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Time spent in the radiotherapy department for breast cancer treatment, pre-, mid- and post-COVID-19 pandemic (a 6-year, single-centre service review)

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Original Article

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Abstract

Introduction: Before COVID-19, breast cancer patients in the UK typically received 15 radiotherapy (RT) fractions over three weeks. During the pandemic, adoption of a 5-fraction treatment prescription and more advanced treatment techniques like surface-guided RT, meant a change in the duration and number of hospital visits for patients accessing treatment. This work sought to understand how breast cancer patients' time in the RT department has changed, between 2018 and 2023.

Methods: Appointments for CT simulation, mould room, and RT, from January 2018 to December 2023, were extracted from the Mosaiq® Oncology Management System. Appointments lasting between 5 minutes and 5 hours were analysed. Total visit time was calculated from check-in to completion on the quality checklist.

Results: In total, 29,523 attendances were analysed over 6 years. Average time spent in the department decreased during the pandemic but has since increased 12·4% above pre-COVID-19 levels. Early morning and late afternoon appointments resulted in the shortest visits, with early afternoon appointments leading to the longest visits. On average, patients spend the longest in the department on a Monday, and the least amount of time on a Friday. Friday was the least common day to start a 15-fraction treatment, whereas Tuesday and Friday were equally uncommon for the 5-fraction regime.

Conclusions: During the COVID-19 pandemic, the number of visits a patient makes for breast cancer RT and related services dropped, and remained lower post-COVID-19, due to fewer treatment fractions being prescribed. Average time spent in the department initially decreased but has since increased beyond pre-COVID-19 levels.

Introduction

The time commitment that cancer treatment commands should be a key consideration when evaluating services. Whilst access and travel for radiotherapy (RT) appointments can pose a significant burden,[1] the total time that a patient spends in the department should also be considered. Visits for CT simulation, clinic appointments, treatment fractions and other essential activities all contribute to a burdensome patient experience but may be related to higher-quality treatment. External drivers, such as the COVID-19 pandemic, force necessary changes to patient pathways and provision of auxiliary services, like patient education sessions, which can impact patients' experiences of care. When considering the changes in the patient pathway and experience around COVID-19, the total time patients spend in the department for their treatment becomes important.

Several articles have analysed the impact of COVID-19 on patients and RT services in 2020 and 2021,[2–6] focusing on waiting lists, patient experiences of RT and workload burden. It remained unclear how decisions made during the COVID-19 pandemic impacted the total time that patients spent in RT departments. This study aimed to assess patients' total time spent per visit to the department for daily outpatient RT, and the impact of changes in the patient pathway on these times. By reviewing patient attendance data from before, during and after the pandemic, this study aimed to establish how patient visits for RT may have evolved, and how pathway development post-COVID-19 has further impacted the total time that patients spend in the department for their RT treatment.

Before the COVID-19 pandemic, most breast cancer patients in the United Kingdom (UK) receiving RT would attend for 15 fractions (15#) of treatment over three weeks, as well as attending appointments for clinics, imaging and other services supporting the RT pathway.[7] During these visits, important services such as patient education sessions, charity and social

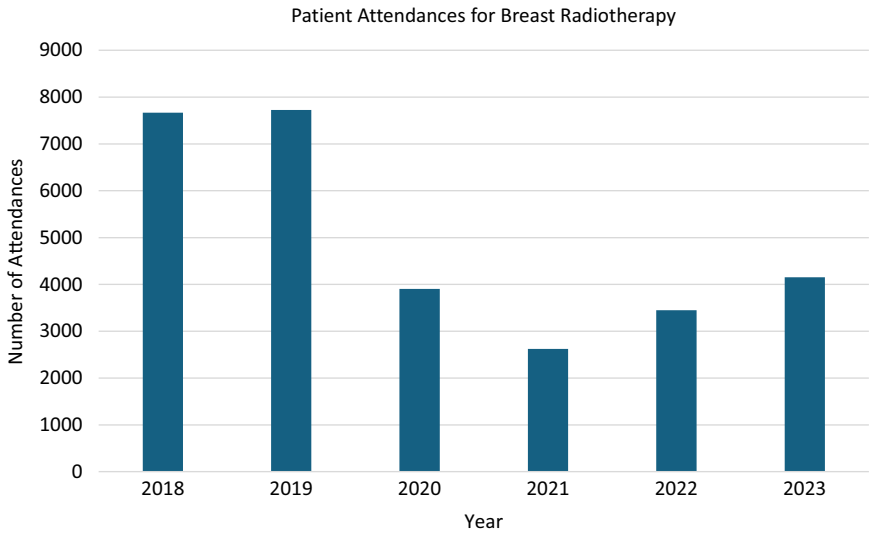

Figure 1. Breast cancer patient visits for treatment, 2018–2023.

