Breast cancer survivors' perceptions of cardiovascular risk following radiotherapy in the United Kingdom.

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Breast cancer survivors' perceptions of cardiovascular risk following radiotherapy in the United Kingdom

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ABSTRACT

Introduction: Modern adjuvant treatments for early-stage breast cancer have improved survival rates, shifting clinical focus towards managing long-term effects such as radiation-induced cardiovascular disease (CVD). This study aimed to evaluate and explore, amongst breast cancer patients treated with non-palliative radiotherapy, their awareness, understanding, risk perceptions and health beliefs around CVD & cardiovascular late effects of radiotherapy.
Methods: Purposeful sampling was used to recruit participants with lived experience of early breast cancer, to explore their perceptions and understanding of the risks of cardiovascular late effects following adjuvant left-sided radiotherapy. University ethical approval was obtained. Participants were recruited for interview through Breast Cancer Now. Each interview was audio-recorded, transcribed *verbatim* and thematically analysed.
Results: Ten semi-structured interviews were completed with participants aged between 42 and 56, across three UK nations. Analysis established four themes: Knowledge and perception of risk, Heart-health follow-up, Heart-healthy behaviours and Needs and preferences. Participants were indirectly aware of CVD risks via discussions on heart volume mitigation techniques by their radiotherapy healthcare professionals, but direct information on the risks, as well as health promotion conversations were lacking.
Conclusion: Despite receiving complex radiotherapy with known cardiac implications, women often feel under-informed about long-term cardiovascular risks. The provision of timely information can support the process of informed consent and support patients to be active in their own self-management and care, helping to mitigate long term CVD risk.
Implications for practice: To improve outcomes, radiotherapy teams must deliver timely, clear, and personalised information, supported by standardised tools. Our findings support calls for national survivorship protocols to include cardiovascular monitoring for high-risk breast cancer survivors.

Introduction

Breast cancer is the most common cancer in the United Kingdom (UK), with an annual incidence of 56,800.[1] Due to modern treatment strategies, survival rates over the last decade have nearly doubled, 25 % of women will survive their cancer for five years after they are diagnosed.[1] This increase in survival rates brings new challenges to the medical community, leading to the potential for increased risk of long-term cardiac consequences associated with radiotherapy, chemotherapy, and endocrine therapy.[2] In patients with left-sided breast cancer, radiotherapy increases ischemic heart disease risk in a dose-dependent manner. Minimising heart exposure is key to reducing long-term cardiac risk and supporting survivor well-being.[3] Epidemiological evidence demonstrates that ischaemic heart disease is the world's biggest killer, responsible for 13 % of total deaths.[4] There are several known cardiovascular complications, such as left ventricular dysfunction, myocardial ischemia and hypertension which are associated with anticancer drugs and radiotherapy. Some drugs, such as anthracyclines or other biological agents, such as

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Trastuzumab have also been known to cause irreversible cardiac dysfunction.[5–7] Targeted therapies are considered less toxic and better tolerated by patients, however, rare but severe cardiovascular complications can still occur.

Adjuvant radiotherapy for early breast cancer plays an integral and major role in its treatment, preventing local and regional recurrence and potentially benefiting survival.[8] However, there is a growing body of evidence that illustrates an increased lifelong risk of radiation induced cardiac disease (RICD) from adjuvant radiotherapy, and survivors can live with this burden.[8] Radiation associated cardiovascular toxicity are of likely greater clinical importance in younger patients and those and with curable disease, creating time for them to develop cardiac injury.[9]

Incidental irradiation of the heart due to its presence within the treatment field may result in a variety of RICD, which can occur many years after treatment. Cardiac complications, mostly related to the left anterior descending (LAD) and right coronary artery commonly present 10–15 years post radiotherapy.[10–12] Cardiotoxicity has been shown to cause ischemic heart disease, congestive heart failure, arrhythmias, conduction defects, valvular disease or pericarditis.[13–15]

The volume of heart irradiated, referred to as Mean heart dose (MHD) correlates with cardiac damage.[12,16] With no minimum threshold, even the smallest exposure may pose a cardiac risk.[16,17] MHD is an excellent surrogate for the risk of apparent RICD from older treatment techniques, the advances of modern radiotherapy, including 3-dimensional (3D) planning and new treatment techniques such as deep inspiration breath hold (DIBH) have reduced cardiac exposure.[16] Despite a lower MHD, conformal techniques can often generate hot spots in the cardiac substructure.[18]

Population based studies suggest that the cumulative RICD event risk amongst patients having had left sided radiotherapy is up to 2 % over a 10 yr period.[8] The effects of radiation on the heart are magnified by individual cardiac risk factors, which include confounding co-morbidities, such as hypertension, diabetes, smoking, obesity, and history of heart disease.[19] RICD amongst those without individual cardiac risk factors may only be small.[20] Women with even one of these risk factors showed a nearly 2-fold higher risk of major coronary events and patients with a history of ischemic heart disease have > 6-fold higher risk of major coronary events than those without.[20]

