optimistic in that it will allow RTs to focus on other aspects of the profession or in fact advance the profession.'</p> <p>(15) 'I'm hopeful further implementation will help reduce some of the more mundane tasks to free up time for those decisions requiring more critical thinking, and to provide opportunities to improve techniques etc with more time available.'</p> |
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| | <p>(61) AI implementation will lead to changes in tasks RT's undertake but allows for new areas of learning and new problem solving to be completed.</p> <p>(37) I think that we will grow with technology as we already have within this field. Clinical judgement is also something that I believe we will have more time to utilise as AI becomes more prominent in this field.</p> <p>(35) I am a QA/ QI / patient care focused RT. I think AI will increase these areas of RT</p> <p>(69) It will become important to manage expectations around the impact of AI on RT Roles. There is a view that AI will replace large sections of the profession but I believe it is more a complimentary service and RT's will need to up-skill around technology and embrace it. I believe RT will become more complex as AI and automation increase resulting in an increase in required capability and training.</p> <p>(67) As with all advances in RT, this will reduce some of the tasks an RT has to do, and require more knowledge in other areas. Similar to the advent of IMRT/VMAT planning.</p> <p>(59) My role will have to focus on implementing technological advancements.</p> <p>(57) I think it is likely and will enhance my role by taking away some tasks to allow me to focus on others</p> <p>(53) I think the role will become more diverse and exciting</p> <p>(51) In my current role as an academic and researcher it may assist in various ways, for example reviewing student plans (?) It will certainly necessitate up-skilling if we are to create curriculum that reflects AI clinical practices.</p> <p>(16) Role may become more automated. Profession might become more specialised dealing manually with harder cases</p> <p>(87) Exciting topic - will be the future of RT</p> |
| <p>Increased job satisfaction</p> | <p>(74) More time to focus on patient care should remind clinicians of the ultimate benefits of this profession, thus increasing job satisfaction</p> <p>(53) Again this is very departmentally specific, but I think overall if the time saved could be reassigned to either more patient facing or research task then job satisfaction could increase</p> <p>(51) If used correctly, it may increase job satisfaction. Realistic staff expectations and good management will be needed if any substantial changes to clinical processes and protocols are made.</p> |

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| | <p>(92) More technology and AI means change in skill set and learning. Positive change. Better job satisfaction</p> |
| Increased time with patients | <p>(67) spend more time with patients to improve care, and more time for further CPD.'</p> <p>(66) making more time for human aspects of radiotherapy and patient care.'</p> <p>(37) 'I feel that AI will be able to increase efficiency of radiation therapy and (37) allow radiation therapists more time to focus on patient care.'</p> <p>(81) This depends on what you find most satisfying but If ai reduces the time to do menial tasks this could allow more time to practice patient care which will not be replaced by ai. (81) Also decreasing the number of treatment deviations/incidents is satisfying</p> <p>(67) Reducing time doing repetitive tasks such as contouring and more time with patients will be good more morale.</p> <p>(66) AI has the potential to improve consistency, quality and efficiency of some tasks, while decreasing human error, and making more time for human aspects of radiotherapy and patient care.</p> |
| Reduced repetition | <p>(20) 'Radiotherapy provides many opportunities for the application of AI due to the amount of data we routinely collect and the numerous decisions and processes we undertake. ".'</p> <p>(104) AI could replace the mundane activities RTs encounter, but the purpose of the job is not removed.</p> <p>(78) I see the automation of low value tasks improving satisfaction and hopefully creating the capacity to fixing the next problem in RT.</p> <p>(67) Reducing time doing repetitive tasks such as contouring and more time with patients will be good more morale.</p> <p>(46) Can help speed up some tedious tasks eg contouring and help provide potentially better quality plans etc</p> <p>(105) I believe it will decrease repetitive tasks allowing more time spent on training and advancing practice</p> <p>(104) I don't believe what I do can be replaced by the robot, the only area that could improve is in CT contouring and I wish it can do a better job of it so I won't have to spend so much time editing.</p> <p>(103) Workflow is becoming more automated in the CT loading role with the use of MIM .</p> |
| Streamline Workflow | <p>(67) 'I think it is important to embrace the technology to assist the quality and speed of our work so that as therapists we can deliver quality treatment quicker (reduced planning time)</p> <p>(89) It will make the work easier, particularly for less capable staff</p> |