support and cafes are all made available to patients to reduce anxiety relating to their treatment, support patients with a friendly place to wait and provide a familiar environment within the hospital.[8] In early 2020, the UK went into lockdown due to the COVID-19 pandemic, and provision of healthcare adapted to be much more functional, with the aim of minimising time spent with the department due to increased infection risks, and without the supplementary services that often support patients' wellbeing and improve their experiences of healthcare. This resulted in the temporary, but in some cases prolonged, cancellation of patient education sessions, and closure of supportive services such as cafes, open waiting areas for family and friends and many others.

A few months into the pandemic, on April 6th 2020, South-West Wales Cancer Centre (SWWCC) treated their first patient with a 5-fraction (5#) treatment regime, outside of a clinical trial, and has since been treating all women with operable breast cancer requiring adjuvant RT to partial or whole breast with 5#.[9] The 5# prescription requires a higher dose per fraction compared to the 15# prescription and consequently takes slightly longer to deliver each day. Sequential boosts stayed as electron boosts, with some mini-tangent photon boosts. At the end of 2021, and into 2022, SWWCC introduced surface-guided RT (SGRT) to increase compliance with deep-inspiration breath-hold (DIBH) protocols and improve outcomes; this included changes to appointment lengths in CT simulation, allowing more time to coach patients and for cleaning between patients in line with COVID-19 protocols, as well as changes to workflows on-set in the treatment room.

Methods

For this service improvement review, appointment attendances for radical breast cancer treatment, between January 2nd 2018 and December 29th 2023, were presented in the dataset, extracted from Mosaiq® (v2.84, Elekta) Oncology Management System, the information and patient management system used in the department. Visits to the department for CT simulation, mould room for the creation of a breast shell and treatment were all included for analysis. Appointments for services such as physiotherapy, lymphoedema classes and other support were excluded, as they fell outside of the scope of this service improvement review. Approval from an ethics committee was not required for secondary data analysis as part of a service improvement review.

A report was generated, including the patients' arrival times, locations of appointments, activities and completion times. Total time spent in the department was calculated as the period between arrival at the RT department when the patient is checked in using a barcode scanner and subsequently queued in Mosaiq®, and completion of the appointment on the quality checklist (QCL). All attendances between 5 minutes and 5 hours in length were included for analysis. Attendances shorter than 5 minutes were removed during data cleaning as they were due to incorrect queuing or early QCL completion and did not accurately reflect the patients' actual time in the department. Attendances longer than 5 hours were also removed, as they were caused by delayed QCL completion, so also incorrectly reported total time in the department.

To validate the data, a separate review of the number of plans completed over the same six-year period was conducted. Quantitative analysis of plans completed, accounting for replans, multiplied by the number of fractions prescribed, was compared to visits for treatment as a secondary check that all patient visits had been identified during data collection.

Results

A total of 29,523 appointments were recorded and analysed. These included 2,627 attendances for CT simulation, 26,755 attendances for treatment and 141 attendances to the physics mould room. Figure 1 shows the number of patient visits made to the department across the 6 years of studied data.

The data cleaning process removed 197 attendances (0·7%). Of the 197 removed, 7 were for CT simulation, 189 were for treatment and 1 was for mould room, with an even distribution over the 6 years. Of the 7 CT simulation attendances removed, 1 was due to delayed QCL completion, leading to an incorrectly reported total time in the department of more than 5 hours, and 6 were removed due to incorrect queuing or early QCL completion, leading to total time in the department of less than 5 minutes. For treatment attendances, 187 were removed for being shorter than 5 minutes and 2 were removed due to exceeding 5 hours. For the mould room, one attendance was removed for exceeding 5 hours.