Racial and ethnic minority populations are also at a higher risk compared to the European white population.[19] Many studies have highlighted the need for guidelines to prevent, monitor and treat cardiac side-effects.[8,21–23] One such recommendation is the optimisation of care through the implementation of cardio-oncology, which involves collaboration between Oncologists and Cardiologists. In some countries this has led to the emergence of a new generation of 'cardio-oncologic' investigators,[24–26] whose aim is to facilitate breast cancer treatment while minimising cardiac damage and reducing the risk of cancer treatment interruption.[27]

Being informed of personal risk factors can enable patients to modify their lifestyle, screening, and health behaviours to further limit personal risk.[20,28] At present there is limited understanding of how the risk of RICD is communicated to patients across healthcare services in the UK, or how consistently healthcare professionals support them in engaging with heart-healthy lifestyles.

In late 2020, the National Cancer Research Institute (NCRI) Living with and beyond late consequence group, developed the Heart4Health (H4H) project. The work focuses on James Lind Alliance Research Priority 2, which explores how patients and their carers can be appropriately informed about the long-term and late effects of treatments, and how this information influences their treatment choices.[29]

Our study aimed to explore the perception and understanding of the risks of RICD by UK patients diagnosed and treated for breast cancer.

Method

Study design

The qualitative research project was conducted within a constructivist research paradigm. Women who had been diagnosed and treated with non-palliative radiotherapy for early stage left-sided breast cancer since 2014 were included. Appendix 1 outlines all participant inclusion and exclusion criteria.

A semi-structured interview schedule (IS) (appendix 2) was co-developed by the authors and patient, public involvement and engagement (PPIE) representatives. The IS was peer reviewed by the wider members of the H4H group and a pilot interview was undertaken virtually with a patient representative. This provided an opportunity to 'test' the suitability of interviews for data collection, review structure and format and make any required modifications to the IS prior to data collection.[30] The IS was used across all interviews by a single interviewer to maintain the consistency. The questions were supplemented, when appropriate by follow-up questions dependent on the participant response. This format providing a systematic and comprehensive method for exploring responses, and flexibility whilst ensuring the interview was focused on the desired topic of interest.[31]

Sampling and recruitment

Purposeful sampling was used to recruit participants with lived experience of the diagnosis and radiotherapy treatment for early left-sided breast cancer. Guided by the principles of information power, a less extensive sample was needed as each participants held characteristics that were specific for the aims of the research.[32] Participants were recruited via email, with an advert distributed by Breast Cancer Now (BCN) through their monthly bulletin to over 3000 members. The advertisement included a link to register an expression of interest, through which potential participants were asked to provide their contact details, information related to their diagnosis to facilitate screening alongside limited demographic data for participant stratification. Eligible participants were stratified by the authors, with an aim to maximise variation in geographical locations of radiotherapy treatment centres, and a range of participant ages, socio-economic and ethnic backgrounds helping to obtain variation within the participant group of their lived experience[32] (Fig. 1). On completion of the stratification criteria, potential participants were contacted by telephone/email as per their preference, provided with a patient information sheet (PIS) and consent form in advance of arranging the interview at a time convenient to them.

Data collection

To facilitate participant involvement, online interviews took place using Microsoft Teams or Zoom platforms, dependant on preference. The interviews lasted between 30 and 45 min, each were video recorded, with Dictaphones used us a secondary data capture. Telephone interviews were also offered, only one participant accepted this. Recordings were transcribed following each individual interview by the lead author supporting the process of data immersion by reading, reflecting, and connecting with the data. Each were then pseudonymised and all identifiable details removed to maintain confidentiality. Recordings and all

