Identifying core components of a radiotherapy comfort intervention package using nominal group technique

Simon Goldsworthy MSc[1,2], Jos M. Latour PhD, RN[3,4], Shea Palmer PhD[5], Helen McNair PhD[6], Mary Cramp PhD[2]

1. Beacon radiotherapy, Musgrove Park Hospital, Somerset NHS Foundation Trust, Taunton, United Kingdom.
2. Faculty of Health and Applied Sciences, University of the West of England, Bristol, United Kingdom.
3. Faculty of Health, University of Plymouth, Plymouth, United Kingdom.
4. School of Nursing, Midwifery and Paramedicine, Faculty of Health Sciences, Curtin University, Perth, Australia.
5. School of Healthcare Sciences, Cardiff University, Cardiff, United Kingdom
6. Royal Marsden NHS Foundation Trust and Institute of Cancer Research, Sutton, United Kingdom.

Correspondence: simon.goldsworthy@somersetft.nhs.uk

Conflict of interest: None to declare

Funding: College of Radiographers Doctoral Fellowship (Reference number 008) & Macmillan Cancer Support (Reference number 008)

Key words: Comfort solutions, NGT, interventions, consensus, radiotherapy,

Manuscript data:

Abstract: 280 words (280 max)
Body of text: 3225 words (4,000 max)
Number of tables: 2, Number of figures: 1
Number of references: 35
Electronic supplement: 4

ABSTRACT

Introduction

A comfortable treatment position in radiotherapy may promote patient stability and improve outcomes such as accuracy. The aim of this study was to identify, prioritise and determine the feasibility of delivery of intervention components as part of a radiotherapy comfort intervention package.

Methods

Prior research, consisting of a systematic review and qualitative interviews with patient and therapeutic radiographers, was triangulated and 15 intervention components developed. An online nominal group technique consensus meeting with 7 patients who received radiotherapy exceeding 10 minutes for one of three anatomical cancer sites and 3 therapeutic radiographers (TRs) participated. Four activities were undertaken: 1) discussion of comfort intervention components; 2) initial vote; 3) prioritisation of intervention components; and 4) discussion of feasibility in radiotherapy and were analysed using established quantitative and qualitative methods.

Results

One intervention component was added from initial discussions to the 15 pre-determined components being discussed. 11 components were recommended as ‘accepted’ (n=5) or ‘accepted with caution’ (n=6) to proceed to development. The highest scoring intervention components were ‘Compassionate & empathetic communication training for TRs’ and ‘Tailored information, e.g., TRs provide the required information only as part of preparation for treatment’. Anther that followed closely was ‘Adjustments & supports provided for arms or legs during treatment by TRs’. Those ‘accepted with caution’ included ‘Soft pads/mattress under the body to alleviate body discomfort managed by TRs’. Qualitative analysis highlighted concerns over the radiation environment and emphasised the importance of resources such as equipment, training, and time.

Conclusion

The recommended comfort interventions have potential to improve patient comfort during radiotherapy and should be considered to incorporate into positioning and immobilisation guidelines. However, specific intervention strategies to address these components will need to be developed and robustly evaluated.

Implications for practice

Comfort interventions might help patients relax and stay still during treatment, which could improve treatment accuracy and efficacy. Introducing these comfort interventions in practice have potential to lead to a more positive patient experience and improved overall quality of care during radiotherapy.

INTRODUCTION

Patient comfort is increasingly considered a fundamental need to address stress, anxiety, pain and discomfort in healthcare (1). Patient comfort is multidimensional, and recognised to have physical, psychospiritual, sociocultural and environment aspects (2). In radiotherapy, patient comfort can be affected by the need to adopt rigid and uncomfortable positions to achieve accurate and safe treatment (3–5). Cancer treatment also affects psychological and social well-being (6). Yet, there has been limited attention on improving comfort during radiotherapy and evaluating its impact on clinical outcomes (7,8)

Five studies have explored patient comfort during radiotherapy (9–13), three of which were qualitative and gave useful insights into psychological interventions for paediatric patients (9–11). Improvements such as giving concrete and repeated age adjusted information, distractions (e.g. listening to a parent via earphones, video or augmented realities), well thought out procedures, routines, compassionate care, and a friendly environment were suggested (9–11). The remaining studies investigated interventions to improve comfort in adult patients undergoing radiotherapy and reported similar suggestions including distractions and compassionate care such as dignity (12,13).

To inform the development of comfort interventions for adults undergoing radiotherapy, a programme of work was undertaken that included a systematic literature review (SLR) and qualitative investigation of comfort experiences and suggested solutions (14–16). The SLR identified comfort interventions reported for clinical procedures that involved sustained inactivity and stability over time, similar to radiotherapy (14). Interventions were grouped into four categories including psychological, physical, audio-visual and other (aromatherapy and education/information). Medium to large effect sizes were reported in many intervention categories. Subsequently, 25 adult patients who had received radiotherapy to cancers in the head and neck, thorax and pelvic regions and 25 therapeutic radiographers (TRs) were interviewed. Five themes emerged; ‘modification or adjusting patient position’, ‘support patients to maintain position’, ‘self & supported coping methods’, individually tailored information’, preparational

approaches', and 'environmental modifications'(16). The interventions from both studies were prioritised as part of the current study (14–16).

Generation of comfort intervention components

The findings of the SLR of comfort interventions applicable to radiotherapy (14) were triangulated with the findings of qualitative interviews with patients and TRs of how comfort was best managed in radiotherapy (16). During triangulation (Supplementary material 1.) the data was combined for real world meaning in radiotherapy (Supplementary material 2.).

A package of comfort interventions is likely to be required to address the complex and multidimensional needs of patients receiving radiotherapy. Therefore, the present study aimed to identify, prioritise and determine the feasibility of delivery of intervention components as part of a radiotherapy comfort intervention package.

METHODS

A modified Nominal Group Technique (NGT) consensus meeting with patients and TRs was used to identify and prioritise recommendations of components for a comfort intervention package in radiotherapy (17). An online NGT consensus meeting was chosen because patients and TRs did not have to attend in person which provided safety during the COVID 19 pandemic, especially for immunocompromised patients. Also, participants have previously felt more open to speak up in an online environment (verbally or using text) (18–21). This technique has also been used successfully within a similar population group to develop interventions (22). Ethical approval was granted by Southwest - Frenchay Research Ethics Committee on October 2021 and the protocol was prospectively registered [www.clinicaltrials.gov NCT03984435]. Patients and TRs gave written informed consent, and the consensus study was conducted on the 18th of January 2022. This study is reported in accordance in accordance Consolidated criteria for Reporting Qualitative research (COREQ) checklist (23).

Recruitment

Patient and TR panel members were initially identified if they had indicated agreement on the consent form as part of involvement in previous qualitative

interviews (15,16). Further patient participants were recruited via a radiotherapy department in the Southwest of England.

Patients were included if they were deemed well via their electronic medical record, were 18 years or older, diagnosed with cancer at one of three major anatomical sites (head and neck, thoracic/breast or pelvis) and received radiotherapy with delivery time exceeding ten minutes. Therapeutic radiographer panel members were included if they were practising TRs (HCPC register check) and delivering radiotherapy techniques with times exceeding 10 minutes. No TRs from the host radiotherapy clinic or more than two TRs from the same radiotherapy clinic were recruited to ensure heterogeneity of views and practices. Patient and TRs needed to be able to use a computer and perform the required tasks to participate in the study. A training session was provided to facilitate participation.

The proposal was to recruit up to 12 panel members; up to 9 patients and 3 TRS. Recruitment was unevenly weighted towards patients to amplify the patient's voice amongst potential vocal TRs and patients. Patients were purposively recruited to include at least two patients with either cancer in the head and neck, thoracic/breast or pelvis regions.

Nominal group technique procedure

Following expression of interest, potential panel members were contacted by Chief Investigator (CI), sent the Participant Information Sheet by email and subsequently issued with a formal written confirmation letter, joining instructions, schedule for the day (supplementary material 3.). The CI ensured panel members could access Microsoft TEAMS. After 3-7 days, the CI provided a compulsory one to one training session. Potential panel members were guided through Microsoft TEAMS and asked to complete a couple of tasks required for the consensus study before giving electronic informed consent via JotForm©Inc (www.Jotform.com).

The NGT consensus meeting consisted of a facilitator and session moderators. The NGT consensus meeting convened for 4.5 hours (Supplementary material 3). The

four activities of the modified NGT consensus meeting are outlined in Figure 1. Panel members having difficulties during any of the activities were placed in break out rooms with a moderator to support them. Activities 2 and 3 were deployed real-time with JotForm©Inc questionnaires (www.Jotform.com). A summary was presented back to panel members after activities 1-3.

Activity 1 Idea generation & round robin
(Convened for 30 minutes)

In three break-out groups panel members discussed the intervention component list and were asked by the researchers if any interventions were missing and needed inclusion.

Activity 2 Clarification of important intervention components
(Convened for 30 minutes)

Panel members were asked to choose which interventions they felt were important by answering “yes” or “no” on an electronic questionnaire. After the activity, the results were shared and discussed.

Activity 3 Ranking of important intervention components
(Convened for 45 minutes)

Panel members were asked to rate intervention components on scale of 1-9, with 9 being high priority showing that it’s important to them or could be to others based on the RAND/UCLA appropriateness method (24). After the activity, the results were shared and discussed.