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| | <p>(59) I think at first it increases job satisfaction because when you plan a complex prostate in less than an hour which would have taken you a week you feel really good. But then the role just becomes - importing and quality assurance/checklists and it can become really boring. Lack of challenge and perseverance.</p> |
| Opportunity for research | 42 It will increase the opportunity for research. |

Negative Impact of AI on RT Profession

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| Losing Skills | <p>(21) 'I believe I have, but I think reliance on automation means our newer grads don't appreciate what good quality can look like to properly analyse their plans, mostly see this in planning'</p> <p>(97) 'Concerned that treatment planning will become obsolete'</p> <p>(95) 'AI automates procedures, compromising quality and lateral thinking when the AI doesn't work. Decrease jobs in future?'</p> <p>(80) My concern around automation is the loss of technical skills due the the over-reliance of AI processes, and therefore lack of understanding to then troubleshoot - especially for new or inexperienced staff where automation is the standard. I also wonder if this means that "better" processes won't then be found, since staff would not be free to experiment and find other ways that may work too.'</p> <p>(79) I think it also trains RTs to think less about what they are doing and to lose some confidence in their professional abilities. Ie they are more likely to accept what the computer gives them rather than critically assess and have confidence in their assessment.'</p> <p>(59) 'I see the new graduates who are expected to autoplan prostate/rectum/gynae/breast plans with no skill to actually manually plan or work out what isnt right. They can't critique their own work (unless there is a traffic light) and it manual intervention is required it often takes longer. It scares me to think that these skills which are required where autopanning is not yet well established or doesnt work (complex, multiple ptv or retreatments) will be lost as the more experienced staff leave the profession.'</p> <p>(50) 'I don't mind the technology itself but I am a little worried that I will continue to loose my edge as one of our department's specialists. Many RTs including our Chief are only interested in pushing buttons in the right order to produce a result without actually looking at the individual outcome. It feels like technology could take us back to where we were in the 1980s when RTs knew how but not why.'</p> |
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(38) 'I feel like the less work we do ourselves, the less clinical skills we are going to maintain, the less problem solving skills we can work on. There are also big problems when technology fails us, and then we won't know how to deal with that.

(25) 'I worry that people will not try to improve on an AI produced plan and so patients may not get the best possible plan and that AI will replace RT positions as well'

(79) I feel like we are becoming computer operators and losing our sense of professional judgement. I already find work less satisfying than 20 years ago

(61) However, it can also reduce some of the roles we enjoy as RT's including problem solving of planning etc. so will depend on the individual.

(44) Not sure, I hope it won't result in RTs being 'button' pushers and not needing to exercise their clinical reasoning muscles.

(32) Can already see this occurring as staff rely on automated processes and do not focus on the basic fundamentals when learning. This reduces their problem solving ability when automated processes do not work as expected, resulting in low morale from the discovery of gaps in knowledge.

(25) Less control over outcome and less learning about how you can impact dose distribution

(6) AI will reduce the 'brain function' of our role.

(1) RT staff may feel their skills being down graded or losing skills.

(32) I am concerned that skills will be lost due to the reliance on automation/ai which may affect patients in the long term

(25) may also lead to a dumbing down of planning skills

(1) reliance on AI without correct training and checking procedures in place

(50) I think my expertise and knowledge will become redundant and I will be rostered back to linac treatment

(25) fewer staff in planning and less rotations in area

(23) Worry that we may need less clinical RT's - dont think treatment jobs will become obsolete but may need less planners. Hard to say but always in the back of my mind when thinking about AI.