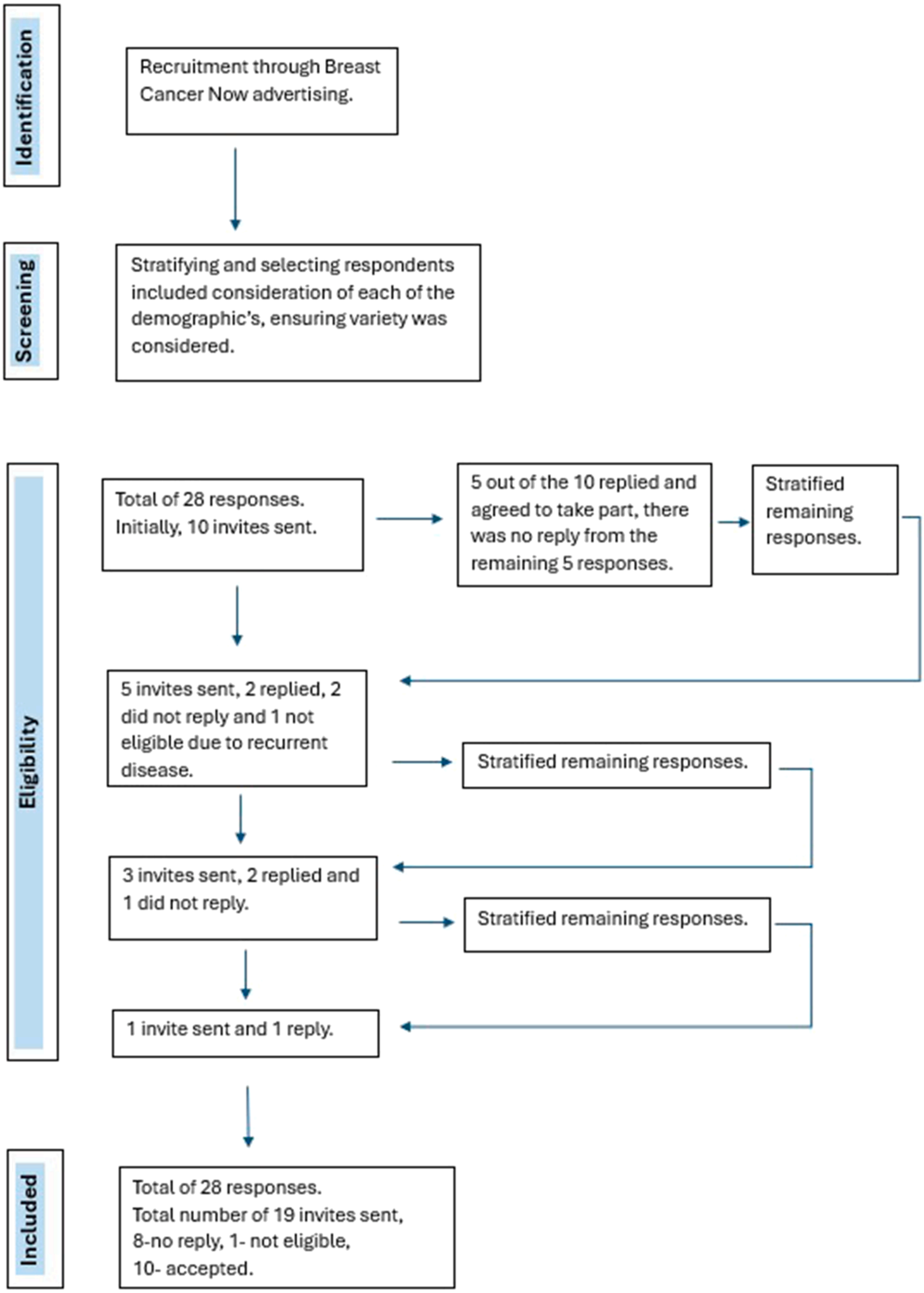

Figure 1. Recruitment and sampling strategy.

documentation were stored and destroyed in accordance with ethical approvals.

Data analysis

Thematic analysis was conducted in accordance with the principles outlined by Terry et al.,[33] The analysis was carried out in two stages: (1) initial coding and (2) theme development. This approach facilitated the systematic coding, categorisation, and identification of patterns within the data[34] with each process repeated 4 times until no new themes occurred. Quirkos software was utilised to support the organisation and management of thematic codes throughout the analysis process.[35] To mitigate the influence of personal bias, the transcripts and the analytical codes/themes were independently reviewed by (author to be inserted) themes were discussed and agreed with (author to be inserted), with the option to include a third team member if any disagreements had occurred.[36] The themes were discussed with our PPIE representatives, and each participant was emailed a summary version of the themes and supporting quotes. No modifications were requested during the process of member checking.

Ethical considerations

Higher Education Institution ethical approval was obtained, including General Data Protection Regulation (GDPR). As a potentially emotive subject, the welfare of participants was considered throughout. Participants were informed they could take a break or stop the interview at any time and were also provided the contact details of a named individual at BCN should they experience any distress at the point of interview. Participant recruitment was undertaken through BCN, Health Research Authority (HRA) approvals were not required.

Reflexivity

As a research team composed of clinical and academic therapeutic radiographers, with the Lead Researcher being a clinical radiographer with experience in oncology care, we recognise that we are not representative of those we were seeking to understand. Frequent analysis meetings provided the opportunity for reflection and a space for discussion. Engaging those with personal lived experiences as PPIE representatives, ensured the findings were representative of and shaped by the participant voice, void of clinical preconceptions.

Results

Ten semi-structured interviews were undertaken between December 2021 and January 2022 (Fig. 1). The majority of participants (n = 8) were recruited from England, and ages ranged from 42 to 56 years old. Full demographic data can be found in Table 1.