Activity 4 Feasibility intervention components
(Convened for 45 minutes)

Panel members had a group discussion of whether it is important and feasible to deliver the included intervention components based on the RAND/UCLA appropriate method (24). The NGT consensus meeting exceeded the scheduled time by 30 minutes, so panel members were emailed post-hoc asking them to rate whether interventions were important and feasible answering “Yes” or “No” and to provide comments. All panel members responded to the email.

The discussion about whether intervention components were important and feasible were audio recorded and transcribed verbatim. The data derived from Microsoft TEAM audio recordings and chat, field notes and comments sent by email to the facilitator and were collected for analysis.

Analysis

The purpose of the study NGT consensus meeting was to reach agreement over priorities for comfort intervention components through the application of an NGT technique. The consultation groups generated two forms of data: a ranked list of comfort intervention components and qualitative narrative of panel members' discussions about the feasibility of interventions in practice. The RAND/UCLA Appropriateness Method (24) was used to evaluate the quantitative data arising from the NGT consensus meeting. This method is used to combine scientific evidence with the collective judgement of experts (e.g. patients and TRs) to achieve a consensus opinion from the group. Patients were considered experts in their experience of comfort receiving radiotherapy and how comfort interventions may help them and others. TRs were considered experts in treating multiple patients with radiotherapy and comforting patients in their care. The analysis of activities was conducted in real-time at the online consensus meeting and downloaded using Jotform©Inc (www.Jotform.com) and Microsoft Excel.

Activity 1 Idea generation & round robin

Intervention components, including those suggested by the group were added to Activity 2 after discussion and clarification with research team.

Activity 2 Clarification of important intervention components

Intervention components with >50% votes continued to Activity 3.

Activities 3 Ranking of important intervention components

Median Likert scores were recorded for prioritisation of individual intervention components. The mean absolute deviation of the median was calculated for inter-rater agreement between panel members, and rated as low (>1.41), moderate (1.08–1.41) or high (<1.08) (24).

Activity 4 Feasibility intervention components

Intervention component feasibility scores ≥75% were judged feasible in radiotherapy, scores ≥50% were judged feasible with caution and <50% were judged not feasible in radiotherapy.

Recommendations for inclusion in a comfort intervention package

Intervention components with a median Likert priority score ≥ 6, a 'moderate' to 'high' inter-rater agreement and judged as feasible by ≥75% of participants (8) were recommended as 'Included' for development in a radiotherapy comfort intervention

package. A median priority score >6, a ‘low’ inter-rater agreement and/ or a feasibility percentage between 50% and 74% were recommended as ‘Included with caution’ indicating further investigation required. A median priority <6 with a low inter-rater agreement and a high or low feasibility score were ‘excluded’ from consideration for a comfort intervention package or further investigation.

Qualitative analysis of feasibility

Qualitative analysis of the transcripts was undertaken using NVivo software package (25). Due to the structured format of the modified NGT groups, a deductive analysis approach was taken (26,27).That is, comfort intervention components, rated as ‘Included’, and those recommended ‘Included with caution’ and ‘excluded’ were used as a predetermined framework for the thematic analysis. Key terms used by participants to describe intervention components were coded according to the intervention component they were describing. This process identified themes and contextual considerations associated with the intervention component, and also helped identify interactions or themes across multiple intervention components. These themes were used to determine the salient categories for the feasible implementation of a radiotherapy comfort intervention package. For trustworthiness and rigour, two panel members (one patient and one RT) were asked to complete a member check of the NGT consensus meeting findings.

FINDINGS

Patient characteristics

Seven patients consented to participate - five new patients and two from the previous interviews (15,16). Panel members were aged 35-72 years and five were male. Two patients had received radiotherapy for head and neck cancer, three for lung cancer and two for pelvic cancers.

TR characteristics

Three TRs consented to participate, all from the previous interviews (15,16) . All were female and in advanced practice roles (Years of experience ranged from 8-28 years) and were aged 32-51 years.

Prioritisation and feasibility of comfort intervention components

Fifteen intervention components were considered by panel members in Activity 1 (Supplementary material 2.) to suggest modifications or additions. After discussion

by the panel members and consideration by the research team, one further intervention component 'Visible or audio countdown clock of treatment length' was included for sifting at activity 2. During activity 2, sixteen intervention components were therefore considered for importance by panel members. The panel voted to exclude 'Aromatherapy provided at patient request' but voted favourably for the other fifteen intervention components. During activity 3, five intervention components were recommended as 'Include' as moderate to high priority and feasible for development in a radiotherapy comfort intervention package. Six intervention components were 'Included with caution' indicating further investigation required based on a moderate to high priority and/ or low inter-rater agreement and low feasibility percentage. Four intervention components were 'excluded' from consideration in a comfort intervention package or further investigation with low priority scores. In total, eleven intervention components were recommended for inclusion in a comfort intervention package consisting of those recommended as 'included' and 'included with caution' (Table 2.).

Based on the comfort interventions components, categories of feasible implementation emerged (Table 2.) from panel member narratives (Supplementary material 4.). These categories arose from the consideration of TR time, resources, training, practicalities and online or video approaches to utilising a toolbox approach for patients to select from. An example of an excluded intervention component was 'Human touch in person (hand holding) or having something to remind them of human contact (e.g., holding a soft item like a blanket) provided at patient request'. Panel members were divided over their views, some disappointed that human touch was excluded with a category 'Human Touch Essential' with comments like this:

"I'm just surprised that the human touch didn't make it through.." [P2]

While others could see that human touch was not practical during radiotherapy with the category 'Holding Something During treatment Not Feasible'

"For obvious reasons handholding during treatment is impossible, but if someone wanted to hold an object of comfort I don't see why not." [R2].

Although human touch is an important aspect of care, it is not possible during the delivery of radiotherapy although touch could be facilitated using remote technology (28).

An example of an intervention component that was included with caution was ‘Stretching and exercises coaching before and after positioning for radiotherapy treatment’ with the category; ‘TR Time & Training’. Panel members felt that this component had the potential to be a time burden for TRs, stating:

"Staff time is required to specifically discuss this. Training required for staff, so they are up to date with most recent research/ practice in exercise e.g., pelvic floor exercises". [R1]

Others suggested that there may be opportunities to make these interventions possible with the category; ‘Self-Direction (Video) In Stretching To Save Time’. Panel members suggested that time could be saved by using a pre-recorded video with a patient stating:

“*This could be covered fairy easily face to face and save time with vide*o” [P5].

An example of an ‘Included’ intervention component was ‘Compassionate & empathetic communication training for TR’ with the category; ‘Natural Compassion From Staff Appreciated’ with a patient saying;

“*Personal interaction ++++, You can’t beat personal interaction* “[P1].

A second category summed it all up - ‘Don’t Over Medicalise’ - with another patient saying;

“*Don't over medicalise that bit of informality, that bit of humanity….”[*P2].

‘Resource Considerations’ was an outlier and deemed applicable to all interventions and this included the following categories: ‘Do we actually need an intervention?’, ‘Financial considerations’, ‘Logistics, staffing, equipment, training & access’, ‘Online or video’, and ‘Radiation environment considerations’. The following patient quote summarises this category;

"Feasible as a very good idea and would be fantastic in a perfect world but I recognise this could be unworkable or severely restricted by departmental budgets, staffing levels, workloads and space” [P3]

DISCUSSION

The objectives of this NGT consensus meeting were to identify and prioritise intervention components for inclusion in recommendations for a radiotherapy comfort intervention package and explore feasibility. Eleven intervention components were recommended for development in a radiotherapy comfort intervention package and five components were excluded. Aromatherapy was the only intervention component 'excluded' at Activity 2. The panel considered aromas to be person dependant and that smells could linger impacting on patients who really do not want it. This is a serious concern because patients receiving cancer therapies can suffer hyperosmia causing nausea (29). At Activity 3, four more intervention components were 'excluded' because the panel members felt that TRs were not skilled to coach patients in meditation and a countdown clock being logistically difficult with fluctuating treatment delivery times. Intervention components 'accepted with caution' arose from panel members who considered there was potential for extra training, increased treatment session times, an effect on positional reproducibility, radiation attenuation, availability of devices in all departments and cost. Intervention components 'accepted' were considered feasible for practice however the panel had similar concerns to intervention components accepted with caution although highlighted some categories that enabled implementation. These included choosing intervention components and format, providing information when required and in groups (for efficiency), and assessing position.

For many intervention components, there was concern about the impact on the efficiency of radiotherapy services. This led to the emergence of the overall implementation category 'Resources', which in the real-world is highlighting for example that extra time maybe required from TRs, including training, extra facilities, extra equipment and extra time during treatment or after the treatment session. However, how an intervention component is implemented and delivered will determine the overall impact on services. For example, if a thorough process of implementation is undertaken where observation (Gemba walking – a walk through to refine the process) and refinements are made, then it is possible to create efficiencies and negate the concerns in this category (30). Furthermore, some studies have found that taking step to improve comfort during radiotherapy produces similar or improved reproducibility and reduces patient set up times (31,32).

Therefore the recommended comfort intervention components should be carefully considered in practice.

Although there is a justified concern about resources, many of the intervention components exist within the current infrastructure of many radiotherapy services. The recommended list of intervention components has the potential to improve patient outcomes through improving comfort as radiotherapy treatment times increase with more advanced techniques (33). Supporting patients to complete their radiotherapy treatment using a comfort intervention package is likely to improve stability and accuracy of radiotherapy. Previous work in this area, including a systematic literature review of effective interventions, provides the required details to develop interventions specifically for radiotherapy (14). A comfort intervention package needs to be developed for cancer patients receiving radiotherapy, which is adaptable to age and deployed at the patient's choosing.

