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Patient and therapeutic radiographer experiences of comfort during the radiotherapy pathway: a qualitative study.

Simon Goldsworthy MSc^{1,2}, Jos M. Latour PhD, RN^{3,4}, Shea Palmer PhD⁵, Helen A McNair PhD⁶, Mary Cramp PhD²

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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. Centre for Care Excellence, Coventry University and University Hospitals Coventry & Warwickshire NHS Trust, Coventry, United Kingdom
6. Royal Marsden NHS Foundation Trust and Institute of Cancer Research, Sutton, United Kingdom.

Correspondence: simon.goldsworthy@somersetft.nhs.uk

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ABSTRACT

Introduction

There is little research regarding the experiences of patient comfort and how it is best managed in radiotherapy. The aim of this study was to explore the experiences of patient and therapeutic radiographer views of comfort during radiotherapy.

Methods

This qualitative study involved semi-structured interviews, with cancer patients (n=25) and therapeutic radiographers (n=25), conducted between January-July 2019. Patients were recruited from one radiotherapy clinic and therapeutic radiographers were recruited from across the United Kingdom via specialist interest groups and social media. Interviews were audio-recorded and transcribed verbatim. Thematic analysis was used to analyse the data separately between both groups and shared themes were identified.

Results

Four themes were identified of which two themes were shared among both the patients and therapeutic radiographer. Emotional Health was a shared theme highlighting experiences such as stress, vulnerability and privacy. The second shared theme, Positioning and Immobilisation Experiences, concerned how patients' experience being physically positioned and using immobilisation for accurate radiotherapy. The theme Information and Communication Experience was derived from patients highlighting concerns over sharing and provision of information and ways of communication. The last theme, Environmental Experience, emerged from the patient interviews and related to the first impressions of the radiotherapy environment such as reception or treatment rooms and how this effects the overall feelings of comfort.

Conclusion

This qualitative study has provided the shared voice of patients and therapeutic radiographers and their experiences of comfort during radiotherapy. These shared experiences emphasise the importance of considering comfort holistically and not just from a physical context. This information can be used by therapeutic radiographers to better understand their patients experiences and needs to provide better comfort during radiotherapy to improve patients' outcomes.

INTRODUCTION

Recent advances in radiotherapy delivery have led to greater accuracy of treatment, with improved targeting and avoidance of toxicities (1). Stereotactic ablative body radiotherapy, extreme hypofractionation, 4D approaches, and online adaptive approaches have improved survival, quality of care and availability of treatment (2). However, most of these advances have increased treatment times which may have a negative impact on patient comfort and treatment accuracy because patients need to maintain a set position for longer (3). International guidelines in radiotherapy specify that patients should be positioned in a stable and reproducible position for a treatment course but provide limited details on patient experiences or guidance for practice (1,4–6). The evidence base for patient comfort during radiotherapy is increasing but further research in a wider range of cancers is required to guide therapeutic radiographers (TR) treating patients (7–9).

Therapeutic radiographers have commonly used rigid positioning and immobilisation devices to hold patients in position for accurate radiotherapy treatment. Comfortable positioning might increase treatment accuracy (10–15). To date, investigations have used a non-validated patient-reported scale to assess comfort and evaluated treatment accuracy using geometric measurements of verification imaging on treatment. In a cross-over study comparing a conventional treatment system to a customised pelvic immobilisation system and using 2D planar imaging to verify accuracy, the treatment accuracy was reported to be similar between groups (16). Although the authors suggested comfort had improved, the TRs believed patients were more comfortable using the pelvic immobilisation system rather than the conventional system (16). Bayley et al, randomised patients between supine and prone positioning for prostate cancer treatment and observed a better median patient comfort score for supine compared to prone (14). Later research by Bartlett et al (15) identified that an improvement in patient comfort using a supine position coincided with a significant improvement in treatment accuracy in patients undergoing breath-hold radiotherapy for breast cancer. These studies demonstrate there is a need to explore patient comfort in radiotherapy to generate a better understanding prior to developing interventions to improve comfort.

The shift towards exploring comfortable positioning has led to studies of patient experiences using qualitative methodologies. Two qualitative studies explored the

experiences in patients with head and neck cancer (7,8). A focus group study with head and neck cancer patients identified that comfort was important for them. The three themes emerging were: physical comfort of wearing a mask, passivity of doing what they were asked to do and mental perception of how comfort was perceived and felt differently (7). An interview study performed by Nixon et al (8) identified two themes: 'vulnerability' of feeling exposed in radiotherapy and 'response to experience' which is either the psychological or physical response to the experience of wearing a mask. Although these studies focused on patients with head and neck cancer, it is possible that similar themes could feature in patients with cancers in other anatomical sites. A framework analysis from a workshop with breast cancer patients receiving radiotherapy (9), identified experiences such as misinformation, issues of modesty, impact of side effects and emotional experiences. These studies demonstrate the relevance of further exploring comfort across different anatomical sites. Therefore, the aim of this study was to explore patient and therapeutic radiographer experiences of comfort during radiotherapy.

METHODS

A qualitative study using semi structured interviews was conducted with patients and therapeutic radiographers. The research team consisted of five researchers (SG, JML, SP, HM, MC) and two patient research partners (PRP). The PRPs contributed throughout the study, including review of study materials, piloting of the interview schedules and discussing the findings to ensure that they reflected patient experiences.

Ethical approval was granted by Berkshire B NHS Research Ethics Committee in January 2019 and the protocol was prospectively registered [www.clinicaltrials.gov NCT03984435]. Patients and therapeutic radiographers gave written informed consent and interviews were conducted between January 2019 and July 2019. This study is reported in accordance with to the Consolidated criteria for Reporting Qualitative research (COREQ) checklist (17).

Patient participants

Participants were recruited via a radiotherapy department in the Southwest of England. They were identified and screened for eligibility from a radiotherapy clinic list and invitations to participate were sent to eligible patients. Participants had to be 18 years or older, diagnosed with cancer at one of three major anatomical sites

(head and neck, thoracic/breast or pelvis) and received radiotherapy within the last 3 months with a treatment time exceeding 10 minutes to encompass patients who need to hold position for a longer time. Purposive sampling was used to reach maximum variation across the three major anatomical sites to ensure heterogeneity of views across the different experiences of treatment (18). The proposal was to recruit up to 25 patients, depending on data saturation(19,20), with eight to nine patients recruited from the three anatomical regions.