Table 1
Participant demographics.

Age	Range: 42 -56
	Mean: 50.9
Ethnicity	White n = 4
	British n = 1
	Indian n = 1
	White, British n = 3
	Non-white, British n = 1
Marital status	Married n = 6
	Divorced n = 2
	Single n = 2
Employment status	Self-employed n = 1
	Part-time n = 1
	Full-time employed n = 2
	Employed n = 3
	Taking time out at present n = 1
	Part-time freelance n = 1
	Unemployed n = 1
Education level	Doctoral n = 1
	Postgraduate degree n = 3
	Undergraduate degree n = 5
	GCSE n = 1
Year diagnosed.	2021 n = 1
	2020 n = 1
	2019 n = 2
	2018 n = 1
	2016 n = 4
	2015 n = 1
Pre-existing heart conditions	No = 10
Region of radiotherapy delivery	South West n = 1
	Scotland n = 1
	London n = 4
	Wales n = 1
	West Midlands n = 2
	South East n = 1

The themes and subthemes generated from the data analysis are shown in Table 2. All participants contributed to the four themes: knowledge and perception of risk, heart health follow-up, heart-healthy behaviours and needs and preferences. Each theme and its related sub-theme are explored in the following section. The quotations derived from the interviews were used to support the themes and subthemes.

Knowledge and perception of risk

The analysis revealed a general lack of awareness, understanding, and perception of the risk of cardiovascular late effects associated with radiotherapy among participants. While participants reported receiving substantial verbal and written information prior to the initiation of radiotherapy and during the consent process, information specifically addressing the potential risks of late cardiac toxicity was perceived to be limited or, in some cases, absent.

> *“So, they didn’t give me a lot of information ya know really. They did mention it but didn’t go into it a lot”* (P1)

Further exploration of their narratives however illustrated their healthcare professionals (most commonly the patient's Consultant and/or Therapeutic Radiographer(s)) did mention risks, but rather than directly providing information, this was communicated indirectly through the explanation of how the risk would be mitigated.

> *“he did touch on it, he said, we’ll keep it to a minimum, can damage heart and can damage lungs, if you have an x-ray in the future, you might see some lung changes that will probably be due to the radiotherapy. We will do breath-hold to try and move your heart so that it won’t get touched. He didn’t go into any longer-term stuff”* (P1)

Some participants even felt the risks had been downplayed

> *“it didn’t seem like it was a particularly big risk or a big deal”* (P2)
>
> *“so I suppose I wasn't really made aware of a big risk, but I was told that you know about the purpose of the treatment and to avoid the heart.” (*P8)

Heart health follow-up

Except for those who were prescribed Herceptin, the participants reported no information was provided or discussion with their healthcare practitioners about heart-health following treatment.

> *“there was no long term, I wasn’t told about any long-term follow-up or anything like that.” (*P1)
>
> *“I don’t remember there really being any particular follow up regards the heart”* (P2)
>
> *“I had like another meeting at the end of my final* radiotherapy *appointment I think, just to say, ‘right, ok you know what to do, contact us if you’ve got any issues or blah di blah’. Again, nothing at the end was ever mentioned about long-term heart implications, yeah nothing at all”* (P10)

Typically, participants were provided with an open access nurse follow-up, summarising treatment delivered but no plan was discussed for future heart health monitoring.

Table 2
A summary of themes, subthemes and relevant quotes.

