Public Health England

Protecting and improving the nation's health

National Cancer Intelligence Network

Working paper on variation in delivery of radiotherapy for patients with lymphoma

Haematological Malignancy
Site-Specific Clinical Reference Group

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The National Child and Maternal Health Intelligence Network provides information and intelligence to improve decision-making for high-quality, cost-effective services. Its work supports policy makers, commissioners, managers, regulators, and other health stakeholders working on children's, young people's and maternal health.

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National End of Life Care Intelligence Network

The National End of Life Care Intelligence Network (NEoLCIN) aims to improve the collection and analysis of information related to the quality, volume and costs of care provided by the NHS, social services and the third sector to adults approaching the end of life. This intelligence will help drive improvements in the quality and productivity of services.

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Summary

The National Cancer Data Repository (NCDR) is our best source of data for cancer diagnosis, but does not record whether a patient has received radiotherapy accurately. A number of former regional cancer registries within England did not record treatment information comprehesively. The National Radiotherapy Dataset (RTDS) provides the opportunity to look at radiotherapy treatment patterns by disease and explore any variation between regions and treatment centres.

In practice this proved challenging due to the quality of the data recorded in the RTDS with a number of fields either being missing, unreliable or duplicated. To overcome this a methodology was developed to clean the radiotherapy dataset, which was then linked to the NCDR and patients diagnosed with Hodgkin lymphoma or non-Hodgkin lymphoma (NHL) were identified using the diagnosis codes recorded on the NCDR.

Population level analysis showed that around 19.1% of all patients diagnosed with NHL, and around 28.5% of patients diagnosed with Hodgkin lymphoma were recorded as having received radiotherapy in the RTDS. Significant variation in radiotherapy usage was identified at Strategic Clinical Network (SCN), Cancer Network and trust level after adjusting for confounding factors (age, sex, IMD income domain, co-morbidity and routes to diagnosis). Variation was also seen at trust level when examining the proportion of patients who received curative or palliative treatment for NHL with some trusts delivering significantly more radiotherapy with curative intent compared to others. For Hodgkin lymphoma the recording of radiotherapy use was more uniform at trust level with most patients receiving treatment with curative intent.

Introduction

Radiotherapy makes an important contribution to the management of haematological malignancies. Radiotherapy is a key component in the curative treatment of patients with early stage Hodgkin lymphoma, Follicular lymphoma, solitary plasmacytomas and selected patients with diffuse large B cell lymphoma. Radiotherapy also plays an important role in palliation and symptom control for patients with myeloma and many other haematological malignancies. For Hodgkin lymphoma the efficacy of radiation as a 'single agent' is probably greater than that of any individual cytotoxic drug, and haematological malignancies as a rule are exquisitely sensitive to radiation, with doses an order of magnitude lower than required for solid tumours producing excellent local control.

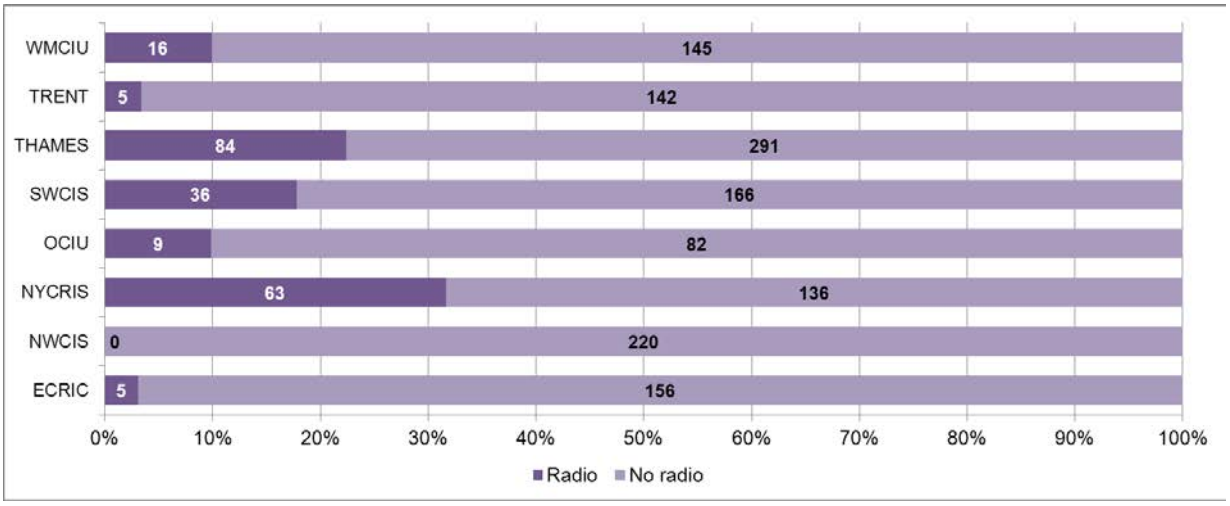
The extensive literature documenting the very real toxicity of widefield radiotherapy to doses of 40 Gray in the young Hodgkin Disease population, has resulted in the use of radiotherapy falling from favour. For early stage Hodgkin lymphoma well designed large clinical trials have demonstrated that the best results in terms of progression free survival can be achieved through the combination of chemotherapy with lower doses of radiotherapy targeting smaller volumes (Engert et al 2010). Despite the expectation that lower doses and smaller volumes will reduce toxicity, and national and international guidelines advocating the continued use of radiotherapy in the curative treatment of early stage Hodgkin lymphoma, there remains an active debate among clinicians, and chemotherapy alone may often be proposed as an alternative to combined modality treatment. This debate may also have had an impact on the use of radiotherapy for other haematological indications. The majority of haematological malignancies are managed from presentation, through diagnosis to completion of treatment, by haematologists who may have limited direct experience of radiotherapy. Radiotherapy requires a referral to a clinical oncologist who may have relatively limited experience of haematological malignancy.

As some aspects of the use of radiotherapy for haematological malignancy are discretionary, the uptake and pattern of radiotherapy delivered may depend on local availability of a clinical oncologist with a special interest, or on the particular structure and operation of individual MDTs. Although peer review mandates discussion of all patients at an MDT with input from a clinical oncologist, there is a perception that significant variation in the use of radiotherapy from

centre to centre may exist, with the potential for a variation in the quality of treatment and impact on patient outcomes.