Given the limited recommendations of how to manage patient comfort during radiotherapy from national and European guidelines (33–35), we suggest that a comfort intervention package now needs to be developed and tested for fidelity in radiotherapy.

Methodological considerations

A limitation of the present study is there was only one NGT consensus meeting round. Furthermore, even after further recruitment initiatives, the panel was small consisting of seven patients and three TRs. This may have been due to the COVID pandemic. While including patients and TRs can be highlighted as one of the strengths of this NGT consensus meeting, there is a potential that different participants may have yielded different conclusions and one vote in a small panel could exclude an intervention component which warrants further investigation. Regarding this methodological consideration, we utilised a pragmatic approach to recommending interventions using a modified NGT endorsing an 'included with caution' criteria. Even with this dispensation, this potential limitation must be acknowledged.

CONCLUSION

This study determined the important components to include in a radiotherapy comfort intervention package, based on consensus from a panel of patients and TRs. As radiotherapy evolves to improve outcomes, so interventions must be developed to ensure patients can comfortably comply with the associated increased treatment times. Eleven components have been recommended for inclusion in a radiotherapy comfort intervention package. The clinical implications of our study are to encourage radiotherapy services to consider incorporating such intervention components into their existing infrastructure. Future research is recommended to develop specific intervention strategies to address the recommended components. The resultant radiotherapy comfort intervention package can then be evaluated robustly in terms of feasibility, fidelity, and clinical and cost-effectiveness.

REFERENCES

1. Pineau C. The psychological meaning of comfort. International Review of Applied Psychology. 1982;31:271–83.
2. Kolcaba K. Comfort theory: A unifying framework to enhance the practice environment. Journal of Nursing Administration. 1994;36(19):1178–84.
3. Lateef F. Patient expectations and the paradigm shift of care in emergency medicine. J Emerg Trauma Shock [Internet]. 2011;4(2):163–7. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3132352/
4. Purdy JA. Advances in the planning and delivery of radiotherapy: new expectations, new standards of care. Front Radiat Ther Oncol. 2011;43:1–28.
5. Cui N, Qiu R, Zhang Y, Jin J. "Patient Comfort Can Be Sacrificed for Patient Safety"—Perception and Practice Reported by Critical Care Nurses Toward Physical Restraints: A Qualitative Descriptive Study. Front Med (Lausanne). 2021;8(November).
6. Mullaney T, Olausson K, Sharp L, Zackrisson B, Edvardsson D, Nyholm T. The influence of a department's psychosocial climate and treatment environment on cancer patients' anxiety during radiotherapy. European Journal of Oncology Nursing. 2016;20:113–8.
7. Bartlett FR, Colgan RM, Donovan EM, McNair HA, Carr K, Evans PM, et al. The UK HeartSpare Study (Stage IB): Randomised comparison of a voluntary breath-hold technique and prone radiotherapy after breast conserving surgery. Radiotherapy and Oncology [Internet]. 2015;114(1):66–72. Available from: http://dx.doi.org/10.1016/j.radonc.2014.11.018

8. Bayley AJ, Catton CN, Haycocks T, Kelly V, Alasti H, Bristow R, et al. A randomized trial of supine vs. prone positioning in patients undergoing escalated dose conformal radiotherapy for prostate cancer. Radiotherapy and Oncology. 2004;70(1):37–44.

9. Holt DE, Hiniker SM, Kalapurakal JA, Breneman JC, Shiao JC, Boik N, et al. Improving the Pediatric Patient Experience During Radiation Therapy-A Children's Oncology Group Study. Int J Radiat Oncol Biol Phys [Internet]. 2021;109(2):505–14. Available from: https://doi.org/10.1016/j.ijrobp.2020.09.002

10. Ångström Brännström C, Engval G, Mullaney T, Nilsson K, Wickart Johansson G, Svärd AM, et al. Children undergoing radiotherapy: Swedish parents' experiences and suggestions for improvement. PLoS One. 2015;10(10):1–15.

11. Engvall G, Lindh V, Mullaney T, Nyholm T, Lindh J, Ångström-Brännström C. Children's experiences and responses towards an intervention for psychological preparation for radiotherapy. Radiation Oncology. 2018;13(1):1–12.

12. Nixon JL, Brown B, Pigott AE, Turner J, Brown E, Bernard A, et al. A prospective examination of mask anxiety during radiotherapy for head and neck cancer and patient perceptions of management strategies. J Med Radiat Sci. 2019;66(3):184–90.

13. Probst H, Rosbottom K, Crank H, Stanton A, Reed H. The patient experience of radiotherapy for breast cancer: A qualitative investigation as part of the SuPPORT 4 All study. Radiography [Internet]. 2021;27(2):352–9. Available from: https://doi.org/10.1016/j.radi.2020.09.011

14. Goldsworthy S, Palmer S, Latour JM, McNair H, Cramp M. A systematic review of effectiveness of interventions applicable to radiotherapy that are administered to improve patient comfort, increase patient compliance, and reduce patient distress or anxiety. Radiography [Internet]. 2020;26(4):314–24. Available from: https://doi.org/10.1016/j.radi.2020.03.002

15. Goldsworthy S, Latour MJ, Palmer S, McNair H, Cramp M. Patient and therapeutic radiographer experiences of comfort during the radiotherapy pathway: a qualitative study. Radiography. 2023 Feb 23;29(S1):3–9.

16. Goldsworthy S, Latour JM, Palmer S, McNair H, Cramp M. A thematic exploration of patient and radiation therapist solutions to improve comfort during radiotherapy: a qualitative study. The Journal of Medical Imaging and Radiation Sciences. 2023;1–8.

17. Potter M, Gordon S, Hamer P. The Nominal Group Technique: A useful consensus methodology in physiotherapy research. New Zealand Journal of Physiotherapy. 2004;32(January 2004):126–30.

18. McMillan SS, King M, Tully MP. How to use the nominal group and Delphi techniques. Int J Clin Pharm. 2016;38(3):655–62.

19. McMillan SS, Kelly F, Sav A, Kendall E, King MA, Whitty JA, et al. Using the Nominal Group Technique: how to analyse across multiple groups. Health Serv Outcomes Res Methodol. 2014;14(3):92–108.

20. McMillan SS, King M, Tully MP. How to use the nominal group and Delphi techniques. Int J Clin Pharm. 2016;38(3):655–62.

21. Harvey N, Holmes CA. Nominal group technique: an effective method for obtaining group consensus. Int J Nurs Pract. 2012;18(2):188–94.

22. Somers C, Chimonas S, McIntosh E, Kaltenboeck A, Briggs A, Bach P. Using Nominal Group Technique to Identify Key Attributes of Oncology Treatments for a Discrete Choice Experiment. MDM Policy Pract. 2019;4(1):238146831983792.

23. Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): A 32-item checklist for interviews and focus groups. International Journal for Quality in Health Care. 2007;19(6):349–57.

24. Fitch K, Bernstein S, Aguilar MD, Burnard B, LaCalle JR, Lazaro P, et al. The RAND/UCLA Appropriateness Method User's Manual. Vol. 46, European Commission. European Commission; 2001. 1–123 p.

25. Woolf NH, Silver C. Qualitative analysis using NVivo : the five-level QDA method. Routledge; 2017. 1–234 p.

26. Hsieh HF, Shannon SE. Three approaches to qualitative content analysis. Qual Health Res. 2005;15(9):1277–88.

27. Assarroudi A, Heshmati Nabavi F, Armat MR, Ebadi A, Vaismoradi M. Directed qualitative content analysis: the description and elaboration of its underpinning methods and data analysis process. Journal of Research in Nursing [Internet]. 2018;23(1):42–55. Available from: https://doi.org/10.1177/1744987117741667

28. Goldsworthy S, Zheng CY, McNair H, McGregor A. The potential for haptic touch technology to supplement human empathetic touch during radiotherapy. J Med Imaging Radiat Sci. 2020;51(4).

29. Bernhardson BM, Tishelman C, Rutqvist LE. Olfactory changes among patients receiving chemotherapy. European Journal of Oncology Nursing. 2009 Feb;13(1):9–15.

30. Cheuk A, Dawson G, Restrepo J, Peters J. (P123) Reducing Time From Patient CT Simulation (CT SIM) Appointment Time to Start of Actual CT Scan: Lean Thinking in the VA System. Oncology (Williston Park). 2015 Apr 21;29(4 Suppl 1).

31. Deseyne P, Speleers B, De Neve W, Boute B, Paelinck L, Vakaet V, et al. Crawl positioning improves set-up precision and patient comfort in prone whole breast irradiation. Sci Rep. 2020 Dec 1;10(1).

32. Bartlett FR, Colgan RM, Carr K, Donovan EM, McNair HA, Locke I, et al. The UK HeartSpare Study: Randomised evaluation of voluntary deep-inspiratory breath-hold in women undergoing breast radiotherapy. Radiotherapy and Oncology [Internet]. 2013;108(2):242–7. Available from: http://dx.doi.org/10.1016/j.radonc.2013.04.021

33. The Royal College of Radiologists, Society and College of Radiographers I of P and E in Medicine. On Target 2: Updated Guidance for Image-guided Radiotherapy. Clinical Oncology. 2021.