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| | <p>(86) " Use if AI has caused systematic errors and RTs are losing skills so less and less likely to be able to pick those errors up."</p> |
| Repetitive | <p>(71) 'I do worry that the job will be too automated in the sense that I feel I wont be making much of my own personal impact. I do also worry the job will get repetitive and boring as everything is essentially done for you.'</p> <p>(59) I think at first it increases job satisfaction because when you plan a complex prostate in less than an hour which would have taken you a week you feel really good. But then the role just becomes - importing and quality assurance/checklists and it can become really boring. Lack of challenge and perseverance.</p> <p>(30) While it reduces some tedious tasks, it seems to be more 'button pushing' and less input is required from staff.</p> |
| Decreased job satisfaction | <p>(38) The less work we do ourselves may lead to lack of job. satisfaction</p> <p>(80) On the other hand, based on my personal opinion, automation takes away the satisfaction of completing a task or plan.</p> <p>(79) I feel like we are becoming computer operators and losing our sense of professional judgement. I already find work less satisfying than 20 years ago</p> <p>(63) I worry that AI will reduce brain satisfaction from solving problems and finding the best outcome</p> <p>(48) May make experienced staff feel their knowledge is not as valuable anymore</p> <p>Reference 6 - 0.87% Coverage</p> <p>(38) The less work we actually do ourselves, the lower our job satisfaction. We won't feel like we are putting in any effort, and not contributing to the workplace/patient care. And considering how little technological skills I have personally, if there became an operating issue with the AI technology I wouldn't feel competent enough to figure out how to fix it, which would lead to increased workplace stress.</p> <p>Reference 7 - 0.23% Coverage</p> <p>(24) Planners may feel less satisfied if AI takes over many of the challenging/interesting parts of dosimetry.</p> <p>Reference 8 - 0.28% Coverage</p> <p>(12) In terms of dosimetry/planning it would mean less actual 'planning' if it is automated, which would reduce job satisfaction.</p> |

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| | <p>Reference 9 - 0.30% Coverage</p> <p>(3) Although efficiency and quality has improved, perhaps RTs will become 'bored' or unsatisfied with their engagement and involvement in tasks</p> |
| Less jobs | <p>(95) 'AI automates procedures, compromising quality and lateral thinking when the AI doesn't work. Decrease jobs in future?'</p> <p>(25) 'I worry that people will not try to improve on an AI produced plan and so patients may not get the best possible plan and that AI will replace RT positions as well'</p> <p>48 less intervention by RT, means less may be needed if everything is automated</p> <p>12 may reduce number of planning/ct loading staff required</p> <p>94 Job security is a main concern.</p> <p>48 i feel experienced staff are apprehensive about their job security given the automation could be achieved by less experienced staff now</p> |

Neutral Impact of AI on RT Profession

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| <p>(55) "I think it will improve some aspects and decrease some aspects of the job satisfaction, therefore I believe in total it won't affect the equilibrium, but it might attract different types of people into RT as a career with these changes. The older more settled staff won't like AI the newer more adaptable staff will love it. "</p> <p>(39) "This question required another box. There will be times it increases and decreases with the increase in implementation of AI. Our roles will adapt in new ways as automation removes some components of our job."</p> <p>(23) "I believe it will depend on the RT. For those treatment oriented I feel as though it wont affect job satisfaction as they will still have the patient interaction and AI will only make treatment easier/faster for patients."</p> <p>(20) "Our roles as radiotherapists will change as we use more AI based technology in our work, but I don't think on average it will reduce satisfaction."</p> <p>(17) "I don't think it will affect job satisfaction. Ultimately AI will hopefully alleviate RTs from doing mundane tasks letting us focus on our patients. This patient centred care could improve job satisfaction but only if AI is utilised in this manner and not as a replacement, which I feel would be a massive decrease in how we feel about our jobs :-)."</p> <p>(12) "Personally a lot of my job satisfaction comes from dealing with patients face to face on treatment or in simulation which I don't think would change."</p> |
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(6) "I see our role becoming even more patient facing and less 'planning' based."