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Table 1. Treatment plans for breast cancer created at South-West Wales Cancer Centre between 2018 and 2023

	2018	2019	2020	2021	2022	2023
Breast	383	410	258	303	423	405
Breast SCF	96	91	67	50	47	67
Breast VMAT	0	0	0	0	10	44
Total Breast Plans Produced	479	501	325	353	480	516
Breast Patients Treated	455	465	316	334	460	484

Table 1 shows the number of treatment plans completed throughout this study. Only a small difference (5·3%) between the measured number of attendances and the number of breast plans produced was found. This is due to replans and was deemed acceptable as a validation of the data collected from Mosaiq®.

Figure 2 shows how the average length of time a patient stays in the department for their breast RT changed between 2018 and 2023, including markers for the start and end of COVID-19 restrictions in the department, and implementation of 5# treatments and SGRT.

Figure 3 visualises how often each day of the week is selected for a patient's start date, for 5# and 15# prescriptions,

Figures 4a (15# prescription) and 4b (5# prescription) show the average time a patient spends in the department for breast RT across the week, split into two-hour periods based on their arrival time to the department (early morning, mid-morning, late morning, early afternoon, mid-afternoon and late afternoon).

Discussion

Number of appointments

Figure 1 shows that the number of patient appointments for CT simulation, treatment, and the mould room was stable for two years before COVID-19, with around 7,000 breast cancer RT fractions delivered annually to 500 patients. In 2020, treatment attendances dropped by over 35%, due in part to reduced referrals caused by the pandemic, and the reduction in prescribed treatment fractions. Muschol & Gissel found that fear of COVID-19 led to patient uncertainty and delays in seeking care, reducing outpatient appointments and delaying diagnoses.[10] Similarly, Di Lalla *et al.* report that 34% of cancer patients felt anxious about hospital visits during the pandemic.[11]

Patient numbers remained lower in 2021, before recovering to pre-COVID-19 levels from 2022 onwards. Appointments for CT simulation reached similar levels to those found pre-COVID-19. However, treatment visits have remained lower than they were before the COVID-19 pandemic. The primary reason for this reduction in visits for treatment is the move from 15# of RT to 5#, effectively cutting the number of attendances required for RT of the breast by two-thirds.

More generally at the department, mean fraction attendances per treatment course have dropped, from 15 fractions in 2019 to around 11 in 2024, largely due to adoption of 5# breast, 5# rectum and changes to prostate treatment regimens.

Appointment length

When attending for a fraction of RT, the active time in the department, as recorded by Mosaiq®, ranged from 39 minutes in 2021 to 52 minutes in 2022 (Figure 2). Before COVID-19, there was a downward trend for time spent in the department for treatment, to the low of 39 minutes. There are many potential factors at play here contributing to this reduction. Principally, during COVID-19, patients were advised to attend on-time for their appointments, rather than early. This was to reduce the number of patients together in the waiting room and meant that most patients arrived and very quickly started their appointments. In combination with this, due to the reduced patient numbers, the treatment machines were less likely to be running behind schedule, meaning patients were more likely to be seen on time. No changes were to the length of the patient slot allocated, i.e. 15 minutes. However, the move to 5# will have increased the treatment time for each fraction, as a higher dose per fraction, requiring longer, was delivered from Q2 2020 onwards. Further investigation of the relationship between appointment time and arrival time may uncover interesting trends.

With fewer patients attending appointments across the hospital, parking was also more readily available for those travelling by car. Traffic was reduced in most areas, with most people working from home when possible, meaning patients were less likely to be delayed during their journey. However, for those using public transport to access healthcare, the pandemic may have compounded the already apparent inequalities in access.[12] With other services closed or restricted, like local cancer charities and cafes, patients were less likely to arrive for their appointments earlier than required. From Q1 2022, as auxiliary services such as the café and cancer charities reopened, patients may have arrived early to their appointment to access these services, extending their time in the department.