34. Leech M, Coffey M, Mast M, Moura F, Osztavics A, Pasini D, et al. ESTRO ACROP guidelines for positioning, immobilisation and position verification of head and neck patients for radiation therapists. Tech Innov Patient Support Radiat Oncol [Internet]. 2017;1:1–7. Available from: http://dx.doi.org/10.1016/j.tipsro.2016.12.001

35. Benedict SH, Yenice KM, Followill D, Galvin JM, Hinson W, Kavanagh B, et al. Stereotactic body radiation therapy: The report of AAPM Task Group 101. Med Phys. 2010;37(8):4078–101.

Conflict of interest

All authors declare that they have no conflicts of interest.

Figure captions

Figure 1. Overview of the nominal group technique consensus meeting

Table 1. Intervention component list

Table 2. Prioritisation and feasibility of comfort intervention components

Supplementary material 1. Triangulation of systematic literature review and qualitative interviews

Supplementary material 2. Generation of comfort intervention components

Supplementary material 3. Schedule for the NGT consensus meeting

Supplementary material 4. Directed content analysis of prioritised intervention components

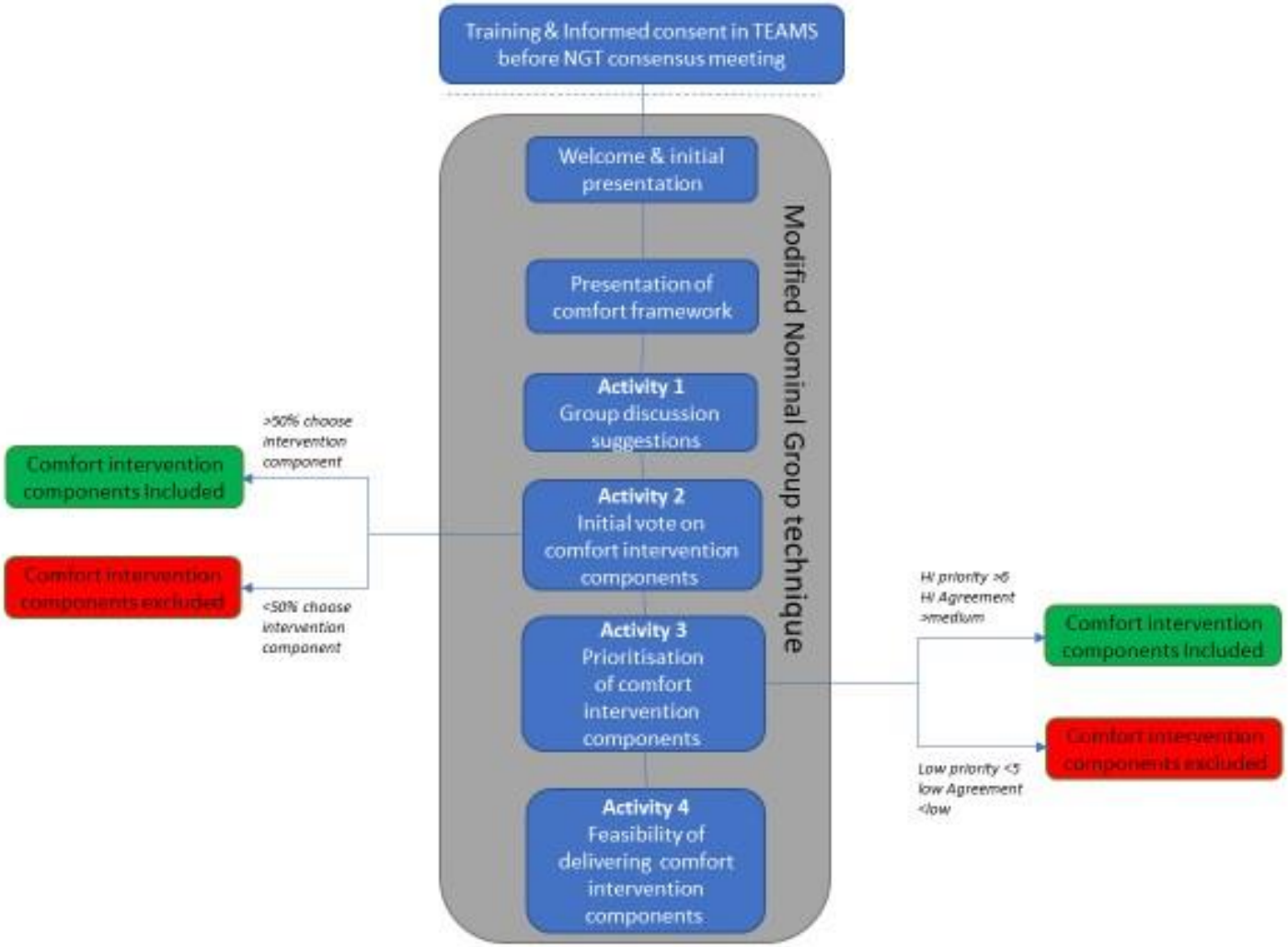


Figure 1. Overview of Nominal group technique consensus meeting

Table 1. Intervention component list

	Before consensus meeting	After consensus meeting
1	Adjustments & supports provided for arms or legs during treatment by TRs	Adjustments & supports provided for arms or legs during treatment by TRs
2	Aromatherapy provided at patient request	
3	Compassionate & empathetic communication training for TRs	Compassionate & empathetic communication training for TRs
4	Customized immobilization provided by TRs e.g., head moulds, vacuum bags, or mask modifications	Customized immobilization provided by TRs e.g., head moulds, vacuum bags, or mask modifications
5	Human touch in person (hand holding) or having something to remind them of human contact (e.g. holding a soft item like a blanket) provided at patient request	
6	Patient advice/training in meditation including talking to self, faith readings, chants, counting down or visualising going on holiday focusing on machine lights/lasers or noise	
7	Patient practice run of treatment position with RT	Patient practice run of treatment position with RT
8	Referral to talking therapies (e.g., counselling, hypnosis, or cognitive behavioural therapy) by TRs at patient request	
9	Soft pads/ mattress under the body to alleviate body discomfort managed by TRs	Soft pads/ mattress under the body to alleviate body discomfort managed by TRs
10	Sound & music interventions such as nature sounds, music audio books, relaxation, instructions, and updates during treatment delivered at patient request	Sound & music interventions such as nature sounds, music audio books, relaxation, instructions, and updates during treatment delivered at patient request

11	Stretching and exercises coaching before and after positioning for radiotherapy treatment	Stretching and exercises coaching before and after positioning for radiotherapy treatment
12	Tailored information e.g., TRs provide the required information only as part of preparation for treatment	Tailored information e.g., TRs provide the required information only as part of preparation for treatment
13	Tour of radiotherapy in person or video provided at patient request	Tour of radiotherapy in person or video provided at patient request
14	Visual interventions such pictures or projections of nature or similar on walls or screens delivered at patient request	Visual interventions such pictures or projections of nature or similar on walls or screens delivered at patient request
15	Workshop by TRs on what to expect e.g., position, mask, bladder/bowel preparation	Workshop by TRs on what to expect e.g., position, mask, bladder/bowel preparation

Table 2. Prioritisation and feasibility of comfort intervention components

Intervention Components *After Activity 1*	**Activity 2** Initial vote	**Activity 3** Prioritisation			**Activity 4** Feasibility		
	Initial filter Is intervention important ≥50% 'Yes' proceeds to activity 3	Median Likert score	Mean absolute deviation from the Median (MADM)	Inter-rater agreement	Feasible & deliverable in radiotherapy - %Yes	Recommendation for inclusion in a radiotherapy comfort intervention package: include*, Include with caution† or Exclude‡	Qualitative analysis of participant discussion leading to Categories For Feasible Implementation (e.g. subthemes linking interventions to quotes)– full analysis can be found in *Supplementary material 4. Directed content analysis of prioritised interventions*
Compassionate & empathetic communication training for TRs	90%	9.0	0.7	High	90%	**INCLUDE**	Four categories emerged from the panel; 'Natural Compassion From Staff Appreciated' with one patient saying: *Personal interaction ++++, You can't beat personal interaction* [P1]. The second category was about retaining humanity: 'Don't Over Medicalise' with another patient saying; *Don't over medicalize that bit of informality, that bit of humanity….[*P2]. The third category was 'Education In Compassion & Empathy' embedded in TR comments such as; *I think any advanced communication skills (and/or clinical supervision) should be as available….[*R2]. The final category was about choice, 'Choosing From A Toolbox' of interventions' with an TR voicing their thoughts: *….It's good because then you can just select from them. Depending on the patient's needs* [R2]. Patients agreed there should be a choice; *Upon request is vital* [P2].
Tailored information e.g., TRs provide the required information only as part of preparation for treatment	100%	9.0	0.8	High	80%	**INCLUDE**	Three categories emerged from the panel; Although priority and feasibility were high, there was concern voiced by participants represented in the category; 'Time For TRs To Tailor Information' including this quote: *But time for TRs to do this is required* [R1]. Another category, 'Do Not Overload Patients', considered the information burden on patients demonstrated in this quote: *because it's quite hard to take everything in [amount of information], in one go* [P4]. The final category emphasised a focus on when to provide information 'Provide Information When Required During Radiotherapy (not all at #1)' with a patient suggesting; *It might be a good idea to have maybe have six or eight sessions, and then for someone just to say, right? You know we've been through some of it. Is there anything you're puzzled about? Or is there anything we can make clear* [P4].
Workshop by TRs on what to expect	90%	7.5	0.9	Moderate	80%	**INCLUDE**	Three categories for feasible implementation were; 'Choice & Format Of Workshops' with patients voicing their view that choice is important: *I would like to attend a workshop upon request* [P2], and an RT stating….*I think these could be online too* [R1]. The second category was 'Efficiency Of Workshops'