(4) "Difficult to tell. I would miss the art as suggested above, however as the patient comes before my own ego/artistry, I believe my satisfaction would increase. Also depends on how much control I still have. Have 'I' created the plan? Or simply watched it happen. Creating a plan for a patient is satisfying, knowing you, personally, have made a difference. I guess there is the fear of becoming button pushers in planning too."

(97) "Less human interaction, and higher workload on rts leading to shorter treatment times."

(55) "Our demographic is older so they don't like AI as much so I feel they may feel a little overwhelmed by AI. It all depends on the area of the AI, if we have AI robots as therapists I think they would be concerned, if its AI in planning and computer work, the patient won't even know there have been changes as they are unaware of all the technological changes over the recent years."

(52) "There are potential gains if it works correctly and is used at the appropriate times."

(46) "As long as it's done under human supervision, can help determine the best treatment eg prescription, plan etc."

(28) "I don't know."

(17) "It truly depends on how AI is utilised. Machine learning to aid in scheduling, treatment techniques and co-ordination resulting in less patient wait time would be great. Removal of human interactions would be bad."

(4) "I do not believe that AI would ever be introduced if there were potentially negative effects on the patient pathway. There is the thought that it may shorten the pathway by allowing the planning and QA process to be completed quicker, however planning and QA are quite often not the bottle-neck in the RT department from my experience (RO responses, chemo-delays, waiting lists etc)."

(82) "Expect AI to be increasingly important in planning and treatment services."

(80) "I think automation will become the standard across most facets of radiotherapy, and therefore change the environment in which we work and duties/responsibilities we partake in."

(74) "I'm hoping AI will become much more prevalent within the next decade as computer hardware/software power increases to facilitate AI integration; all clinical roles will adapt to more involvement of AI."

(73) "More of a reliance on automation & that will see less manual tasks being performed by RTs but more checking being performed."

(70) "As I only have 10 working years left the impact will be minimal I think."

(61) "As mentioned previously I believe implementation of AI will result in changes to current roles to adapt to the use of new technology."

(55) "I think it will make us more of checkers, overseers and quality compliance officers as in we get the AI to do most of the work and we just check that it is correct."

(54) "Planning to become more automated - reduces planning time - staffing needs decrease. Less need for staff to actually plan and treat - role may shift to a heavily QA based job only."

(52) "No change as I will be retired before it is available in any great context."

(46) "Have already seen change, expect to see more especially as computer speeds increase."

(44) "Not a present. Brachy doesn't seem to attract a lot of work in AI, unlike EBRT."

(38) "I don't know enough about AI, and how it would be implemented in the workplace."

(31) "Not sure if technology will improve to such a point in my lifetime to put me out of a job. It might limit me to performing just clinical work."

(30) "Yes, as is always the case, it means learning new technologies and developing new procedures. Not replacing our role but changing it."

(29) "Depends how the department utilise these AI tools, have worked in places where they are willing to maximise efficiency but have also worked in places where they do not want changes too quickly. I think AI will make our work more efficient but at the same time need increased QA and QC to make sure the technology is doing what it is meant to."

(24) "As a junior radiotherapist, I am not aware of what effects it may have on me."

(20) "It is likely to impact the role of RTs creating dosimetry plans, possibly reducing their involvement in plan creation and transitioning to quality assurance roles. I think it will also facilitate online adaptive treatment roles."

(17) "Hopefully in a positive way, however this would require significant changes from vendors in RT which I feel is being used to develop other needs."

(99) "We still need the human touch."

(98) "Would like some more information on it."

(89) "If done correctly and ethically AI will increase efficiency with no detriment to treatment or plan quality, but is time consuming to establish and has potential for people to cut corners therefore making it inferior to the current practices."

(81) "We need to find ways to embrace ai to improve care. This is one of many advancements in a technical field that will change the landscape. There was once a world without IMRT, planning templates, and on board imaging too. These advancement increased the number of patients we can treat, and the resources and workforce to treat them."