Therapeutic radiographer participants

Participants were recruited across the UK mainly via social media (Twitter and LinkedIn). A hand-out leaflet of the study was distributed at two conferences and electronic advertisement were distributed to specialist interest groups. Responding participants were sent invitations to participate and eligibility was assessed via an online form prior to electronic consent. Participants had to be practising therapeutic radiographers (HCPC register check) and delivering radiotherapy techniques with times exceeding 10 minutes. No more than 2 therapeutic radiographers from the same radiotherapy clinic were recruited to ensure heterogeneity of views and practices. A sample size of 25 was set for therapeutic radiographers, depending on data saturation(19,20).

Procedure

Semi-structured interview guides for the patients and TRs (Electronic supplementary material 1) were developed using the existing literature. The interview guides were tested in two pilot interviews with two volunteer patients and two TRs. Minor textual changes for the probing questions were suggested and amended. The final interview guide was approved by the research team. The lead researcher (SG) conducted all the interviews and was unknown to patient participants. The lead researcher was known to some of the therapeutic radiographer participants due to the specialised nature of the work.

Patients were interviewed at a place and time of their choosing, either in the hospital or their homes. This was planned mid-way during radiotherapy or within three months of completing treatment to ensure patients were able to recall their experiences of comfort, aiming to limit the effect of patient recall bias (21).

Therapeutic radiographers were interviewed via telephone at the time of their choosing.

Interviews were audio recorded and transcribed verbatim by the lead researcher.

Data analysis

Thematic analysis was conducted using NVivo, focusing on the exploration of comfort experiences during radiotherapy from the experiences of patients and therapeutic radiographers. The six steps of thematic analysis were followed as described by Braun and Clarke (22). The steps include familiarity with the data, generation of initial codes, searching for themes, reviewing themes, defining the themes and the write-up.

Transcripts of patients and therapeutic radiographers were analysed separately initially, and then synthesised. Themes and sub-themes arising from patient and therapeutic radiographer interviews underwent a process of synthesis to identify shared themes and subthemes (23). This was assessed by first reviewing and aggregating codes, subthemes, and themes.

Trustworthiness and credibility were acquired through peer reviews and debriefings with an independent therapeutic radiographer researcher and PRPs. The researchers aimed to establish the codes' similarities, differences, and their relevance to the phenomenon under study (comfort). Dependability was established by maintaining consistency in data collection and analysis process over the duration of the study. (24,25).

FINDINGS

Participant characteristics

In total, 34 patients were approached with nine declining. 25 patients provided written informed consent and were interviewed (Table 1). The age range of the patients was between 33 and 84 years, with an even distribution of gender (Female n=12, Male n=13). Anatomical cancer site was evenly distributed; head and neck (32%), thorax (36%) and pelvis (32%). For TRs, 30 responded and 25 agreed to participate and provided written informed consent (Table 2). The age range of the TRs was between 23 and 50 years, with an uneven distribution of gender (Female n=20, Male n=5). The majority were senior practitioners (n=14).

Table 1. Patient's characteristics

Attribute	n	Mean (SD)
Age (All)	25	64 (13)
		Percentage (%)
Female	12	48%
Male	13	52%
Cancer site & diagnosis		
Head and neck		32%
Oropharyngeal SCC	5	20%
Salivary gland cancer SCC	2	8%
Haematological Lymphoma	1	4%
Thorax		36%
Breast Invasive ductal cancer	5	20%
Lung Adenocarcinoma	1	4%
Lung SCC	1	4%
Oesophageal SCC	2	8%
Pelvis		32%
Gynaecological Cervical SCC	1	4%
Gynaecological Uterine Adenocarcinoma	1	4%
Prostate Adenocarcinoma	6	24%
Radiotherapy Px & time on treatment couch (mean minutes & SD)*		
30Gy, 15#, 6Mv	10 (0.6)	2
40.05Gy,15#, 6Mv	15 (0.7)	4
40.05Gy,15#, 10Mv	15 (0.7)	1
45Gy, 25#, 6Mv	11 (0.6)	1
50Gy, 25#, 6Mv	15 (0.4)	1
55Gy, 25#, 6Mv	10 (0.7)	1
60Gy, 20#, 6Mv	10 (0.5)	6
60Gy, 30#, 6Mv	10 (0.5)	2
66Gy, 32#, 6Mv	10 (0.6)	1
66Gy, 33#, 6Mv	11 (0.6)	3
70Gy, 35#, 6Mv	11 (0.6)	3

Footnote – SD = standard deviation, SCC = squamous cell carcinoma, *Treatment time = cone beam computed tomography started to treatment completion.