Intervention Components *After Activity 1*	**Activity 2** Initial vote	**Activity 3** Prioritisation			**Activity 4** Feasibility		
	Initial filter Is intervention important ≥50% 'Yes' proceeds to activity 3	Median Likert score	Mean absolute deviation from the Median (MADM)	Inter-rater agreement	Feasible & deliverable in radiotherapy - %Yes	Recommendation for inclusion in a radiotherapy comfort intervention package: include*, Include with caution† or Exclude‡	Qualitative analysis of participant discussion leading to Categories For Feasible Implementation (e.g. subthemes linking interventions to quotes)– full analysis can be found in *Supplementary material 4. Directed content analysis of prioritised interventions*
e.g., position, mask, bladder/bowel preparation							which derived from quotes such as *…..if patients are grouped together this is feasible* [R2]. And the third category 'Specificity of workshops' *What is quite big cause of discomfort can be having to maintain a full bladder so a specific workshop would help* [R3].
Adjustments & supports provided for arms or legs during treatment by TRs	80%	8.5	1.2	Moderate	80%	**INCLUDE**	Two categories for feasible implementation were: 'Adjustment, Consideration & Risk' derived from quotes such as: " Yes, we want to make someone comfortable on the couch, but how far do we go [R1] ?" The second category was 'Assessment Of Position For Individualisation' derived from the desire to assess a patient's ability to hold position; *Not just about exercising, but straight up assessing our movement beforehand if required* [P7].
Sound & music interventions such as nature sounds, music audio books, relaxation, instructions, and updates during treatment delivered at patient request	100%	6.5	1.4	Moderate	80%	**INCLUDE**	Two categories were created, the first was 'Choice And Selection' voiced by a patient who indicated it was straightforward: *Easy enough to provide or have patient bring their own iPod/mobile phone* [P1]. The second category was about using this intervention component as a 'Distraction & Coping' solution with an TR saying: *Uhm, a distraction with music or sounds are beneficial* [R3], and a patient stating: *Broad agreement with this as a coping strategy* [P5].
Tour of radiotherapy in person or video provided at patient request	90%	8.0	0.6	High	70%	**INCLUDE WITH CAUTION**	One category emerged; The potential challenge of tours in person were highlighted with a preference by participants for virtual approaches as per the category 'Online Or Video Tour Or Information Is Time Efficient', which was voiced by participants: *Video definitely could be done. Difficult to do in the working day in a busy department* [R3].
Soft pads/ mattress under the body to alleviate body	90%	7.5	1.3	Moderate	60%		Two categories emerged; The concern over this component maybe around ensuring reproducibility of treatment position. The category 'Caution In Using Soft Pads Due To Reproducibility' is highlighted by an TR: *Providing a*

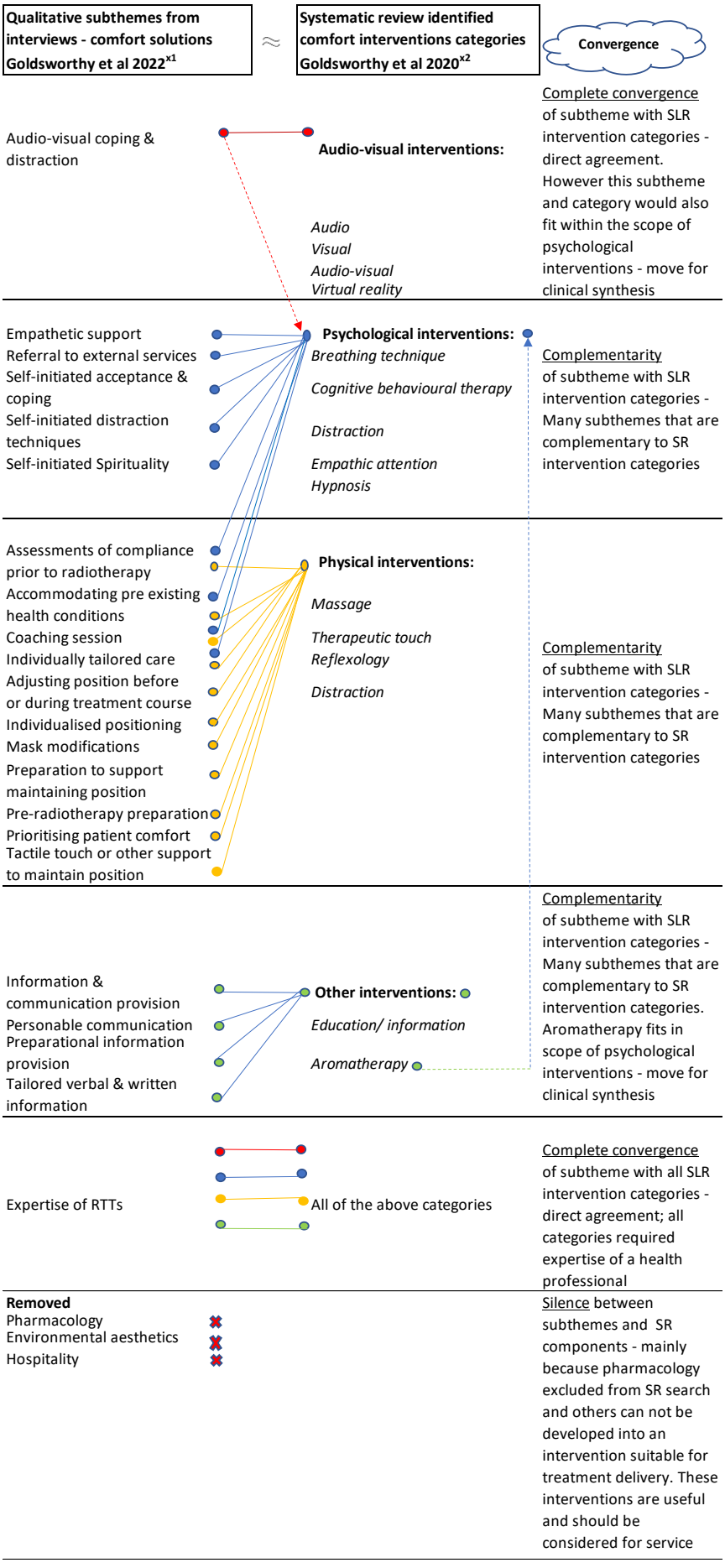
Intervention Components *After Activity 1*	**Activity 2** Initial vote	**Activity 3** Prioritisation			**Activity 4** Feasibility		
	Initial filter Is intervention important ≥50% 'Yes' proceeds to activity 3	Median Likert score	Mean absolute deviation from the Median (MADM)	Inter-rater agreement	Feasible & deliverable in radiotherapy - %Yes	Recommendation for inclusion in a radiotherapy comfort intervention package: include*, Include with caution† or Exclude‡	Qualitative analysis of participant discussion leading to Categories For Feasible Implementation (e.g. subthemes linking interventions to quotes)– full analysis can be found in *Supplementary material 4. Directed content analysis of prioritised interventions*
discomfort managed by TRs						**INCLUDE WITH CAUTION**	*balance is struck - i.e., a mattress which is too soft and thick may cause the patient to move more* [R1], and the second category suggested a focus was required 'Soft Wedges & 'Mattresses To Assist Position Of Limbs' as voiced by one patient: *All I said really, is that so long as you get the original position in right, and if you could add a perhaps some of these soft pads* elsewhere [P4].
Visual interventions such pictures or projections of nature or similar on walls or screens delivered at patient request	90%	6.0	1.5	Low	50%	**INCLUDE WITH CAUTION**	Two categories emerged; There was concern of cost implications observed in the first category; 'Cost Implication Of Visual Interventions' with a an TR saying: There is a *cost implication of visual interventions* [R2]. However, visual interventions may not have to be complex as illustrated by the second category: 'Simple & Calming Visualisation Possible' with a TR stating*: …simple visualisation techniques/ counting etc is reasonable* [R3]. And patients acknowledging potential benefits too; *Calming images or videos would have allowed me to put myself elsewhere* [P7].
Stretching and exercises coaching before and after positioning for radiotherapy treatment	90%	7.5	1.5	Low	80%	**INCLUDE WITH CAUTION**	Three categories emerged; There was concern about the time that may be 'TR Time & Training' with an TR saying: *Staff time is required to specifically discuss this. Training is required for staff…*[R1]. However, in another category, 'Self-Direction (Video) In Stretching To Save Time', it was suggested that time could be saved by using a pre-recorded video with a patient stating: *This could be covered fairy easily face to face and save time with video* [P5]. It was felt that specificity was required in the category 'Specific Anatomical Stretches' with a patient voicing; *I think it's a great idea, particularly for patients receiving treatment to the torso region* [P3]. An TR agreed saying that TRs need to be; *up to date with most recent research/ practice in exercise e.g., pelvic floor exercises* [R1].
Patient practice run of treatment position with TRs	80%	8.5	1.6	Low	70%	**INCLUDE WITH CAUTION**	One category emerged; There was concern about the extra time and resources required. The category 'Time & Resources For Practice Run Through Of Position' was expressed by an TR who highlighted key considerations for the service: *Time implications and machine availability*