The average time spent in the department for CT simulation decreased before COVID-19 and dropped by over 10% in 2020 due to minimisation of patient contact. It rose in 2021 and 2022 due to increased breath-hold coaching, after the introduction of SGRT at the centre. Overall, the average time spent in the department for CT simulation has decreased by 10 minutes since 2018. It has been suggested that patient coaching using educational materials before CT simulation could further reduce the time spent in the department for the CT simulation process for DIBH techniques.[13]

Treatment scheduling

For both 15# and 5# regimes, some days result in longer visits, especially on day one of treatment. This is often due to early arrival due to anxiety about parking or navigation, more time spent with staff for setup and questions, and uncertainty about the process.[14] Figure 3 shows that, for a 15# regime, patients were equally likely to be scheduled to begin treatment on any weekday, except a Friday. Compared to the 15# regime, patients receiving 5# of RT were also much less likely to start on a Tuesday. This is probably because, if a patient were to begin a 5# treatment regime on a Tuesday, they would receive four fractions that week, followed by a two-day break over the weekend, and then delivery of the final fraction on the Monday. Despite the literature stating that 5#s delivered over 7 days is non-inferior,[9] and this Tuesday-to-Monday scheduling fits that criteria, it does seem inefficient to leave just one fraction for the next week. This may also be why Fridays are rarely scheduled for a patient's first day of treatment.

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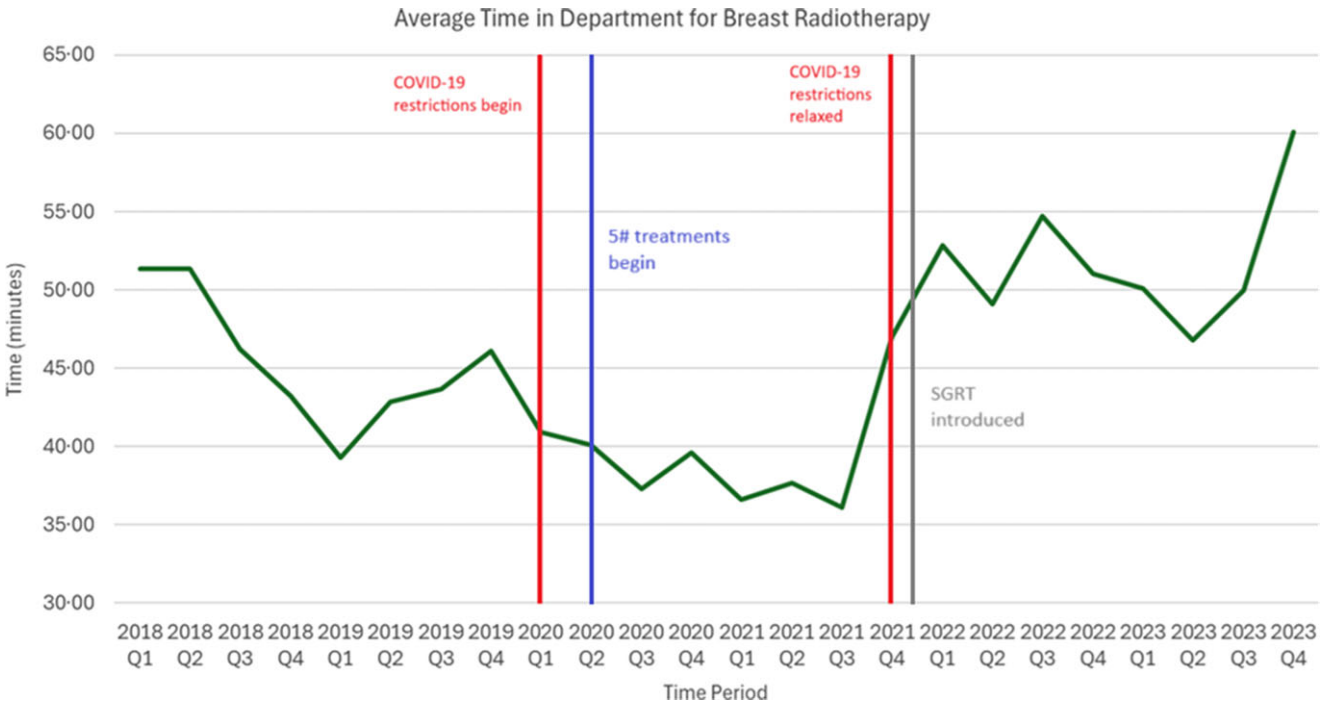

Figure 2. Average time in department for a fraction of radiotherapy to the breast.