Table 2. Therapeutic radiographer's characteristics

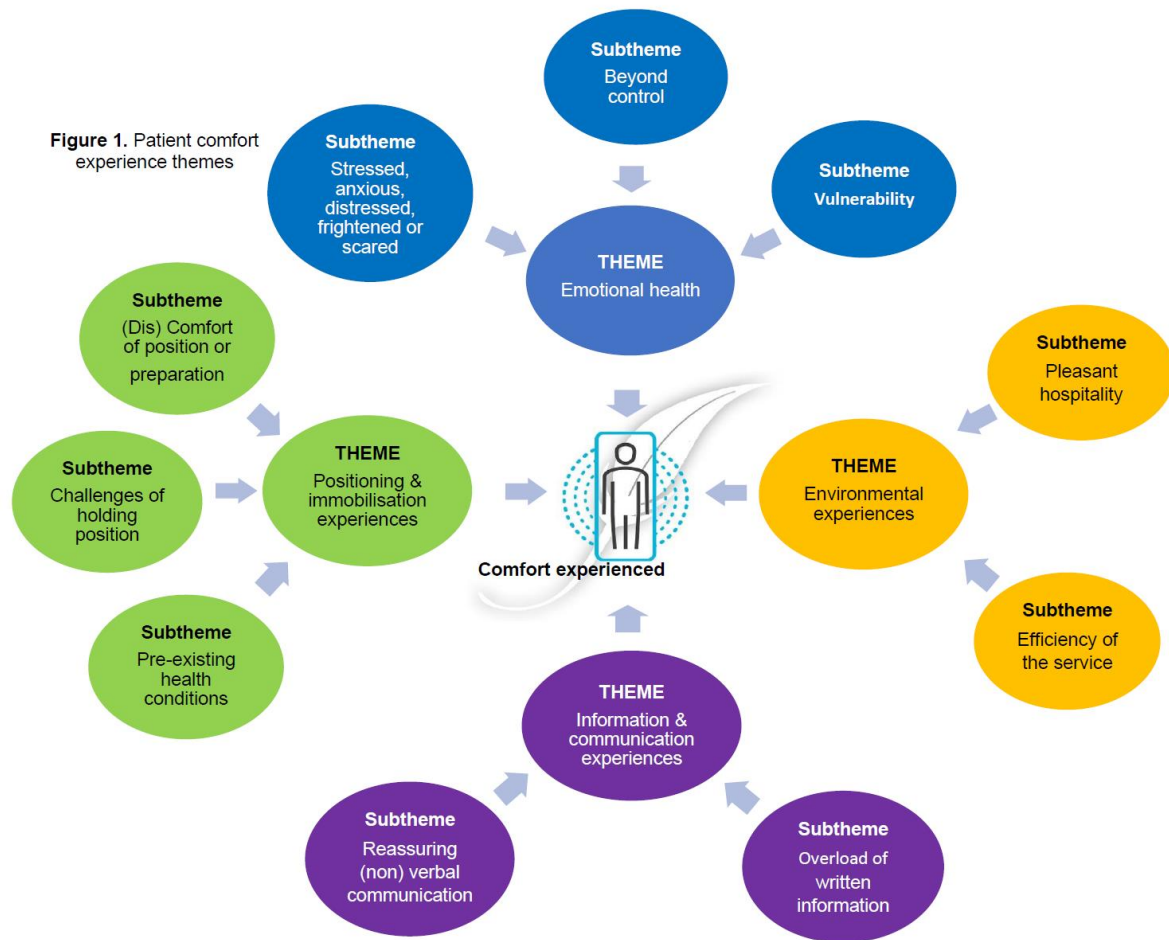
Attribute	n	Mean (SD)
Age (All)	25	35 (9)
Years' experience		11 (9)
		Percentage (%)
Female	20	80%
Male	5	20%
Role		
Lead practitioner	3	12%
Advanced practitioner	5	20%
Senior practitioner	14	56%
Practitioner	3	12%

Comfort experiences of patients

We purposefully report the experiences of the patient participants first as the phenomenon of the study is directly related to the comfort of patients during radiotherapy.

Following thematic analysis, four themes emerged (Figure 1) Emotional Health (3 sub-themes), Positioning and Immobilisation Experiences (3 sub-themes), Information and Communication Experiences (2 sub-themes), and Environmental Experiences (2 sub-themes). The full data set and thematic analysis with related quotations are available in Electronic Supplement Material 2.

Figure 1. Patient comfort experience themes



Emotional Health

The theme Emotional Health entails the negative experiences of radiotherapy for patients. Many patients reported emotional symptoms of stress, anxiety, distress, fright, and being scared when receiving radiotherapy for a range of cancers.

Additionally, some patients voiced feelings of vulnerability during radiotherapy. For patients receiving radiotherapy for head and neck cancer, the negative experiences included the immediate emotional sensation of being restrained in a thermoplastic mask, causing distress or claustrophobia. One patient voiced this emotional response as:

“I was frightened. But it still is frightening but when I had it made, I did not know what was going on in my head, it was not nice and then did not know what was going to happen...” [P01].

Another patient with head and neck cancer described the feelings like:

“I actually felt as though I was in a horror film...” [P12],

while a patient receiving radiotherapy for breast cancer mentioned feelings of vulnerability:

“So, although the people couldn’t be in the room while it is going on. It is radiotherapy, so I do understand the whys and where for so although the comfort level (physical) was as hard, mentally I wasn’t prepared for the feeling of being quite so vulnerable” [P17].

Positioning and Immobilisation Experiences

The Positioning and Immobilisation Experiences theme concerns how patients experience being positioned for accurate radiotherapy including the physical positioning of a patient’s body with or without an immobilisation device to ensure accuracy of treatment. Patients found holding position for a longer time a challenge, that for some was intensified by pre-existing health conditions causing discomfort or pain (e.g., arthritis or previous injury). Patients expressed discomfort being positioned for radiotherapy as:

“Well it is not that comfortable having your arms up, they (the arms) felt really numb because they were up and the blood was going downwards I guess” [P15].

Another patient found being manoeuvred manually a challenge:

“The hardest part is to relax into the table. The moment they touch you and you are tensing again, then as soon as you relax, they move you again you tense up again” [P06].

The experiences of discomfort while being positioned could be worsened with prior conditions as mentioned by a patient with a long-standing injury:

“That was really caused by an accident that I had 50 odd years ago, I lost the muscles in my chest. you do not use those muscles very often until I came here really basically. So that was one thing that was slightly uncomfortable to start with” [P05].

Information and Communication Experiences

This theme describes the patients experiences of receiving sufficient provision of information and communication before and during radiotherapy and referred to information received in a range of formats including written or multi-media to support patient undergoing radiotherapy. The communication between patient and TRs was important to patients. Specifically, patients said they were concerned that they would not be able to inform TRs if they had a problem during radiotherapy, with one breast cancer patient saying:

“I was really worried that if I had a problem, how would they know. I guess I could have waved and they would have stopped the radiotherapy but I was not told it was safe to do this” [P03].

This quote demonstrates how important simple communication is to ease patients' worries and concerns. Furthermore, several patients from all anatomical sites voiced concern over the type and amount of information they received:

“Yes, I am overrun with booklets and other bits of paper telling me what to do” [P16].

The challenge with an overload of information is that there is potential that it will not be read and rather, targeted information may be more appropriate. One patient expressed a need for tailored information when there were too many leaflets:

“I would have liked to choose the type of information, such as a video explanation where I could click to different sections so I could look at my cancer, then how I would get treated by radiotherapy otherwise I threw the leaflets away it was too much” [21].