(62) "AI should never replace physical contact between RT and patient. Information should still mainly come from RT's. AI should be ok to implement in processes that involve the technical side of the patient pathway, and not diminish patient care and intervention."

(52) "AI is a great sales pitch but it doesn't yet stack up with what can be achieved with it."

(31) "AI will take over a lot of the work in planning rooms."

(25) "AI should be monitored carefully to ensure that quality rather than expediency is the desired outcome."

Positive/Negative Impact of AI on Patient

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| Positive | Improved patient care | <p>(85) Also taking over repetitive tasks gives the RT more time to focus on the patient and not on the technology.</p> <p>(74) freeing up more time for clinicians to focus on patient care'</p> <p>(67) spend more time with patients to improve care</p> <p>(66) making more time for human aspects of radiotherapy and patient care.'</p> <p>(37) allow radiation therapists more time to focus on patient care.'</p> <p>(81) This depends on what you find most satisfying but If ai reduces the time to do menial tasks this could allow more time to practice patient care which will not be replaced by ai.</p> <p>(74) More time to focus on patient care should remind clinicians of the ultimate benefits of this profession, thus increasing job satisfaction</p> <p>101 I would hope that AI increases the amount of time that RTs spend with patients</p> <p>96 I would hope positively</p> <p>42 Increased automation will hopefully allow RTs to spend more time positively influencing a patients journey by being more involved in their care.</p> <p>37 Manual intervention is continually required within the field of radiation therapy especially considering how the patient can emotionally and physically require support throughout the treatment journey. AI should positively influence the treatment pathway allowing more time for supportive roles.</p> <p>15 With standardised tasks potentially being completed via AI, time can be redirected to tasks specialised to improve pathways for patients on an individual level</p> <p>41 Provide the opportunity for more patient focus.. reducing process time</p> <p>43 I am very excited about the future of AI and how it can positively impact patient care.</p> |
| Negative | Decreased Interaction | <p>(104) I believe people like to be cared for; I wouldn't like to know my data was put through a machine and spit out a plan and treated by robots</p> <p>79 I find the focus is becoming more on productivity than the patient experience. I also find that the interaction between patient and RT is becoming more scripted and less genuine over time (my observation)</p> |

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| | | <p>(70) face to face interaction with patients will diminish decreasing the "care" factor</p> <p>50 we will continue to loose even more time with the patient to provide care. We are already spending most of our contact time staring at screens rather than communicating with our patients.</p> <p>47 we must be careful that it does not take away from our personal interactions with the patient as these are extremely important to delivering quality patient care.</p> <p>38 Patients will feel like the less work HCPs put into their care, the less we care about them; they are just on a 'people conveyor belt' if you will. There is a lack of humanity when it comes to working with too much AI.</p> |
| | Template treatment | <p>(56) reduce individualised plans and treatment for patients - trying to group patients into one size fits all category</p> <p>54 Plans potentially become standardised across sites and not patient specific."</p> <p>25 less personalised plans</p> |
| | Reduced quality | (99) "The quality is not the same as human intervention." |
| | Equity of service | (59) "Equity - small centres will struggle to implement these systems due to the resources of implementation. There will be centres that are far behind and need to be assisted with funding." |

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| Neutral | |
| | <p>(95) "Streamline workflows to get patient into treatment quicker but is it the best quality option?"</p> <p>(91) "Depends on how it is utilised."</p> <p>(39) "A minimum standard of manual QA will always be required to ensure the AI has interpreted each step appropriately."</p> <p>(30) "Potential to speed up the whole process eg reduce time from planning to treatment. But overall i don't think the patient will necessarily be impacted greatly. Unless it gets to the point where humans are not involved in the treatment setups!!!!"</p> <p>(24) "I think the introduction of AI will have some hiccups initially while we learn its limitations. If the AI were to have complications with our pre-existing technology, there may be delays and complications with the patient's treatment pathways."</p> <p>(7) "If used appropriately."</p> |