Intervention Components *After Activity 1*	**Activity 2** Initial vote	**Activity 3** Prioritisation			**Activity 4** Feasibility		
	Initial filter Is intervention important ≥50% 'Yes' proceeds to activity 3	Median Likert score	Mean absolute deviation from the Median (MADM)	Inter-rater agreement	Feasible & deliverable in radiotherapy - %Yes	Recommendation for inclusion in a radiotherapy comfort intervention package: include*, Include with caution† or Exclude‡	Qualitative analysis of participant discussion leading to Categories For Feasible Implementation (e.g. subthemes linking interventions to quotes)– full analysis can be found in *Supplementary material 4. Directed content analysis of prioritised interventions*
							implications [R3]. Contrary to this concern, patients favoured the intervention component feeling that it could be accommodated: *This could happen during the planning appointment if not already achieved* [P1].
Customized immobilization provided by TRs e.g., head moulds, vacuum bags, or mask modifications	80%	7.5	1.5	Low	90%	**INCLUDE WITH CAUTION**	Two categories emerged; the potential lack of customisable immobilisation available in a radiotherapy department was a concern. The first category defines the challenge; 'Availability Of Customisation Devices' as per TR quote: *Providing the centres has customisable immobilisation available* [R1]. A second category suggests 'Customisation To Aid Overall Position' should be attempted with the following patient quote;*…..If this were expanded to include patients requiring help to remain in a position, then it is a very good idea* [P3].
Patient advice/training in meditation including talking to self, faith readings, chants, counting down or visualising going on holiday focusing on machine lights/lasers or noise	60%	4.5	1.6	Low	30%	**EXCLUDE**	Three categories emerged; There was concern that specific training would be required for TRs. The first category 'Specialist Training Required' as per TR quote: *A R2: "I don't think that I am able. It's in my skill set to train people in meditation or chanting."* Similarly, a second category proposes that 'Not everyone can meditate' and a patient said: *Uncertain about this...not everyone goes on holiday?!* [P2]. However in a third category some patients find their own way without anything formal doing a 'Do It Yourself', with a patient stating: *And I think me and then you just find you just think. Well, it's I'm here now. It's not going to be too long and you find your own way through it, really.* [P4]
Aromatherapy provided at patient request	40%	-	-	-		**EXCLUDE**	Two categories emerged; although some panel members seemed positive about aromatherapy, they did state that smells are person dependant leading to the first category 'Smells are person dependant and can be like 'marmite' An TR said: *I thought aromatherapy was a nice option as some people find smells more comfortable than visual/audio. Aromatherapy I think is very person dependant? As X said some smells may not be great for other people*

Intervention Components *After Activity 1*	**Activity 2** Initial vote	**Activity 3** Prioritisation			**Activity 4** Feasibility		
	Initial filter Is intervention important ≥50% 'Yes' proceeds to activity 3	Median Likert score	Mean absolute deviation from the Median (MADM)	Inter-rater agreement	Feasible & deliverable in radiotherapy - %Yes	Recommendation for inclusion in a radiotherapy comfort intervention package: include*, Include with caution† or Exclude‡	Qualitative analysis of participant discussion leading to Categories For Feasible Implementation (e.g. subthemes linking interventions to quotes)– full analysis can be found in *Supplementary material 4. Directed content analysis of prioritised interventions*
							[R1]. And the second category was 'Smells can linger' a patient said that : *Smells or aromas will linger which may have made me feel sick.[*P6]
Human touch in person (hand holding) or having something to remind them of human contact (e.g., holding a soft item like a blanket) provided at patient request	60%	4.0	1.7	Low	30%	**EXCLUDE**	Three categories emerged: the exclusion of this intervention component caused some controversy with there categories emerging; the first category was 'Human touch essential' a patient stating: *I'm just surprised that the human touch didn't make it through, given how technological and how clinical the whole system is and has to be.* [P2]. The second category 'Holding something may help' suggested that touch maybe feasible in other formats: *Possibly feasible to hold a soft item, etc. should treatment allow but human contact during treatment unfeasible*. [P3] Then on balance an TR stated why some forms of touch may not be possible: *And things that people can hold to remind them. For obvious reasons handholding during treatment is impossible, but if someone wanted to hold an object of comfort I don't see why not.* [R2] leading to the third category 'Holding something during treatment not feasible'
Referral to talking therapies (e.g., counselling, hypnosis, or cognitive behavioural therapy) by TRs at patient request	70%	5.5	2.2	Low	70%	**EXCLUDE**	Four categories emerged: panel members stated that some patients may have benefited from talking therapies and were surprised it was excluded with category one 'Some would benefit from talking therapies or coping strategies' and category two 'Surprised that Talking therapies were excluded'. A patient said that talking therapies; *Could be an extremely useful tool for worried patients*. [P2] And an TR surprised of the exclusion: *Yeah, I mean I'm a bit surprised about the referral to talking therapies as well?* [R2] However patients and TRs voiced that it should be standard with the third category 'Should be standard of care already' with a patient saying; Do this anyway and should be standard practice [P6] and a fourth category 'Elsewhere in the patient pathway' with an TR saying; *That is a really relevant point that some of the interventions may be better at different times in the radiotherapy pathway and in order to practically apply these could be useful to think about this.* [R1]

Intervention Components *After Activity 1*	**Activity 2** Initial vote	**Activity 3** Prioritisation			**Activity 4** Feasibility		
	Initial filter Is intervention important ≥50% 'Yes' proceeds to activity 3	Median Likert score	Mean absolute deviation from the Median (MADM)	Inter-rater agreement	Feasible & deliverable in radiotherapy - %Yes	Recommendation for inclusion in a radiotherapy comfort intervention package: include*, Include with caution† or Exclude‡	Qualitative analysis of participant discussion leading to Categories For Feasible Implementation (e.g. subthemes linking interventions to quotes)– full analysis can be found in *Supplementary material 4. Directed content analysis of prioritised interventions*
Visible or audio countdown clock of treatment length	90%	4.0	2.3	Low	70%	**EXCLUDE**	One category emerged: 'Challenging logistics of having a countdown clock at treatment delivery. Panel members suggested this wasn't really feasible considering treatment times vary day to day, an TR stating just that: *Our treatment delivery times change each day so a countdown will be challenging. We can tell patients when halfway through.* [R3]
Total interventions included or included with caution							11

Supplementary material 1. Triangulation of systematic literature review and qualitative interviews



Convergence of Qualitative Interviews[x1] & systematic review[x2]

The findings of systematic literature review and interviews with patients and Therapeutic radiographers were explored with respect to the meaning and interpretation of subthemes against the intervention categories of the systematic literature review. Then the Convergence Coding Scheme was applied.

Convergence coding scheme

1. Convergence: where findings directly agree. Subthemes and categories are similar in context.

2. Complementarity: findings offer complimentary information on the same issue

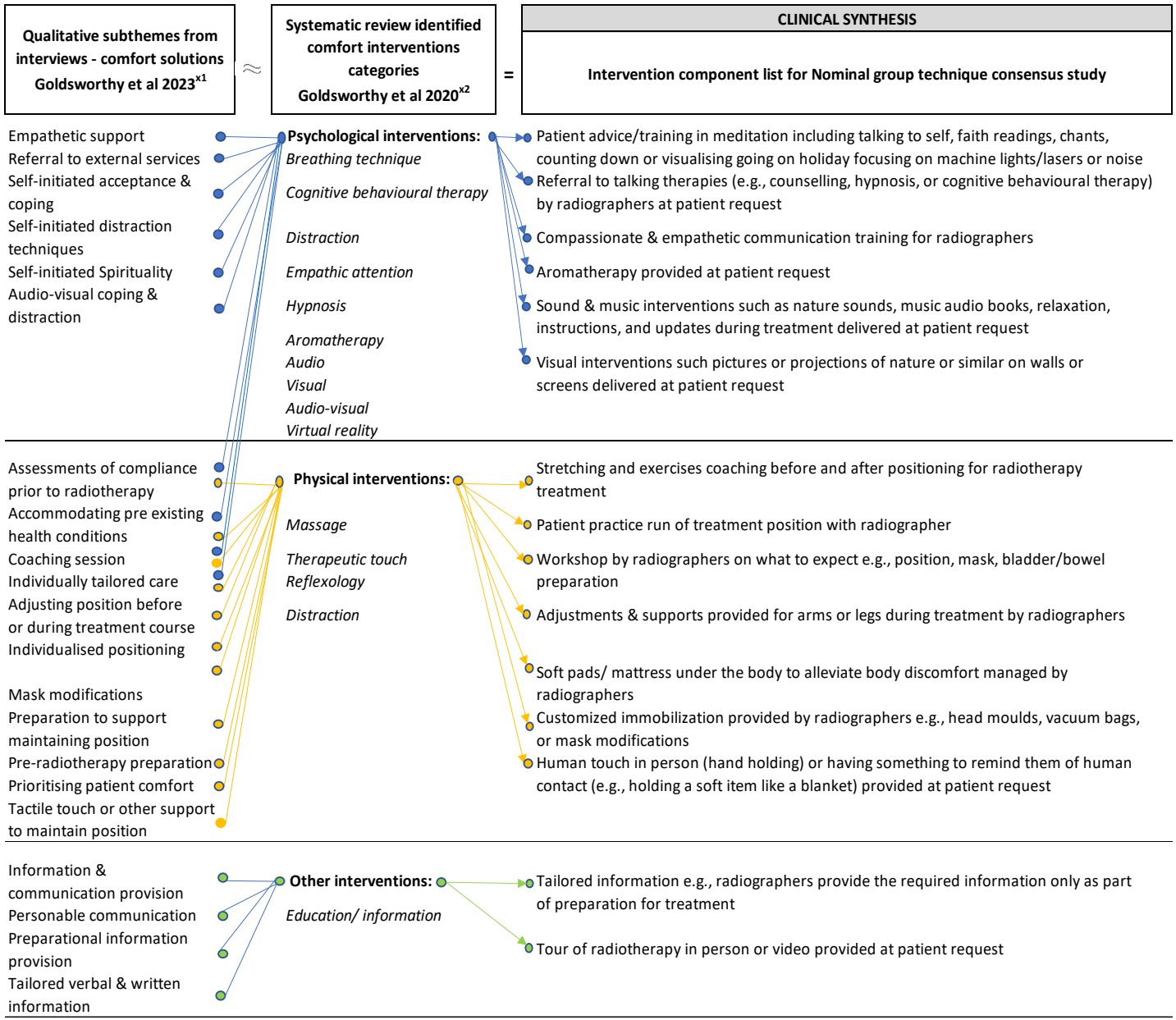
3. Dissonance: findings appear to contradict one another.