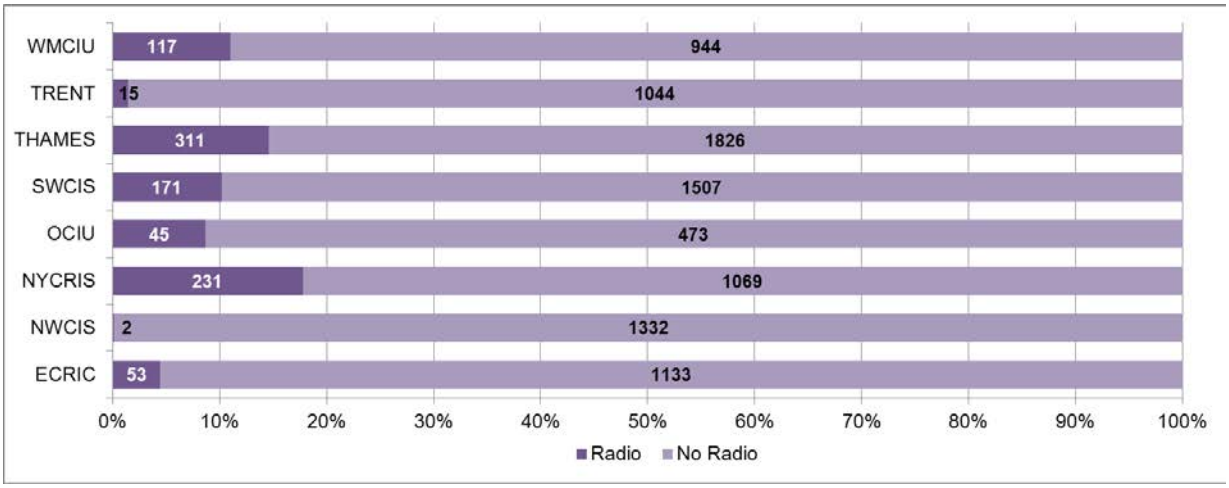
Prior to the introduction of the RTDS regional cancer registries in England sought to identify the main modalities of treatment used in the first six months following diagnosis, including radiotherapy. This was not achieved uniformly and, when present, information on radiotherapy was generally limited to a 'yes/no' indicator without detail on the intent or treatment dose. The figures below taken from the 2012 Blood Cancers Data Quality Report[1] illustrate the scope of information available for 2010 cancer registrations when merged in the NCDR, prior to the availability of RTDS. The scale of variation in recording of treatment in regional registries has meant that it has not proved possible to use the NCDR as the basis for any analyses of variation in radiotherapy use in lymphomas.

Figure 1. Radiotherapy recorded within 2010 cancer registrations for Hodgkin lymphoma by regional cancer registry



[1] NCIN. Blood cancers data quality report [Internet]. London: National Cancer Intelligence Network: 2013 [cited 2014 July 16]. Available from: http://www.ncin.org.uk/publications/

Figure 2. Radiotherapy recorded within 2010 cancer registrations for non-Hodgkin lymphoma by regional cancer registry



This working paper draws on new information which is now available on the delivery of radiotherapy in the care of patients with cancer. Since 1 April 2009, all facilities delivering radiotherapy treatment have been required to submit data items in accordance with the (RTDS), which includes information on the type of cancer treated and details of the treatment delivered. In the working paper we have used all the data available in the RTDS (1 April 2009 to 30 September 2012), in conjunction with the 2010 release of the NCDR, thus providing information on cases diagnosed during 2009 and 2010 to address the question of variation in radiotherapy use in the treatment of lymphoma in England.

Methods

Individuals diagnosed with non-Hodgkin lymphoma (NHL) (ICD10 C82-C85) and Hodgkin lymphoma (C81) between 1 January 2009 and 31 December 2010 were identified from the (NCDR) and linked, where possible, to the RTDS using the unique patient NHS number. Any duplicate records were removed. As patients with a haematological cancer could have received radiotherapy for another cancer over this time the ICD-10 code recorded in the RTDS (for treatment site) was considered when assessing the eligibility for linkage. Sites considered eligible included ICD10-C79, C80 'unknown primary', as this can occur if an individual is admitted as an emergency requiring radiotherapy treatment before the primary diagnosis has been confirmed, C79 and C80 only accounted for a small number of cases (2%) for NHL and (<1%) for Hodgkin lymphoma. The main ICD10 codes included were any haematology code (C81-C85, C88, C90-C96, and D45-D47), all other diagnosis codes were excluded from these analyses.

Information on co-morbidity, which may influence treatment options, was derived from this linkage to the NCDR. A Charlson co-morbidity score was available for each case in the NCDR, derived from available diagnostic coding for any hospital admissions recorded in linked Hospital Episode Statistics (HES) at least three months before diagnosis. Higher scores indicate greater co-morbid disease and patients were grouped into Charlson score categories of 0, 1, 2 and ≥3.

The disease coding in the NCDR and RTDS were done independently, with RTDS data largely inputted by radiotherapy staff, while the NCDR is entered by trained coding staff able to access the full clinical record, so in this working paper the ICD-10 code recorded on the NCDR was used in preference to the RTDS if there was disagreement between recorded diagnostic codes.

Before analysis a number of steps were required to try and 'clean' the RTDS to ensure a dataset that more accurately represented the treatment of patients with non-Hodgkin and Hodgkin lymphoma. The RTDS should combine all records of a patient's treatment into a single summary record, however, this was found not to be the case with some individuals having more than one summary record assigned (NHL: min=1, max=28, mean=2.4, median=1), (Hodgkin lymphoma: min=1, max=18, mean=1.7, median=1). While it is possible that one individual could have had more than one treatment course, it was clear that the vast majority of this was a consequence of problems in data capture and aggregation in the RTDS. A methodology was therefore developed and applied to try and identify a unique record for individuals included in these analyses.

Records for individuals in the RTDS were categorised into two groups; those with only one summary record (3,025 patients with NHL and 757 with Hodgkin lymphoma), and those with multiple 'summaries' (872 patients with NHL with 2,241 'summaries' and 177 patients with Hodgkin lymphoma with 391 'summaries'). The records for the 1,049 patients with multiple summary records were reviewed, in order where possible to resolve the data so that a single record of treatment could be obtained. The rules applied explored total attendances and the date difference between diagnosis and treatment to identify the definitive record; cases with the most attendances and a first treatment date closest to the diagnosis date were selected, where two records contained the same treatment date and the same number of attendances the record with the most information was chosen. The data quality of the RTDS presents significant limitations and while the best has been done to produce a single summary, this was done essentially on a case by case approach and was open to error, so presented results must be treated with caution and considered as provisional at this point.