Positive Impact on the Service

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| <p>Improved outcomes</p> | <p>(103) "I think AI is great as it is more accurate (reducing manual errors), speeds up our work, therefore increasing productivity. This in turns has a better outcome for the patient."</p> <p>(92) "Excited about the scope of AI and how this can potentially improve practice and patient outcomes"</p> <p>(51) "The AI plan will always need a human to validate it"s clinical acceptability, just like we wouldn"t accept automatically created contours without looking through the dataset to validate they are right. Daily adaptive RT using AI would decrease the uncertainty of patient positioning and blurring of isodoses over the combined treatment course. The daily treatment plans could then be combined, providing a closer match to the actual delivered treatment than our current approach, of having one plan created on an image set from a single instance in time, representing an entire treatment course."</p> <p>(30) "AI helps to eliminate human error, increases productivity, results in overall improved service for patients."</p> <p>(92) "I welcome the expansion of AI in radiotherapy as this will enable us to provide a better service for our patients resulting in better patient outcomes."</p> <p>(82) "Radiation therapy is becoming increasingly complex. Without AI we will not be able to continue to improve the service we deliver without becoming increasingly unproductive."</p> <p>(81) "Increased treatment accuracy benefits patient outcomes. Increased time to provide patient care improves outcomes."</p> <p>(51) "As detailed earlier, AI may open up possibilities of daily adaptive RT for patients. This may make their treatment appointment slightly longer (giving RTs more chance for patient care and communication?). Overall, this in theory at least should improve patient outcomes."</p> <p>(50) "There might be tiny incremental improvements in outcomes."</p> <p>(16) "Improve treatment outcomes and better predict appropriate treatment options."</p> |
| <p>Increased efficiency</p> | <p>(96) "Anything that helps to decrease time when planning is very valuable"</p> <p>(85)"If it can increase workflow and hence increase access to radiotherapy for more patients then it is a great thing."</p> <p>(67) "I think it is important to embrace the technology to assist the quality and speed of our work so that as therapists we can deliver quality treatment quicker (reduced planning time) "</p> <p>(66) "AI has the potential to improve consistency, quality and efficiency of some tasks, while decreasing human error"</p> |

(61) "beneficial to staff/employers in terms of efficiency."

(57) "AI has the potential to automate a lot of processes & make them more consistent eg OAR contouring. It will have an impact on how we do what we do and also shift focus on what we do to improve our output"

(54) "Has the ability to improve efficiency and quality of clinical practice. However, cannot become complacent and rely solely on AI."

(46) "There are many advantages to it, especially improving efficiency and improving the average quality of plans, image matching and registration etc. Needs to be manually verified and sometimes changed for best possible outcome however"

(37) "I feel that AI will be able to increase efficiency of radiation therapy"

(34) "AI increases the efficiency and safety to a greater extent, particularly in image matching."

(33) "With many courses becoming VMAT/IMRT and less fractions, the amount of work needed for each patient is increased, so being able to produce and QA plans more quickly would allow the same amount of treatments per day with less or the same amount of staff, although the patient courses are shorter."

(31) "Increase efficiency"

(30) "AI helps to eliminate human error, increases productivity, results in overall improved service for patients."

(26) "AI has the ability to speed up the planning and online image matching processes, however decision making should not be left to the technology, and RT involvement should still occur to either approve or edit the AI's work, as the work is not always perfect."

(24) "So far, the automated technology I have used has been time-efficient, even if it tends to fail often. I think with improvement to the pre-existing automated technology plus the use of new AI technology the radiotherapy workplace may become more efficient."

(80) "I'm unsure about this. On one hand, AI can speed up processes meaning work can be completed quicker, potentially resulting in less stress/workload for the therapist."

(70) "It will increase plan output maximising patients treated but my job satisfaction comes from patient interaction which won't change"

(66) "AI has the potential to improve consistency, quality and efficiency of some tasks, while decreasing human error, and making more time for human aspects of radiotherapy and patient care."