Environmental Experiences

In addition to having to manage the experience of initial cancer diagnosis, patients also need to deal with the complexities of the radiotherapy environment. The first impressions of entering reception to the high-tech environment and unfamiliar nature of radiotherapy played a major role in the patient experience. Several patients from all anatomical sites found the experience of attending radiotherapy efficient voicing positive and negative comments about the ease of 'check in' with one saying:

“So I found the whole thing really efficient and really well put together...” [P04].

Another patient had an alternative view:

“Although check in was easy I found the automatic check in very impersonal” [P7].

There was also an appreciation for a pleasant hospitality:

“The atmosphere was nice, and I didn’t feel like a cancer patient. I felt like I had nothing wrong with me” [P12].

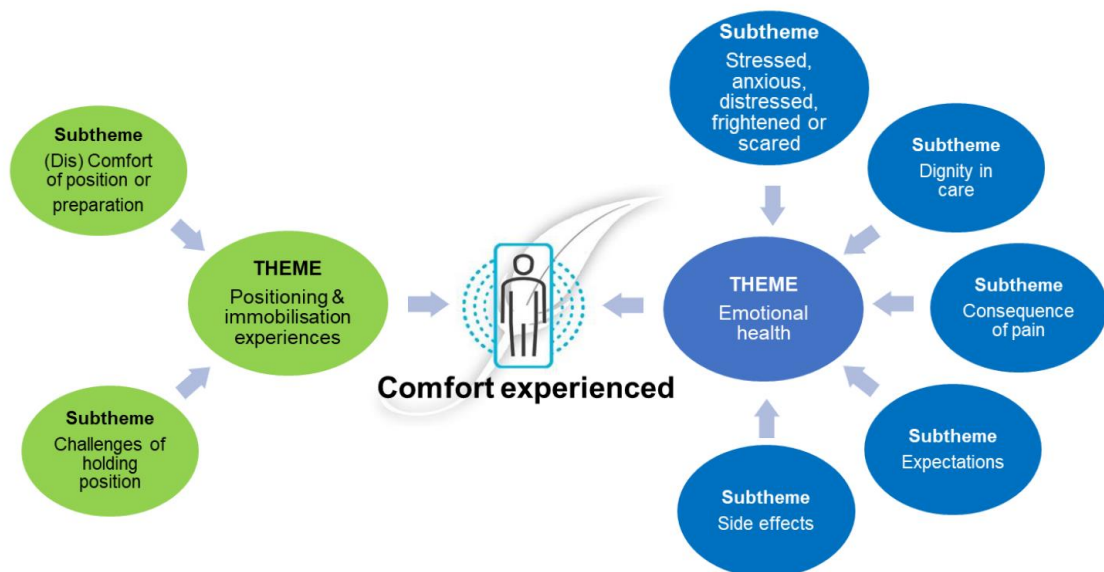
Another patient found the environment not so pleasant:

“The reception and waiting areas had that clinical feel and smell, and radiotherapy (treatment rooms) was something like I have never seen” [P9].

Comfort experiences of Therapeutic Radiographers:

Following thematic analysis, two themes emerged which were similar to themes emerging in the patient analysis (Figure 2.): Emotional Health (5 sub-themes) and Positioning and Immobilisation Experiences (2 sub-themes).

Figure 2. Therapeutic radiographer comfort experience themes



Emotional Health

The theme Emotional Health entails the negative patient experiences of radiotherapy as observed by TRs. The TRs perceived many different views of patients receiving radiotherapy ranging from stress, anxiety, distress, and being scared when confronted with being positioned or immobilised. The TRs remarked on the distress

or claustrophobia of thermoplastic masks for patients receiving radiotherapy for head and neck cancer. They also felt that patients' privacy was compromised, that they suffered from negative experiences due to side effects, pain, and the expectations of patients before and during radiotherapy (e.g. bladder preparation or donning a tight fitting mask). The TRs had observed anxiety or distress in many patients with one TR saying:

"You know you get some patients that say fine come in quietly and then you get other patients that come in and they're very anxious" [R11].

Another TR furthered this view with:

"It's always frightening and scary and they (referring to all patients) have got no idea what to expect. Wham bam thank you ma'am. But they have got to take that for the next 10 weeks every day" [R01].

The TRs also had thoughts on how patients may experience issues with their privacy:

"Again comfort comes in a different number of definitions. For breast patients' comfort may be body perception" [R04].

Finally, patients suffer from the side effects of radiotherapy which impact on emotional health:

"Yeah, patients they get a lot of swelling (referring to all patients), changes that are often easy to monitor and we are much better at treating things, even though their skin is getting sore, and they get difficult to swallowing and breathing, which has an emotional strain for patients" [R24].

Positioning and Immobilisation Experiences

From the perspective of TRs, positioning and immobilisation in radiotherapy includes how patients experience having their bodies positioned 'externally' and 'internally' for accurate radiotherapy. 'Externally' includes the physical positioning of a patient's body with or without an immobilisation device and 'internally' includes internal soft tissue positioning through methods of preparation such as bladder or rectal filling for pelvic irradiation or a breath hold for breast irradiation to ensure accuracy of treatment. The TRs reported that they have supported many patients going through

the discomfort of positioning and immobilisation or experiencing generalised physical discomfort such as cramping. For example, one TR said:

“So it wasn’t always the most comfortable position especially for patients (referring to all patients) so they would often feel cramping like some things, they would usually be able to tolerate without having to stop always” [R13].

Several TRs commented specifically about patients struggling to hold position during treatment:

“Some patients (referring to all patients) manage 10 minutes quite easily whereas other patients struggle with 10 minutes even less than that really” [R05].

Shared experiences of comfort between patients and therapeutic radiographers
The four main themes of the patient and TRs analysis present the experiences of comfort in radiotherapy. The shared experiences between both groups are presented in the two themes Emotional Health and Positioning and Immobilisation Experiences. The themes Information and Communication Experiences and Environmental Experiences only emerged from the patient interviews (Electronic Supplement Material 2).