It had been intended to examine the 'treatment intent' and 'treatment region' recorded in the RTDS, but initial review identified sufficient inaccuracy and incompleteness in these data that they were not included in analysis nor allowed to contribute to the record selection process.

Information on the number of fractions of radiotherapy delivered were not included in the RTDS so total attendances were used instead as a surrogate indicator. Based on clinical advice, patients with lymphoma will normally receive one fraction per visit. In the absence of recorded treatment intent it is clearly difficult to attribute this solely on the information available on attendance pattern, but to allow some exploration of the treatment pattern individuals with Hodgkin and non-Hodgkin lymphoma who had ≥10 attendances were taken as having a 'curative' pattern, less than ten attendances were taken as having a 'palliative' pattern, clinical advice was sought regarding this.

Time points between treatment and diagnosis were established, only cases treated with curative intent up to one year after diagnosis were included. Cases treated with palliative intent for several years after diagnosis were included, as palliative treatment can continue for many years. In all cases any treatment delivered more than one month before diagnosis was excluded. 319 cases of NHL and 91 cases of Hodgkin lymphoma were removed as they had a treatment date >365 days after diagnosis and curative intent. 18 curative cases and 14 palliative NHL cases were removed as they had a treatment date >30 days before diagnosis. Four curative cases of Hodgkin lymphoma were removed as they had a treatment date >30 days before diagnosis.

Following this exercise 3,549 NHL records and 839 Hodgkin lymphoma records within the RTDS were cleaned with a single summary record generated for analysis.

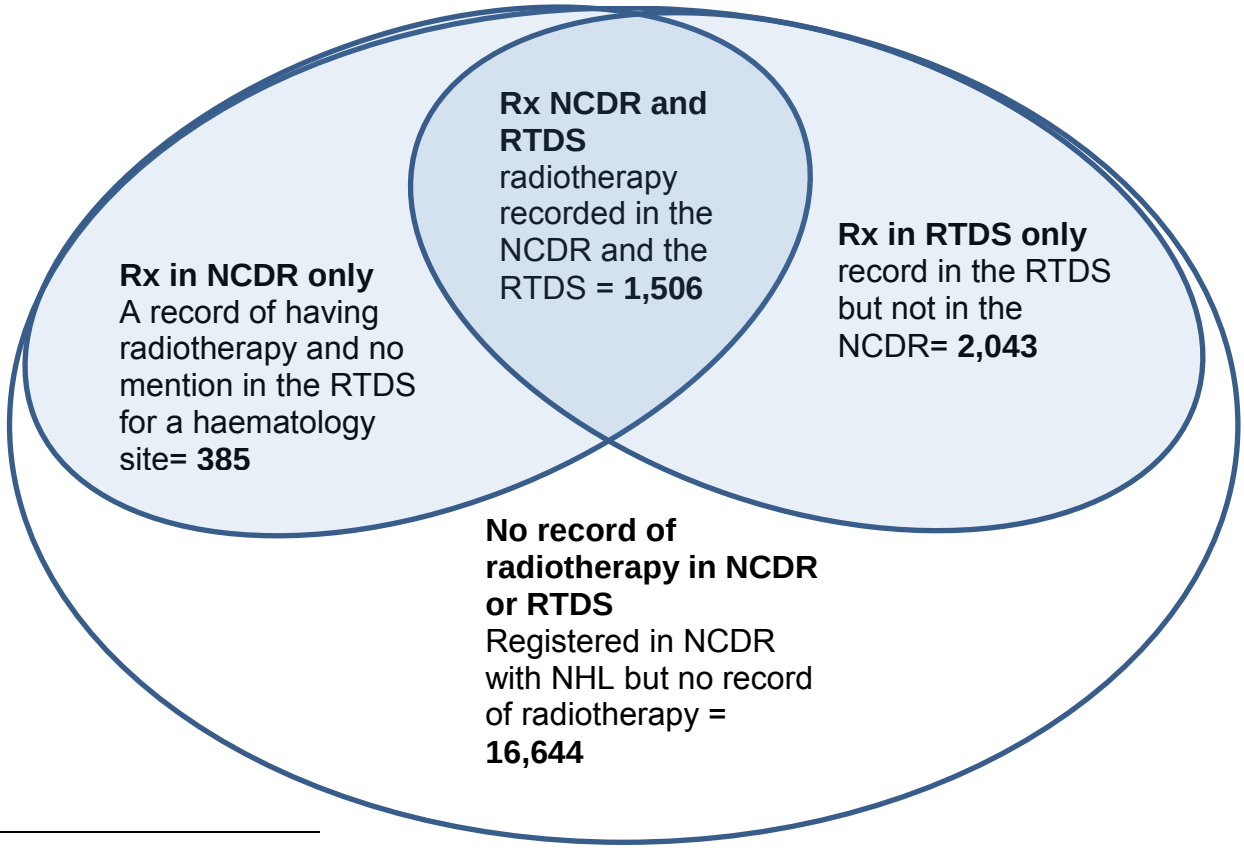
The main measures examined in the analyses were proportions of registered patients with lymphoma with evidence from the RTDS or NCDR of treatment with radiotherapy. These were considered at a population-level (Strategic Clinical Networks and historic Cancer Networks) and within trusts. Funnel plots were then use to compare the proportion of all patients with lymphoma with evidence of radiotherapy between SCNs and to compare the proportion of patients receiving curative/palliative treatment patterns by trust. SCNs and trusts with greater than two standard deviations from the national figure (ie outside the 99% control limit) were considered to be outliers. To try and account for other factors which might have influenced treatment these proportions were adjusted for the following factors (age, sex, IMD income domain, co-morbidity, route to diagnosis). Multilevel mixed-effects logistic regression models were built for cases to determine factors associated in the use of radiotherapy. These models were built with a hierarchy of patients clustered within hospital trusts, SCNs and former Cancer Networks. The dependent variable was use of radiotherapy and the explanatory variables were age, sex, IMD income category, Charlson co-morbidity score and Route to diagnosis.

Death certificate only (DCO) records were removed from the population level analyses. DCO records were excluded as a result of the patient not have a diagnosis of cancer until after they had died and as such treatment options were not discussed, 44 NHL and three Hodgkin lymphoma cases were excluded.