(48) "Increases productivity ."

(33) "Increase productivity and reduce stress."

(24) "I believe I may be able to complete more of the planning workload + treat more patients with the introduction of AI."

(3) "Although efficiency and quality has improved, perhaps RTs will become "bored" or unsatisfied with their engagement and involvement in tasks."

(87) "Will reduce wait times if a plan and QA is more rapid - which is a huge win for patient satisfaction."

(85) "Access to treatment will improve, and time from initial consult to first treatment should improve."

(80) "Generally, I think that the treatment pathway for patients will be improved, and perhaps could lead to better clinical decisions, and patient outcomes as AI could provide additional information on patient factors (e.g. radiomic research) and improve quality of RT processes."

(74) "It should accelerate/reduce the time taken for the patient to proceed to treatment delivery."

(73) "shorter treatment times."

(72) "I see that AI will streamline and quicken the processes to get a patient on the bed for treatment which is a benefit."

(71) It will increase the amount of patients seen within a much shorter time. This will help reduce wait times and speed up the pathway to accessing care.

(70) "It will become more efficient."

(68) "The use of AI should expedite the patient's journey and provide increased quality."

(67) "The time from CT simulation to treatment could be greatly improved."

(67) "contouring tasks could go from several hours down to several seconds."

(63) "quicker turn around."

(61) "It should allow for decreased time interval between CT simulation and treatment as it increases the efficiency of the planning stage provided the departments are able to maintain this, which would be a benefit for patients."

(59) "Patients may get treatment faster."

(57) "It should help improve efficiency and throughput."

(56) "I feel productivity and efficiency will increase."

(54) "Quicker planning - potentially faster turnaround."

(53) "I think there could be less errors and patient pathway could be more streamlined (ie quicker time to treatment)."

(47) "Increased productivity will positively affect the patient's journey."

(44) "I think it will improve efficiencies and consistency in planning."

(39) "It should increase the efficiencies in the patients pathway."

(35) "I think AI will make areas that are inefficient in patient treatment pathway make positive impact/ EG if a CT scan is done end of day AI can import, etc overnight and then be checked by a RT in the morning, vs waiting for the morning to begin import etc, there fore speeds up option to contour etc, and AI OAR contouring speeds up time etc."

(33) "Speed up time from Sim to treatment."

(32) Treatment pathway will become more efficient."

(26) "In cases where AI can be applied to the patients treatment or planning, the process can be sped up. An online CBCT match is much faster when the computer has done the majority of the match for you, and it only needs tweaking, in comparison to manually matching. This reduces the time the patient spends on the bed, and makes the process more comfortable for the patient, and allows more patients to be treated with greater accuracy."

(25) "may make things more efficient and provide some uniformity."

(23) "I see it helping with treatment times and efficiency which in turn may help with patient satisfaction and not needing to be at their appointment longer than necessary."

(20) "It will create efficiencies in our workflows and improve our confidence in complex decision making."