The theme Emotional Health included three sub-themes from the patients interviews and five sub-themes from the TRs interviews. The common subtheme ‘stressed, anxious, distressed, frightened or scared’ was a shared sub-theme between patients and TRs. One sub-theme emerged only from the patient-interviews and was named ‘vulnerability’. A further four sub-themes were from the TRs-only: ‘consequence of pain’, ‘expectations’ (of patients), ‘privacy in care’, and ‘side effects’.

The theme Positioning & Immobilisation Experiences included a shared sub-theme ‘(dis)comfort of position or preparation’ arising from the interviews of patients and TRs. Another sub-theme occurred among patients and TRs, which was ‘challenges of holding position’. One sub-theme was from patients-only, ‘pre-existing health conditions’.

There were two main themes emerging from the patient interviews only; Information and Communication Experiences and Environment Experiences which included two

sub-themes ('efficiency of the service' and 'pleasant hospitality') with no shared experiences from the TRs. (Electronic Supplement Material 2).

DISCUSSION

This study explored the experiences of comfort with patients receiving radiotherapy treatment and TRs delivering radiotherapy. The main findings highlight aspects of comfort during radiotherapy treatment with time exceeding 10 minutes. The four main themes in our study can be aligned to the comfort theory as described by Kolcaba et al (26), such as our theme Emotional Health relates closely to Kolcaba's 'psycho-spiritual comfort' context in which comfort can occur. Our Positioning and Immobilisation Experiences fit well in the 'physical comfort' context, the Information and Communication Experiences theme can be linked to the 'socio-cultural comfort' context and our Environmental Experiences theme has a close relationship with the 'environmental comfort' of Kolcaba's comfort theory. Overall, the patients do not experience comfort in isolated contexts or like in our study in themes. For example, our sub-theme 'challenges of holding position' during radiotherapy relates to physical comfort although patients experience discomfort (e.g., distress) in the psychospiritual context. This highlights that patient comfort is a complex phenomenon within radiotherapy. It can be suggested that comfort experience in radiotherapy is multidimensional and requires a complex approach to improve patient experiences and outcomes.

The multi-dimensional views of comfort can be observed in the findings of two previous studies exploring experiences of patients with head and neck cancer wearing thermoplastic masks (8,27). Nixon et al (8) explored mask anxiety using quantitative measures and qualitative interviews. They used a validated distress thermometer midway between planning and the end of radiotherapy treatment and found that 26 of 100 patients reported being anxious during radiotherapy. This is consistent with our study where several patients reported being stressed during radiotherapy. Nixon et al (8) identified themes linked to psychological and physiological experiences consistent with Kolcaba's psycho-spiritual and physical contexts of comfort (26). One such theme was 'vulnerability', which arose from claustrophobia of being isolated in a mask and having pre-existing mental health problems. In our study, many patients having cancer across different anatomical sites expressed vulnerability of being in an unknown environment and of being isolated during treatment delivery. A recent qualitative study by Keast et al (27) identified a theme named 'trajectories of mask anxiety' that arose from the distress of mask fitting. In our study, there were many psychological and physiological experiences of discomfort voiced by patients and TRs such as anxiety, distress, being scared and the physiological experiences such as suffering pain

and side effects being similar findings reported in other studies (8,27). It is possible that a greater number of patients with head and neck cancer will suffer distress wearing a thermoplastic mask. However, many patients in our study with cancer in other anatomical site reported some form of anxiety, stress or distress. It has been reported that patients with breast cancer have experienced distress during radiotherapy too (9). This study highlighted the 'experience of being naked' which arose from the need to remain undressed during treatment and to stay with permanent tattoos on their bodies which has similarities with the sub-theme 'privacy in care' as identified by TRs.

In our study, patients expressed how communication can be reassuring, consistent with the literature (9). Probst et al (9) found that patient experience was negatively impacted by the limited answers given by TRs to questions. This is relatable to our sub-theme 'choice of information'. In a survey about the quantity of radiotherapy information, patients responded that they were overloaded with written information which they did not read. Mattarozzi et al (28) surveyed 91 patients with a range of cancers about communication with TRs using non-validated scales to measure attitude towards radiotherapy, pain and discomfort. The relationship with therapeutic radiographers and communication was significantly associated to radiotherapy induced pain intensity and patient attitudes toward radiotherapy (28). Overall, communicating effectively has the potential to improve comfort and support patients (9).

The importance of the environment should not be overlooked as a contributing factor to the overall patient experience of comfort. As a person enters any new environment, they process a mixture of thoughts and feelings. Mullaney et al (29) found that adopting a person-centred approach to the design of the radiotherapy environment affects patient anxiety levels. We discovered that individuals have a preference for personalisation of care such as automated check-in machines versus being greeted by a receptionist or TR. Therefore, the environment of a radiotherapy department remains an important factor for considering comfort experiences.

Study limitations

One researcher conducted all interviews and performed the transcriptions which has the potential for bias. However, the analysis has been conducted with the full research team to secure the credibility, rigour and trustworthiness of the findings including the involvement of the PRP. Another limitation is that patients have been recruited and interviewed from only one radiotherapy centre. Therefore, the findings of the two patient-only themes may not be transferable to other centres. The third limitation is the recruitment strategy of TRs. The TRs were approached via social media, conferences and forums. This might have led to

capturing clinical excellence among a number of TRs which may not represent the full scope of the TR profession.

CONCLUSION

This qualitative study has provided the voice of patients and TRs and their experiences and views of comfort during radiotherapy. Exploring patient comfort in radiotherapy has provided greater insight into patient experiences and how services may be able to tailor treatment and care to patients. The findings have enriched the shared experiences and understanding of comfort by patients and TRs. These shared experiences emphasise the importance of considering comfort holistically and not just from a physical context. The clinical implications of our study can encourage TRs to provide holistic care for their patients throughout the pathway and specifically to comfort patients while they are having treatment. In the short term this could be via simple adaptations to practice including how patients are greeted, effective communication, and positioning and immobilisation procedures accommodating existing health conditions. In the long term, research is needed to develop comfort interventions for patients receiving radiotherapy coupled with testing in clinical trials. It has highlighted some of the positive and negative experiences of comfort based on current UK practice which may support changes to clinical practice.