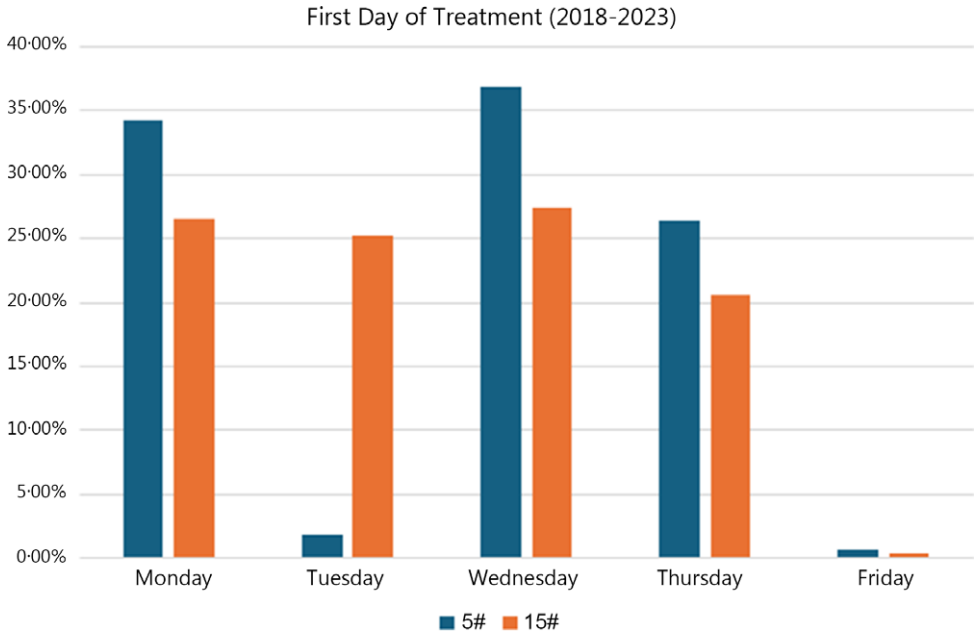

Figure 3. Comparison of start day frequency for 5# and 15# breast radiotherapy.

Analysis of the data also showed that, as patients progress through treatment, the length of time that they spend in the department decreases. For the 5# regime, the longest visits occur on Mondays and Wednesdays, common treatment start days and the shortest on Tuesdays and Fridays, which are typically the fifth and final treatment days. Naturally, patients will develop a better understanding of the treatment process as it progresses and may also become less anxious about their treatment.[15] The impact of pre-treatment patient education to reduce treatment anxiety should be further explored to elucidate any potential benefit to patients.

Figures 4a and 4b show that time of day impacts how long patients spend in the department. The earliest appointments are typically the shortest, likely due to fewer delays and staff efficiency. Mondays and Wednesdays have the longest sessions, aligning with common treatment start days, while Tuesdays and Fridays are the shortest, reflecting patients progressing through treatment. An interesting trend is the reduction in time before lunch, followed by an increase after, possibly due to a "pre-lunch rush" and slower return post-lunch.

Patient education can be used to reduce patient anxiety related to RT,[16] and increase their understanding of the treatment