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| | <p>(12) "Potentially faster time from sim to treat."</p> <p>(11) "Patients should be able to receive treatment more quicker due to AI assistance at diagnostic / prescription stage. Hence the ability to deliver dose to increasingly conformal treatment volumes will improve TCP and NTCP."</p> <p>(6) "Time taken from Diagnosis to active treatment will be reduced."</p> <p>(96) "It will allow RTs more time to focus on more important tasks, so that's a win!"</p> <p>(77) "Less staff will be required for planning and other paperwork/computer related tasks."</p> <p>(93) "Very excited about role of AI in RT in the future. With its proven accuracy in other fields it's very promising and making things a lot more efficient and productive."</p> |
| Improved accuracy | <p>(103) "I think AI is great as it is more accurate (reducing manual errors), speeds up our work, therefore increasing productivity. This in turns has a better outcome for the patient."</p> <p>(66) "AI has the potential to improve consistency, quality and efficiency of some tasks, while decreasing human error."</p> <p>(61) "From my personal knowledge of AI I believe if AI is implemented with appropriate research and safe implementation it can be beneficial to patients in terms of treatment precision."</p> <p>(51) "In my view, using AI especially in treatment planning, has the potential to unlock the possibility of daily adaptive RT. At the moment daily adaptive RT is held back by the time required for a re-plan. But for best patient outcomes, each treatment fraction should have it's own plan based on the patient anatomy of that day. Our current approach makes too many assumptions and estimations. The main one being that patient's anatomy at CT Sim remains "fixed" for the duration of a 5-6 week treatment course. I see AI helping to make daily adaptive RT completely routine."</p> <p>(51) "The AI plan will always need a human to validate it's clinical acceptability, just like we wouldn't accept automatically created contours without looking through the dataset to validate they are right. Daily adaptive RT using AI would decrease the uncertainty of patient positioning and blurring of isodoses over the combined treatment course. The daily treatment plans could then be combined, providing a closer match to the actual delivered treatment than our current approach, of having one plan created on an image set from a single instance in time, representing an entire treatment course."</p> <p>(30) "AI helps to eliminate human error, increases productivity, results in overall improved service for patients."</p> |

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| | <p>(82) "Radiation therapy is becoming increasingly complex. Without AI we will not be able to continue to improve the service we deliver without becoming increasingly unproductive."</p> <p>(81) "Also decreasing the number of treatment deviations/incidents is satisfying ."</p> <p>(92) "Increased productivity and accuracy means reduced time to treat and reduced treatment times."</p> <p>(82) "Increased personalisation of treatment plans possible."</p> <p>(51) "As detailed earlier, AI may open up possibilities of daily adaptive RT for patients. This may make their treatment appointment slightly longer (giving RTs more chance for patient care and communication?). Overall, this in theory at least should improve patient outcomes."</p> <p>(21) "It should mean we can deliver the best care to our patients easier."</p> |
| Increased Quality | <p>(74) "I'm excited about the possibility of AI increasing base-line quality."</p> <p>(67) "I think it is important to embrace the technology to assist the quality and speed of our work so that as therapists we can deliver quality treatment quicker (reduced planning time)."</p> <p>(66) "AI has the potential to improve consistency, quality and efficiency of some tasks, while decreasing human error."</p> <p>(46) "There are many advantages to it, especially improving efficiency and improving the average quality of plans, image matching and registration etc. Needs to be manually verified and sometimes changed for best possible outcome however"</p> <p>(82) "Increased personalisation of treatment plans possible."</p> <p>(78) "There is already significant evidence that applications like knowledge based planning improves plan quality."</p> <p>(69) "I think AI will provide more surety. AI is similar to a peer review where professionals can review so having another impartial system performing tasks can be a benefit."</p> <p>(68) "The use of AI should expedite the patients journey and provide increased quality."</p> <p>(66) "AI has the potential to improve consistency, quality and efficiency of some tasks, while decreasing human error."</p> <p>(63) "more homogenous plans."</p> <p>(61) "Additionally, also should allow for increased accuracy/precision/conformity of treatment improving treatment outcomes and reducing side effects."</p> |

(51) "As detailed earlier, AI may open up possibilities of daily adaptive RT for patients. This may make their treatment appointment slightly longer (giving RTs more chance for patient care and communication?). Overall, this in theory at least should improve patient outcomes."

(31) "Humans create more error and quality of plans vary depending on individuals. If treatment plans are fully AI generated, it takes that human variability out."

(22) "Will likely lead to quicker higher quality plans and treatment."

(21) "It should mean we can deliver the best care to our patients easier."

(66) "AI has the potential to improve consistency, quality and efficiency of some tasks, while decreasing human error, and making more time for human aspects of radiotherapy and patient care."

(26) "AI will not replace the use of radiation therapists, but rather supplement their work to improve quality of care delivered."

(22) "Will automate tasks we do and provide higher accuracy."

(15) "Standardising routine tasks and providing consistency in plan development and treatment delivery."