Themes	Sub themes	Quotes
Knowledge and perception of risk	• Radiotherapy side-effects • Informed about heart health risks • Perception of risks • Minimal information provided • Lack of written information about heart health • Cannot recollect if risks discussed • Faith, confidence and trust in professionals and treatment • Risks played down • Felt protected from information • Reason for DIBH explained • Written information provided • Treatment for cancer priority over heart health	*“Yeah, I mean there was no long term, I wasn't told about any long term follow up or anything like that” Participant* (P1) *“They told you absolutely nothing, they basically, all they say is a very, very, really small risk of there being heart damage”* (P7) *“No, just the fact that, just that there was potential for heart damage, but not any detail”* (P9) *“It didn't feel like a very high risk that they need to go through in any more detail than ….this is it, this is what we are gonna do about it, here's the consent form read through and are you happy to sign”* (P3) *“It wasn't, there was no proper information it was just ‘oh it's very small, you won't get it, don't worry”* (P7) *“It was just about making sure I did the breath hold and practiced that and did what I needed to do there because they weren't making a big deal of it”* (P3)
Heart-health follow-up	• Perception of risks • Self-awareness of lifestyle & exercise changes • Information at follow up- minimal information about risks • Heart health-post treatment concerns • Heart health- not concerned at the time • Desire to know	*“I guess it wasn't dwelt on as a potential future heart condition or heart problem, it was all managed as part of the basic treatment, so it didn't feel like that there was anything needed over and above”* (P3) *“I mean it, it, it didn't seem like it was ya know a particularly a big risk or a big deal and obviously there was the measures put in place to make sure that it was limiting the effects on, on, on the other elements”* (P2) *“I'm getting the impression generally this, this is the first major sort of health issue I've had and very much started asking more and more questions as we've been going along because in the beginning, you just sort of trust what people say, and then you sort of just start delving into it and a lot more”* (P4) *“Yeah, I mean there was no long term, I wasn't told about any long term follow up or anything like that”* (P1) *“was more about how do you feel generally and there was no specific heart related queries or concerns and nothing that was on my mind either to raise it was all everything kind of just stemmed from breast cancer, breast treatment, how that felt how my body felt generally mentally, physically” (P3)*
Heart healthy behaviours	• Self-awareness of lifestyle and exercise • Self-led search for information • Not made aware of extra support	*“I've just become, I guess more conscious of health generally. So yeah, this recognising the need to not to be sedentary …..it's just made me more aware I guess on what healthy eating and healthy living and again just conscious of the foods I'm eating”* (P3) *“Yeah, I think they just briefly went through, ya know, what you had and what treatment you had and just sort of summarised it and they sort of talked about ya know, lifestyle and things and if you had any concerns, things like that”* (P7) *“I mean I am fit, I exercise every day, I do aerobic exercises as well as weight training and yoga, so I'm so I'm quite fit and I'm aware of the kind of importance of it. But I didn't get any guidance on that”* (P1) *“No, it wasn't mentioned. It wasn't mentioned by the radiotherapists specifically. I'd seen it in the breast cancer now leaflets and on their website, there's a lot of information about, but it always to me, it always seems like it's the usual stuff, isn't it?. It's like the answer to everything is eat less, exercise more”* (P4) *“I have to try and push myself, cause I know it's for the greater good to sometimes push yourself and I do have off days, do have really bad days that's because of the endocrine treatment that I'm on, that really does take its toll, so. To get, in that respect I do, I have changed my diet and lifestyle generally”* (P10) *“it would have been nice to have that extra information in terms of things to watch out for”* (P9)
Needs and preferences	• Self-led search for information • Felt protected from information • Risks played down • Informed about heart health risks • Treatment for cancer priority over heart health • Use of social media & support services • Would have benefitted from extra support & information • Does not regret having treatment • Timing	*“I feel that there is a little bit of protectiveness and at least in my trust, protectiveness is not trying to overwhelm with information” (P9)* *“I think if I'd had more information at the beginning I might have made a different decision and that's probably something that's quite important, is timing of giving information” (P7)* *“it would have been nice to have that extra information in terms of things to watch out for” (P9)* *“it seemed like it was obviously all done properly and it was also sort of consistent with what other people had talked about on sort of various breast cancer groups that I've got on Facebook” (P2)* *“I don't have any regrets about doing it or have any concerns about having done it. It was the right choice for me. I also think that the risk, was, was, the right risk to take for me in terms of lifestyle” (P9)*

> *“With the open access nurse, that was the only appointment I had. Once the radiotherapy was done, that was kind of it”* (P7)

> *“then I had my next oncology appointment, I think, around, it was related to different things like my heart scan for my Herceptin, all these other things. So, I didn't, I don't think, I don't remember actually talking beyond skin effects in terms of radiotherapy”* (P9)

Heart-healthy behaviours

Participant conversations with healthcare professionals about lifestyle advice and heart healthy behaviours were lacking instead simply addressing general post-radiotherapy advice.

> *“regards to eating healthy, that all kind of came under the whole oncology umbrella as far as I'm aware, I think that was more like*

> *my oncologists sat me down, expressed even though you will be feeling fatigued, it's like a vicious circle you need to then exercise to kind of relieve that fatigue that you're gonna experience through radiotherapy."* (P10)

> *"I mean I am fit, I exercise every day, I do aerobic exercises as well as weight training and yoga, so I'm so I'm quite fit and I'm aware of the kind of importance of it. But I didn't get any guidance on that." (P1)*

Several of the participants undertook self-led lifestyle changes, but these were in response to their cancer diagnosis (or other personal circumstances), rather than specific heart-healthy advice or guidance.

> *"I have attempted to make lifestyle changes, I won't say that I have held to them very well and I tried to do better sleep, to have more regular and longer sleep to get more regular exercise"* (P9)

Needs and preferences

Since the completion of their treatment, some of the participants had begun to question the risks, motivating them to undertake their own research and for some individuals, even respond to the study advertisement.