4. Silence: themes arising from one component study but not others

X1: Goldsworthy S, Palmer S, Latour JM, McNair H, Cramp M. A thematic exploration of patient and radiation therapist solutions to improve comfort during radiotherapy: a qualitative study. Journal of Medical Imaging and Radiation Sciences. 2023; Under review

X2: Goldsworthy S, Palmer S, Latour JM, McNair H, Cramp M. A systematic review of effectiveness of interventions applicable to radiotherapy that are administered to improve patient comfort, increase patient compliance, and reduce patient distress or anxiety. Radiography [Internet].

Supplementary material 2. Generation of comfort intervention components



Clinical synthesis process

The principle of clinical synthesis was to create a list of comfort intervention components with real world meaning. The following 5 steps were followed:

1) After Convergence, data from study the systematic review and interviews were explored for potential intervention by reading through and cross checking.

2) Then it was determined whether comfort solutions and intervention categories could be synthesised by either expanding or condensing the meaning.

3) An intervention component list was written in simple form without details for delivery.

4) The intervention component list was reviewed by research team and patient research partners.

5) After editing the final list was approved.

X1: Goldsworthy S, Palmer S, Latour JM, McNair H, Cramp M A. Thematic exploration of patient and radiation therapist solutions to improve comfort during radiotherapy: a qualitative study. Journal of Medical Imaging and Radiation Sciences. 2023; under review

X2: Goldsworthy S, Palmer S, Latour JM, McNair H, Cramp M. Goldsworthy S, Palmer S, Latour JM, McNair H, Cramp M. A systematic review of effectiveness of interventions applicable to radiotherapy that are administered to improve patient comfort, increase patient compliance, and reduce patient distress or anxiety. Radiography [Internet]. 2020;26(4):314–24 [Internet]. 2020;26(4):314–24

Supplementary material 3 - Schedule for the NGT consensus meeting	
Time	**Activity**
09:00 - 09:15	Registration & welcome brief
09:15 - 09:30	Presentation of comfort intervention components
09:30 - 10:00	Group discussion phase
10:00 - 10:30	Participant choice setting phase
10:30 - 10:50	Tea Break (20 minutes)
10:50 - 11:35	Participant prioritisation setting phase
11:35 – 12:00	Tea Break (25 minutes)
12:00 - 12:45	Feasibility of delivering the radiotherapy comfort intervention package
12:45 - 13:00	Close and final remarks
	Close

Intervention component	Descriptor	Categories for feasible implementation	Patient narratives	Therapeutic radiographers (TRs) narratives
Adjustments & supports provided for arms or legs during treatment by TRs	Comfortable adjustments could be made prior the initial planning CT scan or on treatment where permissible due to the restriction of the environment. A slight adjustment outside of the treatment area may be permitted on treatment if it does not change position.	Adjustment consideration & risk	P03: "Very feasible, especially for patients in un-natural positions or experiencing pain and discomfort from prolonged treatment."	R1: "And for example, the mattress. Yes, we want to make someone comfortable on the couch, but how far do we go?"
		Assessment of position for individualisation	P7: "Point concerning movement was really important. Not just about exercising, but straight up assessing our movement beforehand if required. Making the whole procedure more tailored and more comfortable."	R1: "The point concerning arm movement was really important - not just about exercising but straight up assessing arm movement beforehand if required - making the whole procedure tailored and more comfortable."

Intervention component	Descriptor	Categories for feasible implementation	Patient narratives	Therapeutic radiographers (TRs) narratives
Aromatherapy provided at patient request	Aromatherapy using essential oils with a tab on clothing, or an infuser can relax and comfort patients by alleviating anxiety and stress	Smells are person dependant and can be like 'marmite' Smells can linger	P4: "Smells can be like marmite, maybe not everyone will like the sent". P6: "Smells or aromas will linger which may have made me feel sick."	R1: "I thought aromatherapy was a nice option as some people find smells more comfortable than visual/audio. Aromatherapy I think is very person dependant? As X said some smells may not be great for other people"
Compassionate & empathetic communication training for TRs	Compassion is a powerful aspect of the human experience and is one that can be trained. Compassion can be cultivated with training and that greater altruistic behaviour may emerge from an increased understanding of the suffering of other people. Compassion training focuses not	Natural compassion from staff appreciated Don't over medicalise Education in compassion &	P1: "Personal interaction ++++. You can't beat personal interaction." P2: "Don't over medicalized that bit of informality that bit of humanity, that bit of real right what I was finding cause I live alone." P3: "Although I	R2: "I think any advanced communication skills (and/or clinical supervision) should be as available to TRs as it is to nurses - as a profession we sometimes get overlooked as there is a lack of general understanding of the nature of what we do and how much we support our patients during treatment - we are not operators!" R3: "Compassion and empathy – should be in UG training."

Intervention component	Descriptor	Categories for feasible implementation	Patient narratives	Therapeutic radiographers (TRs) narratives
	only on suffering but also on supporting and encouraging compassion for the good of the self and others.	empathy Choosing from a 'toolbox' of interventions	never personally experienced anything other than amazing treatment from fantastic individuals, compassion and empathy are essential when handling patients who are experiencing some of the worst lows in their lives." P2: "Upon request is vital."	R1: "I do think it would be nice to have a balance of having some package that we can practically implement because many others have fed back that they would like human touch." R2: "I mean, personally I feel like as many of these left on the list as possible. It's good because then you can just select from them. Depending on the patients needs."

Intervention component	Descriptor	Categories for feasible implementation	Patient narratives	Therapeutic radiographers (TRs) narratives
Customized immobilization provided by TRs e.g., head moulds, vacuum bags, or mask modifications	Immobilisation maybe customised: thermoplastic masks may be modified (sections over eyes cut out), patient specific vacuum bags or head pads could be modified for patient comfort.	Availability of customisation devices Customisation to aid overall position	P3: "On both occasions when I have required radiotherapy treatment a custom mask was supplied to immobilise the head. If this were expanded to include patients requiring help to remain in a position, then it is a very good idea."	R1: "Providing the centres has customisable immobilisation available." R2: "Modifying the patient positioning to make it reasonably comfortable and stable (as far as is possible) should surely be standard practice."
Human touch in person (hand holding) or having something to remind them of human contact (e.g., holding a soft item like a blanket) provided at patient request	Care conveyed through human empathetic touch promotes comfort, individual attention, and presence. The unique characteristic of empathetic touch is that it provides both psychological and	Human touch essential Holding something may help Holding something	P2; "I'm just surprised that the human touch didn't make it through, given how technological and how clinical the whole system is and has to be." P3:"Possibly	R2: "And things that people can hold to remind them. For obvious reasons handholding during treatment is impossible, but if someone wanted to hold an object of comfort I don't see why not."

Intervention component	Descriptor	Categories for feasible implementation	Patient narratives	Therapeutic radiographers (TRs) narratives
	physical comfort at the same time.	during treatment not feasible	feasible to hold a soft item, etc. should treatment allow but human contact during treatment unfeasible."	
Patient advice/training in meditation including talking to self, faith readings, chants, counting down or visualising going on holiday focusing on machine lights/lasers or noise	Patients may find specific meditation delivered by a therapist or simply talking to self, focusing on something or counting down useful to get through radiotherapy treatment as a way of coping and dealing with discomfort.	Specialist training required Not everyone can meditate Do It Yourself	P1: "A bit niche and would require specialised training." P2: "Uncertain about this...not everyone goes on holiday?!" P4: "And I think me and then you just find you just think. Well, it's I'm here now. It's not going to be too long and you find your own way through it, really."	R1: "In terms of how much they could, maybe you know chant or you know, we certainly put the Koran on a lot and how much they can say that out loud given you know where their treatment area is located. Can they do that? Can they do it in their mind or is it actually they can verbalize it out loud? So I'm actually a bit sad to see that one go because maybe it comes under the audio a little bit." R2: "I don't think that I am able. It's not in my skill set to train people in meditation or chanting."

Intervention component	Descriptor	Categories for feasible implementation	Patient narratives	Therapeutic radiographers (TRs) narratives
				R3: “Techniques like I say, I don't feel able to actually train people to meditate."
Patient practice run of treatment position with TR	A run through of position, breath gating, or even to practice accessory devices such as rectal obturators may alleviate anxiety prior to treatment, improving comfort.	Time & resources for practice run through of position	P1: "This could happen during the planning appointment if not already achieved." P2: "Seems almost a prerequisite.“ P4: "I think this is very important."	R1: "I think it would be really difficult in a lot of radiotherapy departments to do this as we don't have the rooms to do so. I think it would be great for some patients, but unfortunately not feasible?" R3:"Time implications and machine availability implications."