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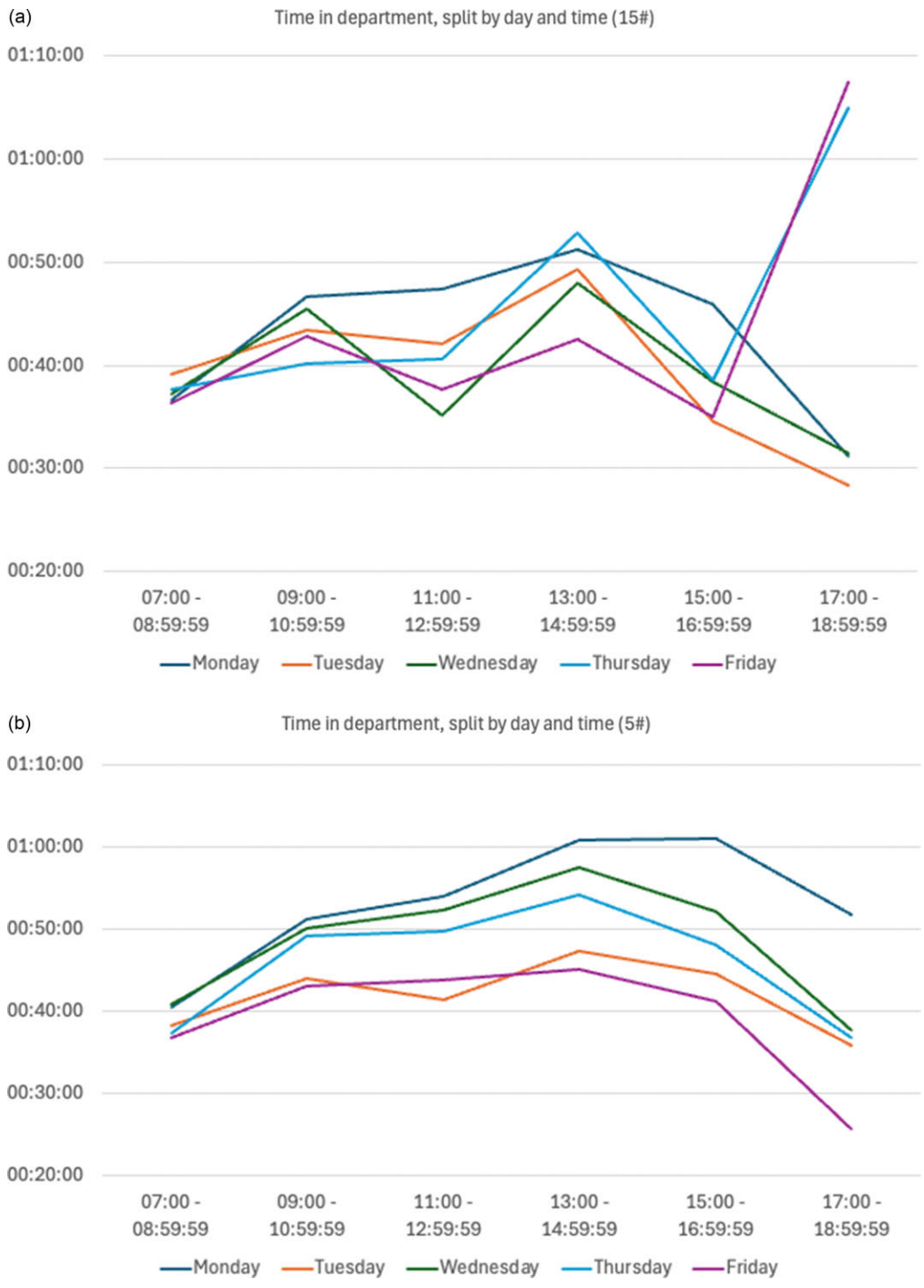

Figure 4. (a) Average time spent in the department for breast radiotherapy, by day of the week and time of arrival, 15#s. (b) Average time spent in the department for breast radiotherapy, by day of the week and time of arrival, 5#s.

process.[17] The use of patient education to familiarise the patient with the clinical environment before their first day of treatment should be explored. It may be possible to decrease patient anxiety, and the time a patient spends in the department if frequently asked questions can be answered and the patient can be introduced to the clinical environment or treatment techniques, like DIBH. Conversely, it should be considered that as total time in the department reduces, so does a patient's contact with healthcare professionals, which could reduce the care and support available to them. Asynchronous resources would help to maintain access to information, even as time spent in the department decreases.

Limitations

The use of QCL completion as an endpoint for the visit does not capture treatment reviews, or ancillary support that patients may access after completion of that day's treatment. Additionally, because specific appointment times were not included in the dataset, for total time spent in the department, patients who arrive early and are treated on time would be considered equal to patients who arrive on time but experience delays before treatment. However, the experiences of waiting when choosing to arrive early, and waiting when treatment is delayed, are very different. Further

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research is required to explicate the true effect of this on the time patients spend in RT departments.

From Q4 2021 onwards, in Figure 2, the average time spent in the department for treatment increases, which coincides with the integration of SGRT into the department, as well as the relaxation of some Welsh Government COVID-19 restrictions.[18] Patient setup using SGRT and DIBH coaching may have extended the time patients spent in the treatment room. Another potential confounding factor is a quality improvement change from MV 2D imaging to kV 2D imaging around the same time.

Conclusion

Patient attendance for RT of breast cancer dropped during the COVID-19 pandemic and has remained lower than pre-COVID-19 levels, as the number of fractions of treatment has reduced. The average length of time spent in the department also dropped during COVID-19 but has increased since, in part due to new treatment prescriptions and techniques.

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Competing interests. The authors declare none.

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