> *"probably didn't question it as perhaps now having the time to reflect. I should have done, which is why I was quite interested in the study actually.* (P6)

> *"So, I looked at it and I'm aware of the fact that you can get fibrosis and heart failure and lung fibrosis and all that stuff but that was my research"* (P1)

This led to them discussing the need for timely information from healthcare professionals.

> *"I think if I'd had more information at the beginning, I might have made a different decision and that's probably something that's quite important, is timing of giving information, I know when your first diagnosed it's very hard because you are completely, errm, well I mean initially you are completely overwhelmed"* (P7)

There was also the perception across the participants that their healthcare professional(s) were trying to protect them by withholding potentially distressing information.

> *"I find more information is better than less and the attitude of sort of protecting me from information ….. I think for some patients that might be the right way to go. But having a range of information available would be useful"* (P9)

Discussion

This qualitative study aimed to explore the perceptions and understanding of the risks of cardiovascular late effects of female patients who had been treated for left-sided non-palliative breast cancer.

This study offers new insights into how women perceive and understand cardiovascular risks after radiotherapy for early left-sided breast cancer. Despite improvements in heart-sparing techniques, our study showed a general lack of awareness, understanding, and perception of the risk of cardiovascular late effects associated with radiotherapy across participants. Similarly, a lack of heart health follow-up, advice or information regarding self-care was also reported.

Participants were poorly informed about heart risks, this was also illustrated in the findings of Clark et al., [37] whose research reported concerns of individuals with breast cancer following radiotherapy was the lack of information and discussion from their HCPs about cardiotoxicity prior to treatment. Effective communication and information about adverse effects are fundamental for a 'patient centred NHS'.[38,39]

Evidence supports the importance of discussing potential cardiac dysfunction with the patient when the risk is high[40]. Fully informing patients, whilst not overwhelming them can pose a challenge for HCP's. This study revealed some participants may feel shielded from receiving information, while others felt that their informational needs were overlooked by healthcare teams. This aligns with prior research showing that cancer patients often report unmet information needs and varying preferences for information delivery.[41,42] A qualitative study by Smith et al.,[43] highlighted the critical role of effective communication in providing information to patients during decision-making. Previously reported barriers to patients effectively communicating include hesitation to ask questions due to lack of trust[43] and how patients may perceive the clinicians to be 'too busy'.[44] There may also be a perceived power imbalance between themselves, and the HCP or they may even forget or feel embarrassed to ask. Equally, HCP's may be hesitant to communicate uncertainty, fearing that such communication would make it more difficult for patients to comprehend.[44]

Waller et al., suggest interventions are needed to prepare patients for treatment and provide education and support towards the end of treatment and at follow up.[45] Tools have been designed to facilitate the Shared decision-making process such as the Oncotype DX test, Prosigna and Predict.[46] Such tools support HCP's when quantifying risks and benefits from systemic treatment, but not currently from radiotherapy. Vickers argued that decision conflict may rise with the use of decision aids with patients being more aware that difficult decisions need to be made.[47] In contrast, Zdenkowski et al.,[48] and Stiggelbout et al.,[49] believe that decision aids can help patients feel more knowledgeable, better informed, and clearer about their values, as well as decrease their decision conflict.

Radiotherapy techniques, new technologies, administration schedules and delivery of treatment has evolved over the years, which has led to reduced acute side-effects but long term follow-up data on late toxicity is not yet available.[9,50] Many survivors are at an increased risk of death from CVD, which is in some cases exceeds death from their initial breast cancer diagnosis or recurrent disease.[3,51,52] As part of clinical decision making, known risks are considered when discussing the benefit of treatment. Long-term breast cancer survival rates have improved over recent decades; subsequently minimising treatment related complications is increasingly important.[53]

Recommendations about long-term follow up have previously been emphasised.[54] Survivorship programs have been developed to assure long-term cardiovascular follow up as part of cancer survivorship, but these have not been implemented in all practices.[55,56] To ensure patient compliance, patients need to be fully informed about the potential risks and consequences of cardiotoxicity. Cardio-oncology services should be conceived to provide a multi-disciplinary specialised evaluation and consistent, continuous, coordinated, and cost-effective care during the cancer process.[57] Collaboration between HCP's, Cardiologists and the wider team will have a direct impact on quality of patient care and outcome provided.[58] A potential barrier to implementing such a service is the future shortfall of Consultant Clinical Oncologists

(CCO's). In 2018 the CCO workforce consensus found the shortage of CCO in the UK has doubled when compared to five years prior.[59] Recent predictions state that the shortfall of CCO's would increase further, rising to 19 % by 2029.[60] The implementation of advanced practice Therapeutic Radiographer roles, allows existing scopes of practice and expertise to be used, followed by enhancing the role of the radiographer which then has a direct impact on the patient radiotherapy pathway.[61–63] These roles are designed to help mitigate workforce issues and provide holistic care.