Intervention component	Descriptor	Categories for feasible implementation	Patient narratives	Therapeutic radiographers (TRs) narratives
Referral to talking therapies (e.g., counselling, hypnosis, or cognitive behavioural therapy) by TRs at patient request	Referral to talking therapies may help patients to accept and cope with any discomfort in receiving radiotherapy. Whether its about having someone listen to emotional issues, or hypnotherapy may help patients relax, cope with treatment and also ameliorate pain, and cognitive behavioural therapy to change the way patients think and behave.	Some would benefit from talking therapies or coping strategies Surprised that Talking therapies were excluded Should be standard of care already Elsewhere in the patient pathway	P2: "Could be an extremely useful tool for worried patients. I personally was extremely anxious during treatment and would have benefitted from being taught coping strategies or methods with which to calm myself down. Also wouldn't add to TR workload being a referral process." P3: "Meditation and talking therapies, I feel have a role in the wider scope as a way of managing your emotions and feelings when you have been affected	R2: "I mean, it's not by no means going to be necessary for all patients, but this does say at patients request, and certainly we would always want to be able to offer that to people if they asked for it." R2: "Yeah, I mean I'm a bit surprised about the referral to talking therapies as well?" R1: "That is a really relevant point that some of the interventions may be better at different times in the radiotherapy pathway and in order to practically apply these interventions it could be useful to think about this." R2: "Modifying the patient positioning to make it reasonably comfortable and stable (as far as is possible) should surely be standard practice."

Intervention component	Descriptor	Categories for feasible implementation	Patient narratives	Therapeutic radiographers (TRs) narratives
			by cancer." P6: "I do yoga and found this sort of exercise invaluable as a prep for the treatment. xx who is running your Prehab programme at the xx is providing guidance on this". Do this anyway and should be standard practice."	
Soft pads/ mattress under the body to alleviate body discomfort managed by TRs	Soft pads or mattresses can be made prior the initial planning CT scan or on treatment for discomfort caused by e.g. co-morbidities where permissible due to the restriction of the environment. A soft pad outside of the	Caution to using soft pads due to reproducibility Soft wedges & mattresses to assist position	P4: "All I said really, is that so long as you get the original position in right, and if you could add a perhaps some of these soft pads elsewhere." P5: "Wedges and foam blocks were	R1: Providing a balance is struck - i.e., a mattress which is too soft and thick may cause the patient to move more? R2: "Large proportion of treatments are VWAT and therefore the impact of a 1cm foam mattress on skin dose is minimal - we use this as standard

Intervention component	Descriptor	Categories for feasible implementation	Patient narratives	Therapeutic radiographers (TRs) narratives
	treatment area may be permitted if it does not change position, or if needed up front radiotherapy.	of limbs	used when I received treatment, but I know my father suffered when having to raise his hands above his head during treatment for cancer to his rib cage."	for SABR treatments with no reduction in reproducibility and patients are more stable if comfortable."
Sound & music interventions such as nature sounds, music audio books, relaxation, instructions, and updates during treatment delivered at patient request	Sounds or music, such as nature sounds, music, relaxation (sound/music/therapy), audio books, machine sound or instructions may help to distract patients to get through the procedure more comfortably.	Choice and selection Distraction & coping	P1: "I was given the opportunity to have music playing. Easy enough to provide or have patient bring their own iPod/mobile phone. (Maternity have floor standing Bluetooth speakers in labour rooms.)" P5:"Sound & music interventions such as nature sounds, music audio books,	R2: " Should always be tailored to patient's wishes where possible - some patients find communication over the intercom reassuring whilst others prefer the distraction of music etc." R3: "Uhm, a distraction with music or sounds are beneficial."

Intervention component	Descriptor	Categories for feasible implementation	Patient narratives	Therapeutic radiographers (TRs) narratives
			relaxation, instructions, and updates during treatment delivered at patient request. Broad agreement with this as a coping strategy."	
Stretching and exercises coaching before and after positioning for radiotherapy treatment	Stretching, exercise or coaching prior to radiotherapy may increase flexibility, reduce muscle cramp/spasms helping patients hold position more comfortably.	TR Time & training Self-direction (video) in stretching to save time Specific anatomical stretches	P5: "This could be covered fairy easily face to face and save time with video." P3: "I think it's a great idea, particularly for patients receiving treatment to the torso region".	R1: "Staff time is required to specifically discuss this. Training required for staff, so they are up to date with most recent research/ practice in exercise e.g., pelvic floor exercises."
Tailored information e.g., TRs provide the required information	Providing patients with information that's tailored to them, in the	Time for TRs to tailor information	P6: "Perhaps just some documents signposting where	R1: "But time for TRs to do this is required."

Intervention component	Descriptor	Categories for feasible implementation	Patient narratives	Therapeutic radiographers (TRs) narratives
only as part of preparation for treatment	right format, right amount, that's easy for them to digest will alleviate the feeling of being overwhelmed improving comfort.	Do not overload patients Provide information when required during radiotherapy (not all at #1)	such guidance can be found. Training issues for TRs." P4:"It might be a good idea to have maybe have six or eight sessions, and then for someone just to say, right? You know we've been through some of it. Is there anything you're puzzled about? Or is there anything we can make clear and for you it etc? cause it's quite hard to take everything in my in one go."	R2: "I think we instinctively tailor the verbal information we give already, although I think sometimes patients are swamped by all the written information they receive."
Tour of radiotherapy in person or video	A tour of radiotherapy can be delivered in person out of hours, virtually or by video	Online or video tour or information is time efficient	P3: "I would consider this a quick win, easy to implement and	R3: "Video definitely could be done. Difficult to do in the working day in a busy department and staff may

Intervention component	Descriptor	Categories for feasible implementation	Patient narratives	Therapeutic radiographers (TRs) narratives
provided at patient request	recording to alleviate pre-conceived anxieties about radiotherapy .		execute and not overly taxing on existing resources once it becomes part of the treatment pathway."	not want to do it after their working day."
Visible or audio countdown clock of treatment length	A countdown verbally over intercom or visually on a screen may help patients to manage their own isolation and how long they must hold their position.	Challenging logistics of having a countdown clock at treatment delivery	P1: "I understand the complexities of having a countdown but giving some indication of start/middle/end of treatment would be great, especially during the first few sessions."	R3" Our treatment delivery times change each day so a countdown will be challenging. We can tell patients when halfway through."
Visual interventions such pictures or projections of nature or similar on walls or	Visual interventions such as pictures, ceiling light boxes, usual lighting or other	Cost implication of visual interventions	P6: "Feasible but not sure if practical. Maybe good if therapy duration	R2: "Cost implication - maybe need to make it a standard when new Linac installed."

Intervention component	Descriptor	Categories for feasible implementation	Patient narratives	Therapeutic radiographers (TRs) narratives
screens delivered at patient request	may help to distract patients to a more comfortable state.	Simple & calming visualisation possible	extends past the current time." P7: "Calming images or videos would have allowed me to put myself elsewhere."	R3: "Training in meditation is outside our remit, but advice to try simple visualisation techniques/ counting etc is reasonable."
Workshop by TRS on what to expect e.g., position, mask, bladder/bowel preparation	Verbal explanation using visual aids describing what to expect, including self-care, will support patients understanding and the importance of what they have been asked to do. This will support them to comfortably comply with expectations during their radiotherapy treatment.	Choice & format of workshops important Efficiency of workshops Specificity of workshops	P2:"Upon request." P1: "Good idea but would need separate room/area to do this. Also requires extra appointment and staff."	R1: "I undertook them in person which was lovely but required a room, I think these could be online too." R2: "There are some resource implications but if patients are grouped together this is feasible." R3: "What is quite big cause of discomfort can be having to maintain a full bladder throughout the whole course of treatment and it's a bit difficult to see what the intervention was and if we knew

Intervention component	Descriptor	Categories for feasible implementation	Patient narratives	Therapeutic radiographers (TRs) narratives
				how he could help people with this."

Intervention component	Descriptor	Categories for feasible implementation	Patient narratives	Therapeutic radiographers (TRs) narratives
Resource considerations Overarching category applicable to all intervention components	There are many logistical and resource considerations when introducing new interventions to radiotherapy. These may include having the right staff, staff time, service time, the cost and whether the interventions is compatible to radiation.	Do we actually need an intervention Financial considerations Logistics, equipment, training & access Online or video Time efficiency Radiation environment considerations	P3: "Feasible as a very good idea and would be fantastic in a perfect world but I recognise this could be unworkable or severely restricted by departmental budgets, staffing levels, workloads and space." P6: "Quite often there's a difference between what's nice and what's needed." P1: "Good idea over and above what is already used. Financial input and staff training needed." P6: "Probably not in person. Hygiene	R2:"Cost implication - maybe need to make it a standard when new Linac installed." R1: "Uhm, this it's the one on" the patient advice and training in meditation. It's not quite. I agree that I wouldn't feel comfortable to give the training in it." R1: "We also found we could give information on exercises etc. in these workshops. I undertook them in person which was lovely- but required a room, I think these could be online too." R3: "Time implications and machine availability implications."

Intervention component	Descriptor	Categories for feasible implementation	Patient narratives	Therapeutic radiographers (TRs) narratives
			issues + time but a video would be useful." P4: "I think this may be difficult to carry through due to time restraints of treatment."	