Results
Non-Hodgkin lymphoma

In total 20,578 individuals were registered in the NCDR during 2009 and 2010 as having non-Hodgkin lymphoma of whom 3,549 had an eligible record for linkage in the RTDS. In addition, 385 individuals registered in the NCDR with NHL were recorded as having radiotherapy in the NCDR but had no matching information in the RTDS. These analyses were limited to individuals with a record of NHL in the NCDR; individuals with NHL recorded in the RTDS, but without an NCDR record of NHL were not included at this point [384 records][2]. Figure 3 shows what information on radiotherapy was available for the 20,578 registered individuals with NHL. In total 3,934 individuals with NHL had a record of receiving radiotherapy (19.1% of all registered cases) of whom 38.3% had treatment captured by both NCDR and RTDS, 51.9% captured only in the RTDS and 9.7% only in the NCDR.

Figure 3. Venn diagram, cases in the NCDR vs cases recorded on the RTDS (non-Hodgkin lymphoma)



[2] Of these 384 patients recorded as having treatment for NHL (C82,C83,C84,C85) on the Rtd and no record of a NHL on the NCDR for 2009-2010, 207 cases (54%) had a haematological malignancy on the NCDR. The remaining cases are recorded on the NCDR with a different cancer type.

Table 1. Table of characteristics

Characteristic of study group

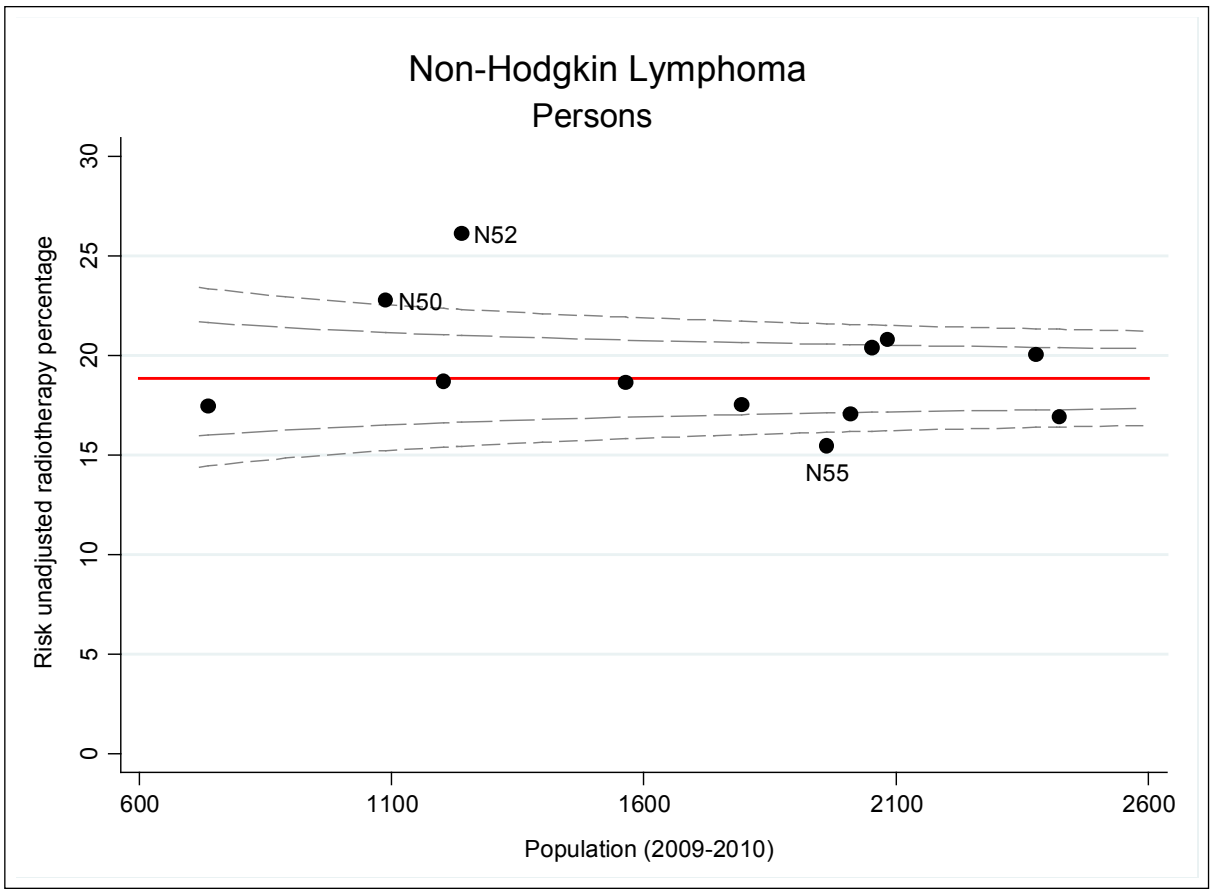
		Radiotherapy use				
			Yes		No	
		Yes	%	No	%	P-value
Sex	Male	2,085	19%	9,084	81%	
	Female	1,849	20%	7,560	80%	0.07
Age at diagnosis	<40	317	25%	970	75%	<0.01
	>=40	3,617	19%	15,674	81%	
IMD income category	Most affluent	827	19%	3,443	81%	
	2	906	20%	3,729	80%	
	3	797	18%	3,683	82%	0.16
	4	767	20%	3,142	80%	
	Most deprived	637	19%	2,647	81%	
Routes to diagnosis	Emergency presentation	756	14%	4,464	86%	
	Non-emergency presentation	2,877	21%	10,839	79%	
	Unknown	301	19%	1,297	81%	<0.01
	Death certificate only – excluded from analysis and this test			44	100%	
Diagnosis year	2009	1,926	19%	8,379	81%	0.12
	2010	2,008	20%	8,265	80%	
Co-morbidities	Known co-morbidities	367	17%	1,735	83%	<0.05
	No known co-morbidities	3,567	19%	14,909	81%	

Population level analysis – proportion of registered cases receiving radiotherapy treatment (Strategic Clinical Networks and previous Cancer Networks)

3,934 cases were identifed as receiving radiotherapy (19.1%). 385 of these cases were identifed only on the NCDR but not on the radiotherapy dataset, these records could be missing from the radiotherapy dataset or the radiotherapy dataset had these patients assigned to a non haematological maligancy.