Our study showed that participants were motivated to adopt independent lifestyle changes; however, these actions were largely driven by their cancer diagnosis rather than awareness of potential cardiovascular late effects. Although general guidance on healthy living was sometimes provided, there remains a gap in the literature concerning the sustained management of cardiac health following cancer treatment and the risk of cardiovascular complications. It is also a standard of proficiency for Therapeutic Radiographers to promote health and prevent ill health,[64] playing an integral role in supporting patients to adopt heart-healthy lifestyles.

While breast cancer survivorship is well-documented in the literature, often highlighting the importance of a healthy lifestyle, treatment compliance, and appropriate follow-up -specific attention to cardiovascular well-being within this context is comparatively scarce. Evidence states that obesity, physical inactivity and diabetes, age, hypertension and smoking are strong predictors for the development of breast cancer therapy-related cardiovascular injury.[64–67] Therefore, continued care should be personalised and informed by routine evaluations of symptoms and existing comorbidities.

If heart risks have not been presented to people, inevitably engagement in heart healthy behaviours will not occur. Equipping people with the knowledge and tools about the importance of heart healthy behaviours will encourage engagement. Timely delivery of information was considered as important by the participants. Social media platforms are increasingly recognised as established sources of health information and support.[66] They offer opportunities for patient empowerment and engagement, provide informational support, enhance communication with healthcare professionals, and serve as channels for disseminating research opportunities. However, these platforms also present risks, including information overload, the spread of misinformation, potential financial exploitation, and privacy breaches.[68] Chua et al., emphasised the value of offering guidance on how to critically assess health information found online.[69]

Limitations

We recognise that this study only reflects the perspectives of ten participants. Each of these held characteristics that were specific for the aims of the research, and the sample was stratified to gain perspectives across different demographics.[32] Limited ethnic diversity of the participants may restrict transferability, subsequently future studies should address these gaps to enhance generalisability. We must also acknowledge self-selection bias may have influenced the findings by over-representing more motivated or engaged individuals.

A consensus of perspectives was illustrated across the themes, and the participants requested no modifications during the member checking process. However, this does not eliminate the possibility of researcher bias. The themes were however independently reviewed and discussed across the research team and with our PPIE representatives. The multidisciplinary nature of the team further enhanced analytic rigour.

Conclusion

This study highlights a gap in patient knowledge and understanding of the long-term cardiovascular risks associated with radiotherapy for left-sided breast cancer. Despite undergoing consent processes and receiving treatment specific information, participants consistently reported limited or absent communication regarding cardiac late effects. The perceived minimisation of this risk by healthcare professionals, coupled with a lack of follow-up or specific heart-health guidance, reinforces a sense of informational void during and after treatment.

Participants often only reflected on these risks retrospectively, with some undertaking their own research or being prompted by participation in this study. This underscores the need for earlier, clearer, and patient-tailored communication about potential late effects. Many felt that while protective strategies (e.g., DIBH) were briefly mentioned, these were not contextualised within the broader landscape of long-term cardiac health. Opportunities to engage patients in preventative behaviours and heart-healthy lifestyle choices appear to have been missed. Our findings also reinforce that while many survivors-initiated lifestyle changes following a cancer diagnosis, these actions are typically self-directed and not guided by structured, evidence-informed advice about cardiovascular risk. The absence of consistent follow-up or survivorship planning specifically addressing cardiac health creates an unmet need, during and post-treatment care. To improve outcomes, it is essential that radiotherapy teams, including Therapeutic Radiographers fulfil their responsibility to promote health, prevent ill health, and support informed decision-making. Clear, honest, and compassionate communication about both benefits and risks is vital, delivered in combination with structured tools. Future models of care could include formalised cardio-oncology pathways and survivorship programmes that are inclusive of radiotherapy-related risks. Advanced practice roles offer a promising solution to workforce challenges and provide an opportunity to embed holistic, person-centred care. Ultimately, if risks are not clearly communicated, engagement in heart-healthy behaviours is unlikely. Providing timely, accessible, and personalised information before, during, and after treatment should become standard practice. This will empower patients, reduce the potential for decision regret, and contribute to improved long-term outcomes in breast cancer survivorship. Further research is needed to explore effective communication strategies and to evaluate the implementation of targeted interventions within routine clinical practice.

Implications for practice

Radiographers and oncology teams have a crucial role in bridging communication gaps. International guidance from the European Society of Cardiology, in collaboration with the International Cardio-Oncology Society and the European Society for Radiotherapy and Oncology[25] aims to support all healthcare professionals who provide care to oncology patients before, during, and after their cancer treatments with respect to their cardiovascular health and wellness. Better training for HCP in risk disclosure and the creation of customised information tools, such as decision aids, can empower patients and enhance adherence to heart-healthy behaviours. Early engagement with patients about the long-term effects of radiotherapy should be incorporated into the radiotherapy consent process, ideally before the planning CT. A personalised approach to care with baseline assessments is also advocated, alongside ongoing surveillance both during treatment and longer-term. To facilitate enhanced models of patient care, more explicit guidelines on how to prevent, monitor and treat cardiac side-effects are however still advocated, alongside clearer illustration of how these can be embedded into clinical pathways.[22,58,70–73]

Ethics approval and consent to participate

Ethical approval for this study was obtained from Sheffield Hallam University.