REFERENCES

1. 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.
2. Wilson JD, Hammond EM, Higgins GS, Petersson K. Ultra-High Dose Rate (FLASH) Radiotherapy: Silver Bullet or Fool's Gold? *Front Oncol*. 2020;9(January):1–12.
3. Hoogeman MS, Nuyttens JJ, Levendag PC, Heijmen BJM. Time Dependence of Intrafraction Patient Motion Assessed by Repeat Stereoscopic Imaging. *Int J Radiat Oncol Biol Phys*. 2008;70(2):609–18.
4. 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.
5. Solberg TD, Balter JM, Benedict SH, Fraass BA, Kavanagh B, Miyamoto C, et al. Quality and safety considerations in stereotactic radiosurgery and stereotactic body radiation therapy: Executive summary. *Pract Radiat Oncol* [Internet]. 2012;2(1):2–9. Available from: <http://dx.doi.org/10.1016/j.prro.2011.06.014>
6. de Ruyscher D, Faivre-Finn C, Moeller D, Nestle U, Hurkmans CW, le Péchoux C, et al. European Organization for Research and Treatment of Cancer (EORTC) recommendations for planning and delivery of high-dose, high precision radiotherapy for lung cancer. *Radiotherapy and Oncology* [Internet]. 2017;124(1):1–10. Available from: <http://dx.doi.org/10.1016/j.radonc.2017.06.003>
7. Goldsworthy SD, Tuke K, Latour JM. A focus group consultation round exploring patient experiences of comfort during radiotherapy for head and neck cancer. *J Radiother Pract*. 2016;15(2):143–9.
8. Nixon JL, Cartmill B, Turner J, Pigott AE, Brown E, Wall LR, et al. Exploring the prevalence and experience of mask anxiety for the person with head and neck cancer undergoing radiotherapy. *J Med Radiat Sci*. 2018;65(4):282–90.
9. 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>
10. Li W, Purdie TG, Taremi M, Fung S, Brade A, Cho BCJ, et al. Effect of immobilization and performance status on intrafraction motion for stereotactic lung radiotherapy: Analysis of 133 patients. *Int J Radiat Oncol Biol Phys*. 2011 Dec 1;81(5):1568–75.
11. Grills IS, Hugo G, Kestin LL, Galerani AP, Chao KK, Wloch J, et al. Image-Guided Radiotherapy via Daily Online Cone-Beam CT Substantially Reduces Margin Requirements for Stereotactic Lung Radiotherapy. *Int J Radiat Oncol Biol Phys*. 2008 Mar 15;70(4):1045–56.
12. Wang W, Yang H, Hu W, Shan G, Ding W, Yu C, et al. Clinical Study of the Necessity of Replanning Before the 25th Fraction During the Course of Intensity-Modulated

- Radiotherapy for Patients With Nasopharyngeal Carcinoma. *Int J Radiat Oncol Biol Phys.* 2010 Jun 1;77(2):617–21.
13. Hubie C, Shaw M, Bydder S, Lane J, Waters G, McNabb M, et al. A randomised comparison of three different immobilisation devices for thoracic and abdominal cancers. *J Med Radiat Sci.* 2017 Jun 1;64(2):90–6.
 14. 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.
 15. 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>
 16. Nutting CM, Khoo VS, Walker V, McNair H, Beardmore C, Norman A, et al. A randomised study of the use of a customised immobilisation system in the treatment of prostate cancer with conformal radiotherapy. *Radiotherapy and Oncology.* 2000;54(1):1–9.
 17. 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.
 18. Fletcher J. What is heterogeneity and is it important? *Br Med J.* 2007;334:94–6.
 19. Creswell, John W; Creswell D. *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* - John W. Creswell - Google Books [Internet]. 4th ed. California: SAGE publications Ltd.; 2014 [cited 2020 Mar 26]. 1–273 p. Available from: https://books.google.co.uk/books?id=PViMtOnJ1LcC&printsec=frontcover&source=gb_s_ge_summary_r&cad=0#v=onepage&q&f=false
 20. Yin RK. *Qualitative research from start to finish.* 2nd ed. Guilford, UK: Guilford Press; 2011. 1–320 p.
 21. Sedgwick P. Non-response bias versus response bias. *BMJ (Online)* [Internet]. 2014;348(April):1–2. Available from: <http://dx.doi.org/doi:10.1136/bmj.g2573>
 22. Braun V, Clarke V. Using thematic analysis in psychology. *Qual Res Psychol.* 2006;3(2):77–101.
 23. Farmer T, Robinson K, Elliott SJ, Eyles J. Developing and implementing a triangulation protocol for qualitative health research. *Qual Health Res.* 2006;16(3):377–94.
 24. Guba E, Clark D, Havlicek L, Mclaughlin J, Miskel C, Guba E, et al. ERIC / ECTJ Annual Review Paper Criteria for Assessing the Trustworthiness of Naturalistic Inquiries. *Educational Communication and Technology* [Internet]. 1982;29(4):75–91. Available from:

http://www.google.de/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&ved=0CDIQFjAB&url=http://link.springer.com/chapter/10.1007%252F978-94-009-6669-7_18&ei=xc1ZVL_AE4i3ONjKgZgl&usg=AFQjCNGrijcV39B_brg3m3D7S6dw9zcyhw&bvm=bv.78677474,d.ZWU&cad=rja

25. Graneheim UH, Lundman B. Qualitative content analysis in nursing research: Concepts, procedures and measures to achieve trustworthiness. *Nurse Educ Today*. 2004;24(2):105–12.
26. Kolcaba KY. Holistic comfort: operationalizing the construct as a nurse-sensitive outcome. *ANS Adv Nurs Sci*. 1992;15(1):1–10.
27. Keast R, Sundaresan P, Burns M, Butow PN, Dhillon HM. Exploring head and neck cancer patients' experiences with radiation therapy immobilisation masks: A qualitative study. *Eur J Cancer Care (Engl)*. 2020;29(2):1–9.
28. Mattarozzi K, Fino E, Panni V, Agostini A, Morganti AG, Russo PM. The role of effective radiation therapist-patient communication in alleviating treatment-related pain and procedural discomfort during radiotherapy. *Patient Prefer Adherence*. 2019;13:1861–5.
29. 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.