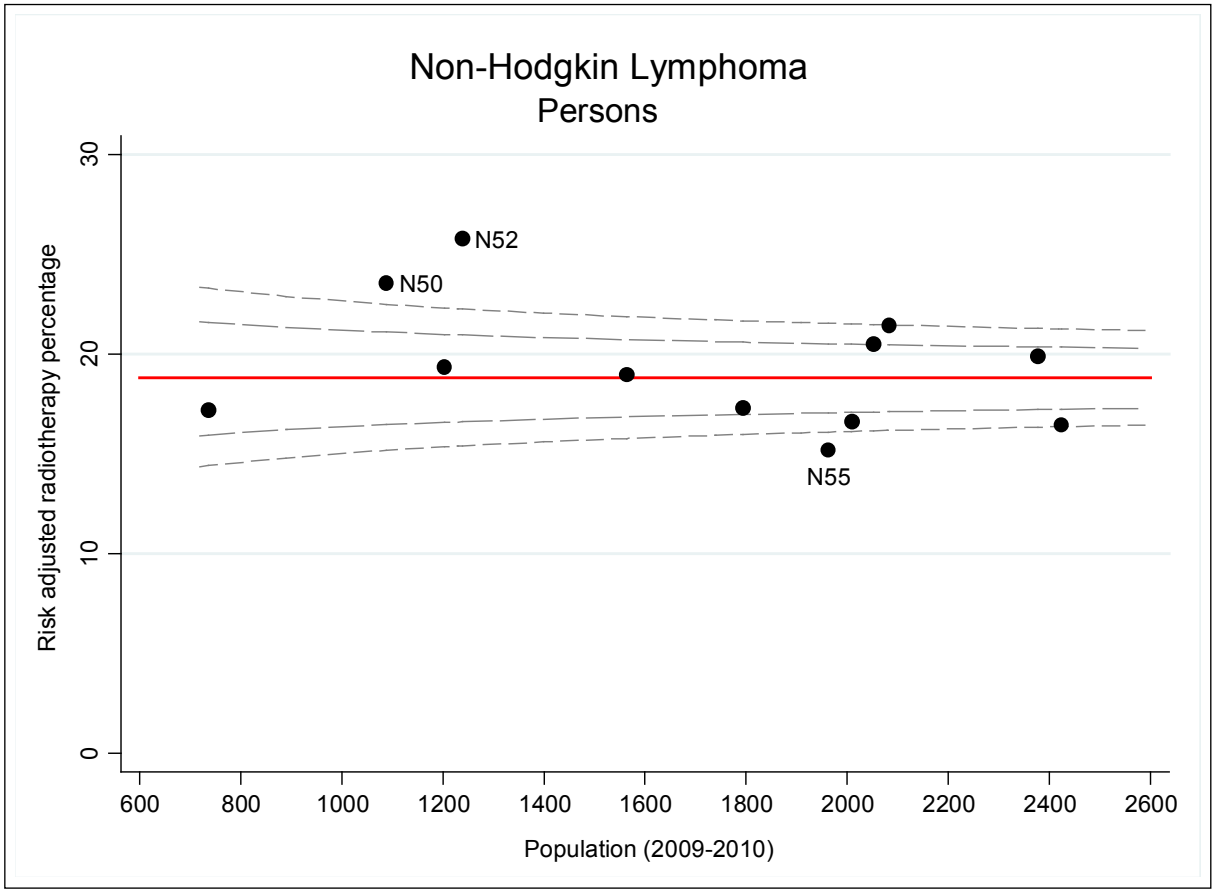
The unadjusted results in Figure 4 show that patients with NHL diagnosed in the Cheshire and Merseyside (22.8%) and Northern England (26.1%) SCNs were significantly more likely to have treatment with radiotherapy recorded, while those in the East Midlands (15.5%) SCN were signficantly less likely to have radiotherapy recorded. Adjustment of these proportions for (age, sex, IMD income category, co-morbidities and Routes to diagnosis) resulted in no additional SCNs being identified as outliers, (Figure 5).

Figure 4. Unadjusted population funnel plot for the proportion of patients with NHL recorded as receiving radiotherapy by Strategic Clinical Network (2009-2010)



Outlier SCNs	
Code	**Name**
N50 (22.8%)	Cheshire and Merseyside
N52 (26.1%)	Northern England
N55 (15.5%)	East Midlands

Figure 5. Adjusted population funnel plot for the proportion of patients with NHL recorded as receiving radiotherapy by Strategic Clinical Network (2009-2010)