Written informed consent was obtained for anonymised patient information to be published in this article.

Availability of data

Data required for this study may be made available by the author(s) upon reasonable request.

Author contributions

AL -, Methodology, Validation Verification, Formal analysis, Writing, Visualisation.

NR - Methodology, Validation Verification, Writing, Visualisation.

JW - Conceptualisation, Methodology.

AH – Conceptualisation, Methodology, Validation Verification, Formal analysis, Writing, Visualisation.

Generative AI use

During the preparation of this work the author(s) used ChatGPT in order to support the word processing and formatting of the manuscript*. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

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Conflict of interest statement

AH is a current Associate Editor at Radiography and NR is a current Guest Editor on the Special Issue, however, as an author of this submission they had no role in or visibility of the handling of the manuscript through the editorial or peer review process.

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Appendix 1. Inclusion and exclusion criteria

Inclusion criteria:

- Semi-structured interviews were undertaken with women diagnosed with primary left sided ‘curative’ breast cancer aged >18+
- Had received adjuvant radiotherapy from 2014 onwards
- Were able to provide informed consent
- Were able to speak English.

Exclusion criteria:

- Women diagnosed with primary right sided ‘curative’ breast cancer
- Diagnosed with metastatic or advanced disease
- Aged <18
- Received radiotherapy prior to 2016
- Unable to provide informed consent
- Were unable to speak English. Due to there being no funding attached to the project it is not possible to provide translators
- Stratification criteria
- The project stratified for:
- Age of participant
- Time since breast cancer diagnosis

Appendix 2. semi-structured interview Schedule

Introduction & background

Provide participants with:

- Discuss with patients the rationale for adjuvant breast radiotherapy. Radiotherapy to the breast or chest wall, is given to destroy any cancer cells that may have been left in the breast/chest wall and surrounding area after surgery. You may hear this called adjuvant radiotherapy. Doing this reduces the risk of local recurrence, meaning to breast or chest wall ± surrounding areas. You will have been informed about the small risk of long term side-effects after radiotherapy to the breast or chest wall ± surrounding area. My aim is to explore your perception and understanding of the risks of cardiovascular late effects following radiotherapy for breast cancer.
- Introduction to the project –who I am, why is the study being undertaken, why you have been asked to take part etc.
- Overview of the interview format
- Discuss process of recording
- Summarise the aims are to explore their experience. There are no right or wrong answers, no impact on future care or services.
- Gain recorded verbal consent from the participant in order to proceed with the interview and clarify right to withdraw at any point.
- Cardiovascular risk overview
  - Sensitively explain about the location of the heart to the treatment field. How HCP's plan treatment and how the treatment is delivered by therapeutic radiographers to minimise risks, but still some risks which will have been discussed with you at consent.
  - Interested in hearing about how you felt when these risks were discussed with you (potentially not all), what went well,

what you would have preferred to have happened, been given etc.

- Did you have any problems or conditions with your heart before your radiotherapy treatment began?
- Thinking about before you started your radiotherapy treatment, were these potential risks discussed with you and was it explained how these would be managed by the treatment team? How did you feel about these risks, knowing why you needed radiotherapy?

Potential follow up question(s) if not addressed in their answer.

- How did you find this conversation, were you happy with the level of information they gave you? Would you have liked more/less?
- Was heart health and the associated late effect risks, something that you wanted to discuss in greater detail with the HCP during your radiotherapy treatment?
- Before you had your radiotherapy you will have signed a consent form, at this point were you provided with any written information about the potential risks of heart damage from radiotherapy?
- Were you given advice about heart healthy behaviours, such as exercise, diet?
- Thinking back to when you finished radiotherapy, did the radiographers or oncologist discuss with you heart healthy behaviours that you could engage in? Were you provided with any written information about the importance of heart health?
- Can you now tell me about your experience when you were followed up after completion of your radiotherapy. Were you asked any questions that were related to your heart? Did you feel that you wanted to ask anything relating to the effects on your heart?
- Can you tell me if you made any changes to your lifestyle?
- Do you feel that you would have benefitted from extra support to do with heart health?

This is the end of our conversation. Are you ok or has anything that we discussed today raised any issues or questions? Would you like me to direct you to any other services?

Would you like a copy of the findings?

Thank you for taking the time to answer my questions.

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