Electronic Supplement Material 1 Interview guides

PATIENT INTERVIEW GUIDE

- **How was your experiences with your radiotherapy so far?**

PROMPT:

How did you find your initial appointments in radiotherapy such as your CT planning scan?

Can you tell me how you felt before you were about to have your radiotherapy CT planning scan?

Can you tell me whether you were comfortable during your radiotherapy CT planning scan?

Can you tell me whether you were comfortable after your radiotherapy CT planning scan?

When you come into the centre to have your treatment, what is it like for you (or how do you find it)?

- **How do you feel being positioned and maintaining position for radiotherapy on the couch for more than 10 minutes during treatment?**

PROMPT:

Can you tell me how you feel before you are about to have the radiotherapy treatment?

Can you tell me whether you are comfortable or not during radiotherapy treatment?

Can you tell me whether you are comfortable after radiotherapy treatment?

- **Have you or you're the radiographers tried anything to help with getting into position and keeping in position during treatment?**

PROMPT:

If yes, what have you tried to improve your comfort?

If no, have you any thoughts about what could be done to improve your comfort during your radiotherapy treatment?

- **Have you any thoughts about what we could do to improve your comfort during radiotherapy?**

PROMPT:

If anything were possible, what would you do?

- **Is there anything else you would like to add?**

Therapeutic Radiographer INTERVIEW GUIDE

- **What are your experiences when delivering radiotherapy to patients with more than 10 minutes?**

PROMPT:

Thinking about your recent experiences working with patients having extended treatment times, what do you think is important to provide effective/efficient treatment?

- **Tell me what you think about the comfort of your patients during radiotherapy?**

PROMPT:

What is it like positioning patients for stability and ensuring they do not move for more-than 10 minutes?

- **What do you do to improve patient comfort during extended treatment times?**

PROMPT:

If you intervene to improve comfort, what have you tried?
If you have not, have you any thoughts about what could be done to improve your comfort during your radiotherapy treatment?
If uncertain, is there anything you would want to change or improve about your practice?

- **Is there anything else you would like to tell me about your experience?**

Electronic Supplement Material 2 Emergent themes and subthemes of comfort experiences

Themes	Subthemes	Example of patient quotes	Example of therapeutic radiographer quotes	Shared experiences
Emotional health				Shared experience
	Stressed, anxious, distressed, frightened or scared	<p><i>P01: I was frightened. But, it still is frightening it is but when I had it made I didn't know what was going on in my head it wasn't nice and then didn't know what was going to happen and its was on my face and then its not a nice thing the mask is not nice at all I, am actually frightened to open my eyes. Cos if I open my eyes the laser might go.</i></p> <p><i>P12: I actually felt as though I was in a horror film, only because I had been watching a lot of horror film. Ooh no I just think that's my imagination running away with me really.</i></p>	<p><i>R01: It's always frightening and scary and they have got no idea what to expect. Wham bam thank you ma'am. But they have got to t take that for the next 10 weeks every day.</i></p> <p><i>R11: You know you get some patients that say fine come in quietly and then you get other patients that come in and they're very anxious.</i></p>	Shared experience. There was a good balance of quotes highlighting the impact of stress, anxiety distress, fright from the perspective of patients and therapeutic radiographers. Some quotes completely match the context for example the use the word 'frightened' and 'frightening' by both patients and therapeutic radiographers.

Themes	Subthemes	Example of patient quotes	Example of therapeutic radiographer quotes	Shared experiences
	Vulnerability	<p><i>P12: Yes, so I knew what to expect apart from my feelings of being in the horror film and vulnerable a little bit.</i></p> <p><i>P17: So, although the people couldn't be in the room while it is going on. it is radiotherapy so I do understand the whys and where for so although the comfort level was as hard as it could be, mentally I wasn't prepared for the feeling of being quite so vulnerable.</i></p>	<i>No quotes for this subtheme</i>	Patient only sub-theme
	Beyond control	<p><i>P01:and then didn't know what was going to happen and its was on my face</i></p> <p><i>P08: They always let me know when they are going out the room because for those two to five minutes that you are on there you are kind of at their mercy.</i></p>	<i>No quotes for this subtheme</i>	Patient only sub-theme
	Consequence of pain	<i>No quotes for this subtheme</i>	<p><i>R02: I mean we have already talked about the palliative patients and you know people in pain find it difficult to keep still.</i></p> <p><i>R19: If they are being treated for some time it can be painful.</i></p>	Therapeutic radiographer only sub-theme.

Themes	Subthemes	Example of patient quotes	Example of therapeutic radiographer quotes	Shared experiences
	Privacy in care	No quotes for this subtheme	<p>R04: Again comfort comes in a different number of definitions. For breast patients comfort may be body perception. So their perception of themselves with no top on. Self-conscious because of post-surgical scars or a double mastectomies they may not be overall happy with the condition that their breast area has been left in they might feel, I think I've seen a lot of reports it reduces their femininity as it where it reaches that female identity somewhat. So they might feel that is a key issue in terms of their emotional comfort.</p> <p>R10: No one really got covered up no matter what their treatment was for dignity. That's just sounds hard but they are suitable due to the metal studs and then were before we tried to use tissue the air conditioning blew it off.</p>	Therapeutic radiographer only sub-theme.
	Expectations	No quotes for this subtheme	<p>R12: What comes to mind initially is the head and neck shell. I think for anybody who has a shell for over 10 minutes a big ask for people I think.</p> <p>R23: I think we're all guilty of perhaps pushing patients a little bit more than we should to get them in a position that's going to mean that they have no control over what is happening to them.</p>	Therapeutic radiographer only sub-theme.

Themes	Subthemes	Example of patient quotes	Example of therapeutic radiographer quotes	Shared experiences
	Side effects	No quotes for this subtheme	<p>R02: You've got to tell them to not drive for a bit and that's where you know you're not knocking them out, but you know that's all about getting him in the position and keeping him in the position. I know that in the past and other places I've worked where they've done stereotactic radiotherapy, I've talked about actually we could do stereotactic for treating certainly brain patients.</p> <p>R24: Yeah, patients they get a lot of swelling, changes that are often easy to monitor and we are much better at treating things, even though their skin is getting sore, and they get difficult to swallowing and breathing, which has an emotional strain for patients.</p>	Therapeutic radiographer only sub-theme.
Positioning & immobilisation experiences				Shared experience
	(Dis) Comfort of position or preparation	P06: Well radiotherapy, its very uncomfortable I've noticed. Its nobody's fault though. If that means I will be uncomfortable for 20 minutes then damn it I will be uncomfortable for 20 minutes on a daily basis. It is for my own good to get rid of this	R13: Patients would often get uncomfortable during those that get and the bolus material to warm up they don't have to be specific position with their knees. So it wasn't always the most comfortable position especially for patients so they would often feel cramping like some things they would usually be able to tolerate without	Shared experience between patients and therapeutic radiographers.