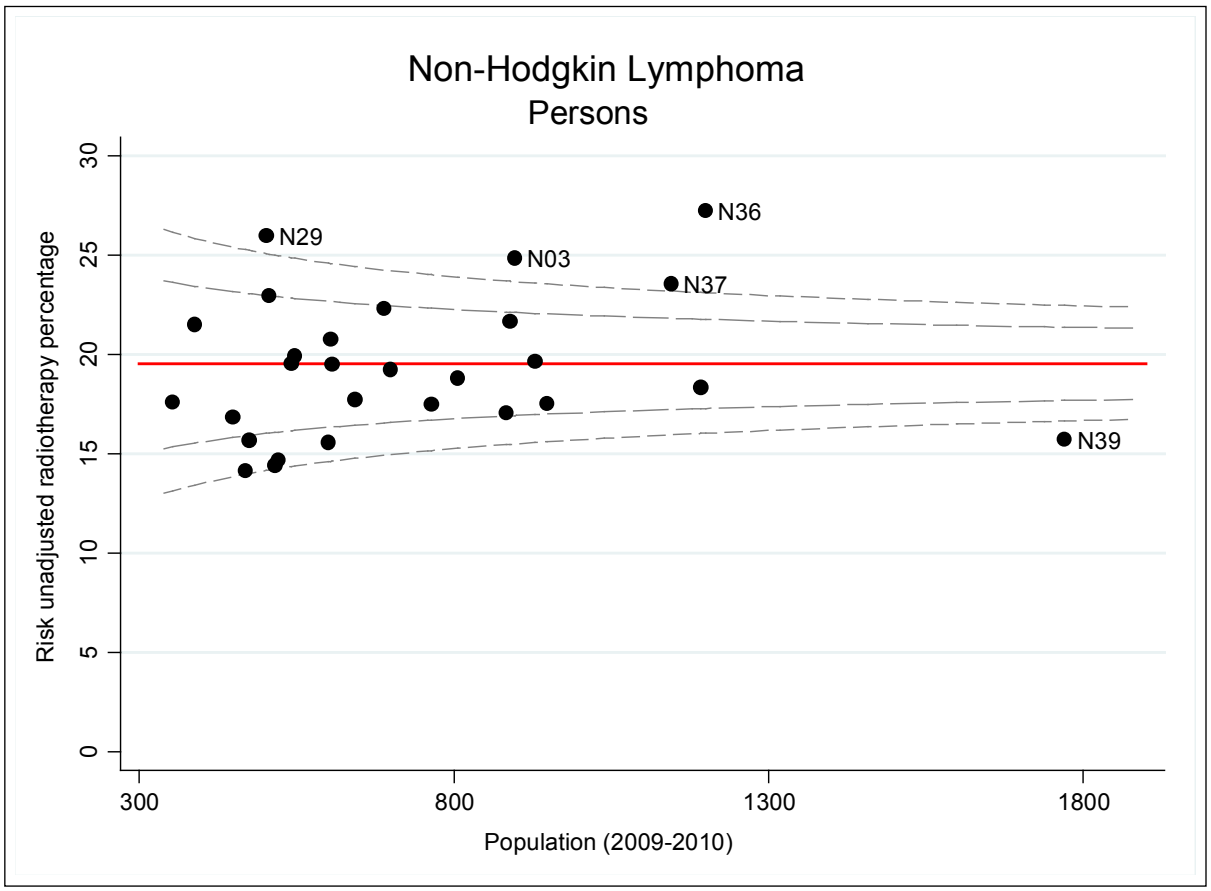


Outlier SCNs	
Code	**Name**
N50 (23.6%)	Cheshire and Merseyside
N52 (25.8%)	Northern England
N55 (15.2%)	East Midlands

Population level analysis was also carried out at the level of historic cancer networks as these are a closer match to patient flows within clinical services.

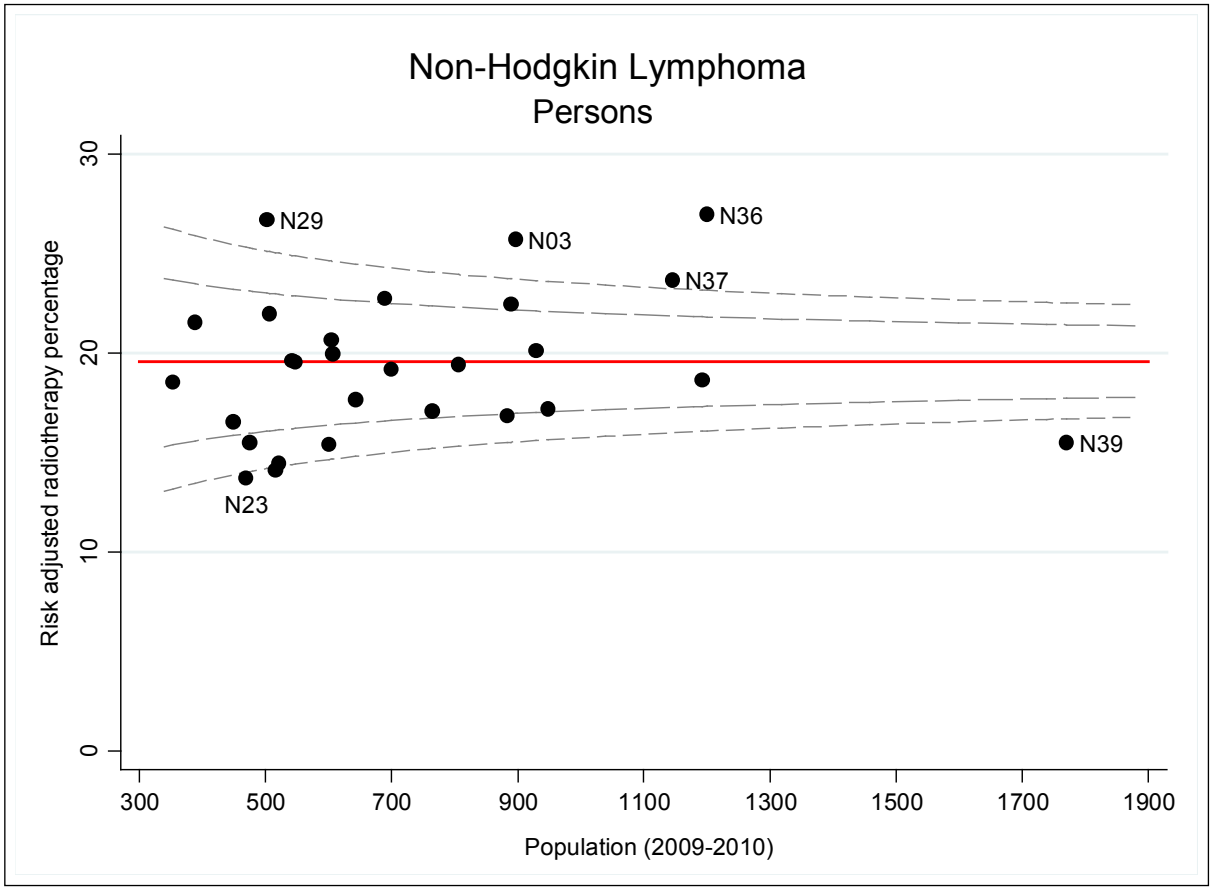
The unadjusted results in Figure 6 show that patients with NHL diagnosed in the Merseyside and Cheshire (24.9%), Three Counties (26%), North of England (27.2%) and Anglia (23.5%) were significantly more likely to have treatment with radiotherapy recorded, while those in (East Midlands (15.7%) were signficantly less likely to have radiotherapy recorded. Adjustment of these proportions for (age, sex, IMD income domain, co-morbidities and Route to diagnosis) resulted in another CN being identified as an outlier North East London (13.7%), (Figure 7).

Figure 6. Unadjusted population funnel plot for the proportion of patients with NHL recorded as receiving radiotherapy by historical Cancer Network (2009-2010)



Cancer Network outliers	
Code	**Name**
N03 (24.9%)	Merseyside and Cheshire CN
N29 (26.0%)	Three Counties CN
N36 (27.2%)	North of England CN
N37 (23.5%)	Anglia CN
N39 (15.7%)	East Midlands CN

Figure 7. Adjusted population funnel plot for the proportion of patients with NHL recorded as receiving radiotherapy by historical Cancer Network (2009-2010)

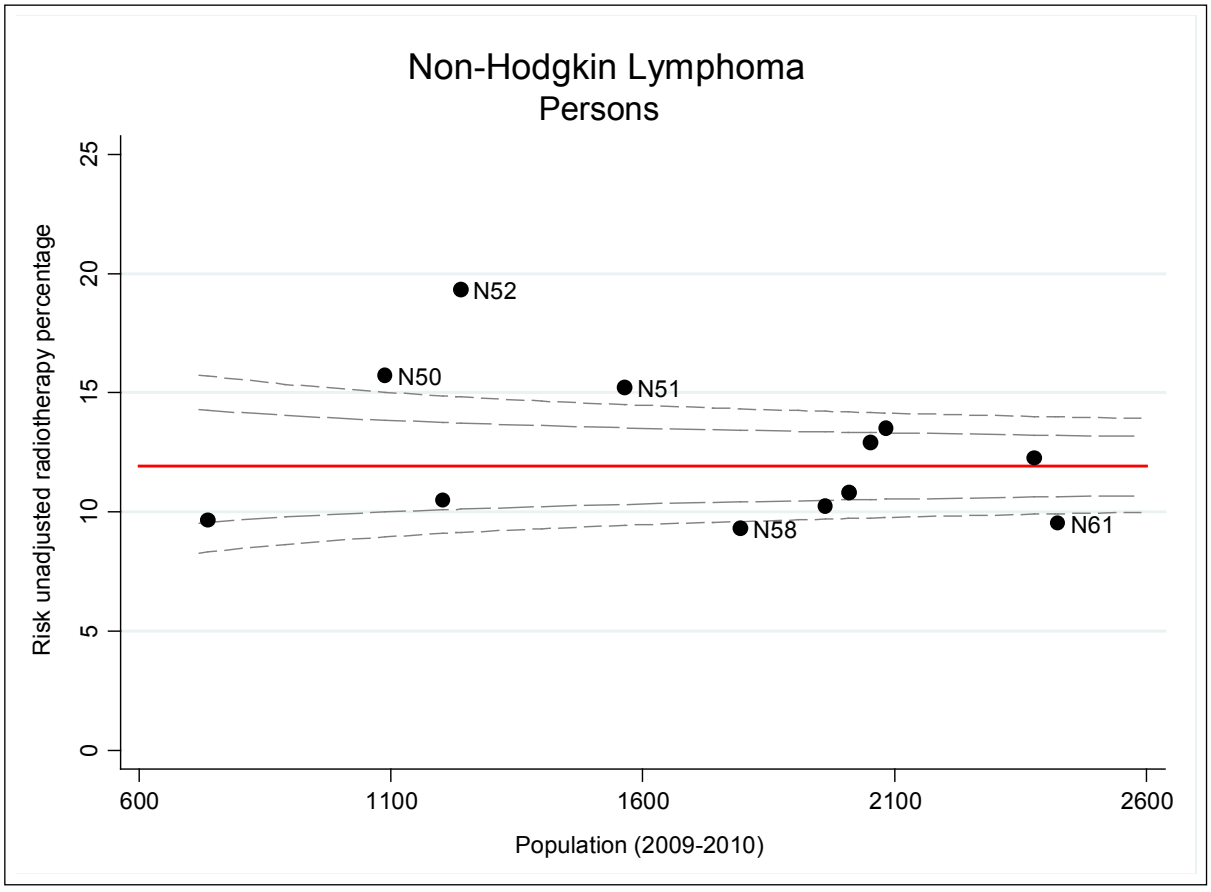


Cancer Network outliers	
Code	**Name**
N03 (25.7%)	Merseyside and Cheshire CN
N29 (26.7%)	Three Counties CN
N36 (27.0%)	North of England CN
N37 (23.7%)	Anglia CN
N23 (13.7%)	North East London CN
N39 (15.5%)	East Midlands CN

Population Level Analysis – The proportion of patients receiving a 'curative' radiotherapy treatment pattern examined by SCN

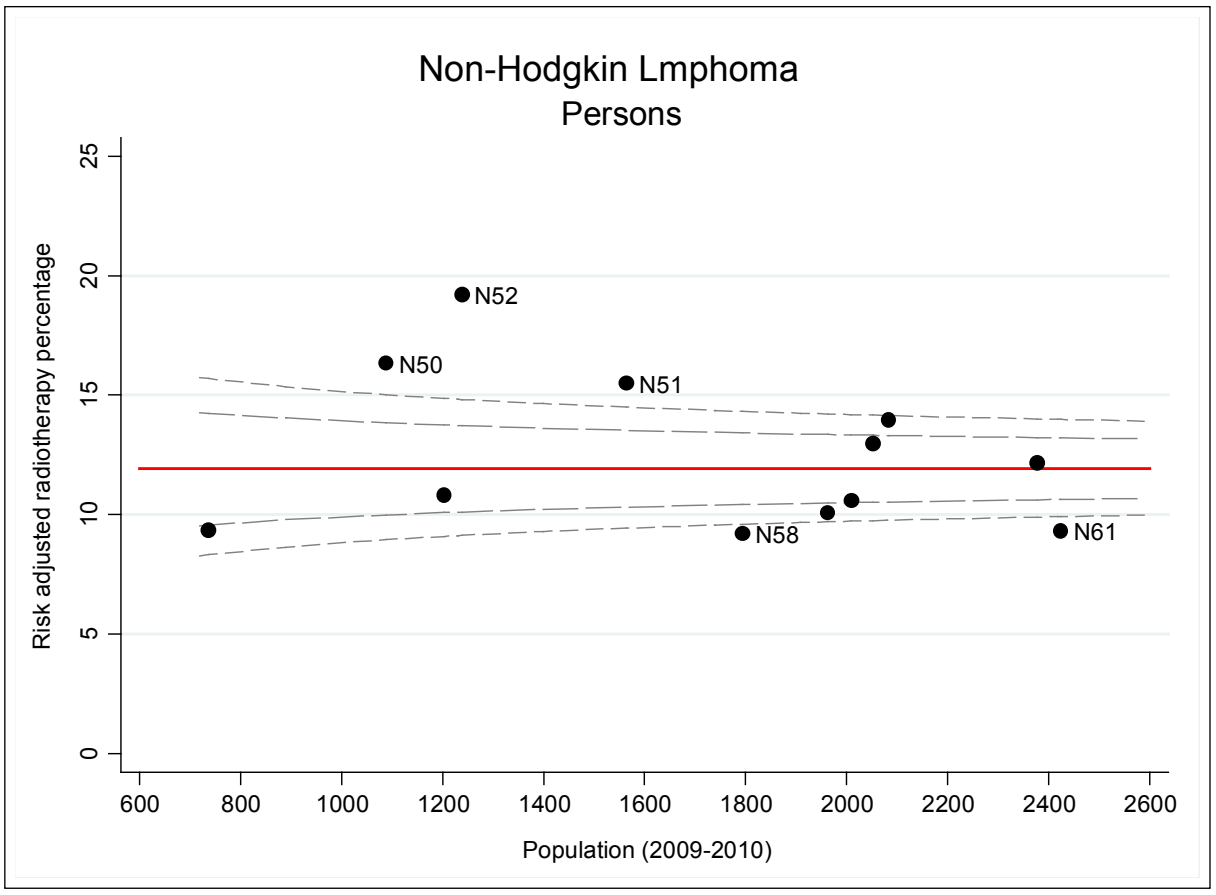
The unadjusted results in Figure 8 show that patients with NHL diagnosed in the Cheshire and Merseyside (15.7%), Greater Manchester Lancashire and South Cumbria (15.2%) and Northern England (19.3%) SCNs were significantly more likely to have 'curative pattern' treatment with radiotherapy recorded, while those in South East Coast (9.3%) and London (9.5%) SCNs were significantly less likely to have a 'curative pattern' of radiotherapy recorded.