Themes	Subthemes	Example of patient quotes	Example of therapeutic radiographer quotes	Shared experiences
		<p>thing.</p> <p>P15: Well it is not that comfortable having your arms up and I did think oh crumbs and I thought how long am I going to have to hold them up , there was one day I thought I am going to really ,they felt really numb because they were up and the blood was going downwards I guess . I thought if I have to stay here a long time, I am not going to feel my arms so that slightly freaked me out.</p>	<p>having to stop always.</p> <p>R17: Well yeah I would say it's not very comfortable for patients to have their arms up because you find that they end up with pins and needles in their arms so high up they end up losing the sensation in the fingers as well.</p>	
	Challenges of holding position	<p>P06: The hardest part is to relax into the table. The moment they touch you and you are tensing again , then as soon as you relax they move you again you tense up again. That is the hardest part really' is to relax. It is not that it's because they want you in a certain position and you are trying to hold that position for them and at the same time they are saying relax now.</p>	<p>R05: Some patients manage 10 minutes quite easily whereas other patients struggle with 10 minutes even less than that really. So, it's kind of just managing it on how the patient is. I mean from personal experience because last week I was actually made to lie on the bed have a treatment mask made and ever since I was on the bed for 20 minutes and I was not a patient it is actually quite difficult for me to think about my patients having to be on the bed for just 10 minutes when they have got issue with the machine or what have you. I was genuinely empathetic</p>	<p>Shared experience between patients and therapeutic radiographers.</p>

Themes	Subthemes	Example of patient quotes	Example of therapeutic radiographer quotes	Shared experiences
		<i>P21: There were times with my arms where I had to hold them in the cups during radiotherapy, and it didn't feel natural at all. An odd position.</i>	<i>with them quite a lot.</i> <i>R10: Well the first thing that we do is question is the patient was actually capable of holding position. Okay so if they were unable to keep the arms above their heads and it was causing a lot of strain because then they would constantly stop over course of the treatment.</i>	
	Pre existing health conditions	<i>P05: That was really caused by an accident that I had 50 odd years ago ,I lost the muscles in my chest . you don't use those muscles very often until I came here really basically. So that was one thing that was slightly uncomfortable to start with.</i>	<i>No quotes for this subtheme</i>	Patient only sub-theme

Themes	Subthemes	Example of patient quotes	Example of therapeutic radiographer quotes	Shared experiences
		<i>P16: But that's only because I've got a lot of back problems and it wasn't hard at the time, but it was afterwards that it hurt. But you can't do anything about that, that's not your fault. That happens to be my back that's all.</i>		
Information & communication experiences				Patient only experience
	Reassuring (non) verbal communication	<i>P03 I was really worried that if I had a problem, how would they know. I guess I could have waved and they would have stopped the radiotherapy but I was not told it was safe to do this. P03: But I mean you know your not going to suffocate, and anytime you can of course wave and they will</i>	<i>No quotes for this subtheme</i>	Patient only sub-theme

Themes	Subthemes	Example of patient quotes	Example of therapeutic radiographer quotes	Shared experiences
		<p><i>stop. So, the key thing really is the reassurance that your given by the radiotherapists because they know exactly what's happening, they know how you might react. I think they have been really good here. Explaining what's going on and reassuring.</i></p> <p><i>P14: Sometimes I want to know more. Other times I am Just quite happy to going along with the people that knows.</i></p>		
	Overload of written information	<p><i>P16: Yes, I am overrun with booklets and other bits of paper telling me what to do.</i></p> <p><i>P17: It is one of those experiences, your brain is so overloaded with information especially with being and all the elements before treatment could start the feeding tube that they wanted to put in my stomach.</i></p> <p><i>P14: Yeah, I mean I wouldn't have known anything more. They gave me all these leaflets to read and I never read them because I didn't want to.</i></p> <p><i>P21: I would have liked to choose the type of information, such as a video explanation where I could</i></p>	<i>No quotes for this subtheme</i>	Patient only sub-theme

Themes	Subthemes	Example of patient quotes	Example of therapeutic radiographer quotes	Shared experiences
		<i>click to different sections so I could look at my cancer, then how I would get treated by radiotherapy otherwise I threw the leaflets away it was too much.</i>		
Environment	Efficiency of the service	<p><i>P04: So I found the whole thing really efficient and really well put together. I think the XX centre works on the basis that this is my theory anyway, that people coming through the door are having a bad day. So lets not make that any worse. And its almost as if someone's put that together at some point and said right this is the vision.</i></p> <p><i>P23: It's easy to check yourself in; you don't have to wait for anybody in reception which I think is a good thing. They've been holding back automating all that sorts of things and obviously to come straight through to the radiotherapy.</i></p> <p><i>P7: Although check in was easy I found the automatic check in very impersonal.</i></p>	<i>No quotes for this subtheme</i>	<p>Patient only experience</p> <p>Patient only sub-theme</p>

Themes	Subthemes	Example of patient quotes	Example of therapeutic radiographer quotes	Shared experiences
	Pleasant Hospitality	<p><i>P01: Definitely a tea machine, even a little bit of music. Before we go in, liven it up a bit. Not like a disco. You would feel warmer. Its got a warmer feel in the main waiting area than in the radiotherapy waiting area.</i></p> <p><i>P12: The atmosphere was nice, and I didn't feel like a cancer patient I felt like I had nothing wrong with me. But I thought I'm just going for a bit of treatment to sort a problem out.</i></p> <p><i>P12: The reception and waiting areas had that clinical feel and smell, and radiotherapy was something like I have never seen.</i></p>	No quotes for this subtheme	Patient only sub-theme