Figure 8. Unadjusted population funnel plot for the proportion of patients with NHL recorded as receiving 'curative' radiotherapy by Strategic Clinical Network (2009-2010)



SCN outliers	
Code	**Name**
N50 (15.7%)	Cheshire and Merseyside
N51 (15.2%)	Greater Manchester Lancashire and South Cumbria
N52 (19.3%)	Northern England
N58 (9.3%)	South East Coast
N61 (9.5%)	London

Figure 9. Adjusted population funnel plot for the proportion of patients with NHL recorded as receiving 'curative' radiotherapy by Strategic Clinical Network (2009-2010)



SCN outliers	
Code	**Name**
N50 (16.3%)	Cheshire and Merseyside
N51 (15.5%)	Greater Manchester Lancashire and South Cumbria
N52 (19.2%)	Northern England
N58 (9.2%)	South East Coast
N61 (9.3%)	London

Table 2. Cases identified on the RTDS

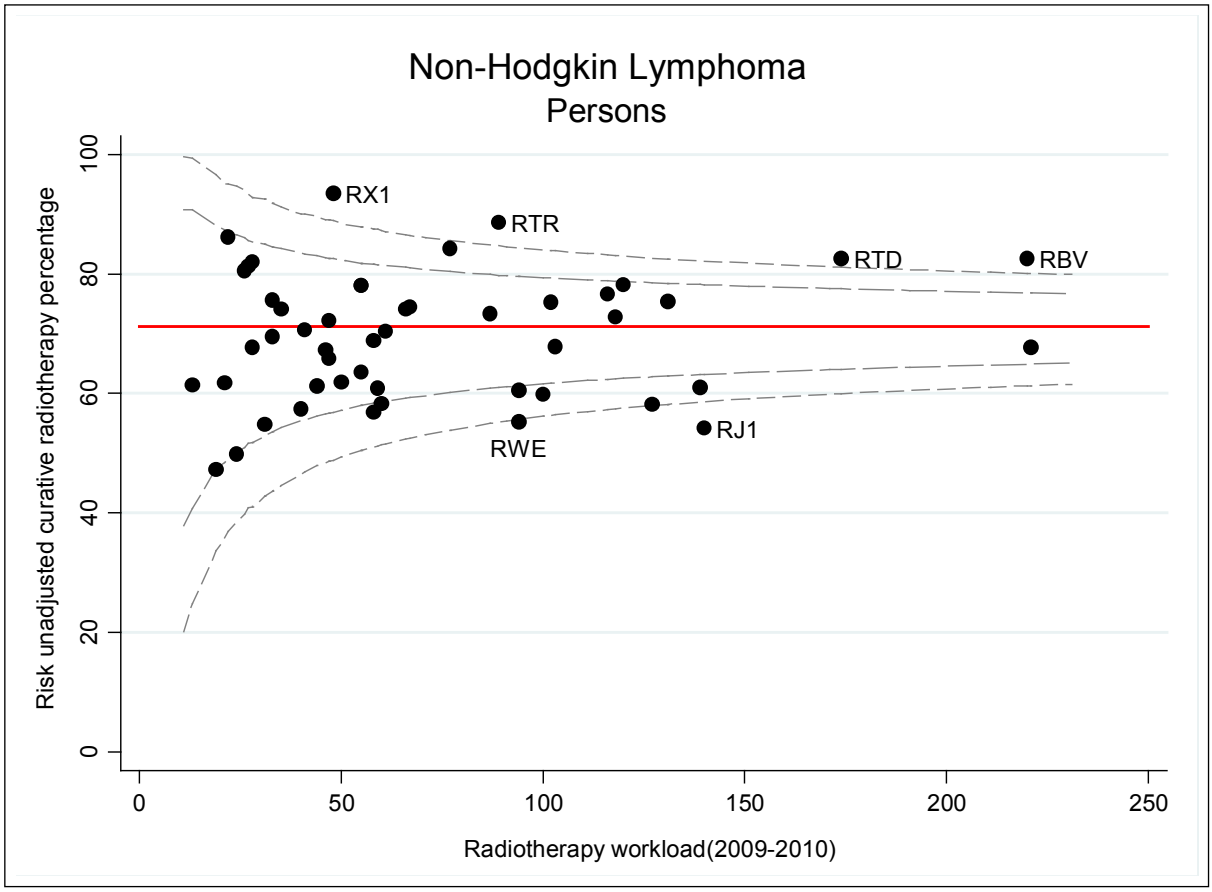
SCN	<10 attendances n *(%)*		>=10 attendances n *(%)*		No recorded radiotherapy in RTDS n *(%)*		Total
N50	78	7.2%	171	15.7%	839	77.1%	1,088
N51	54	3.4%	238	15.2%	1,276	81.4%	1,568
N52	49	3.9%	239	19.3%	953	76.8%	1,241
N53	97	4.8%	217	10.8%	1,698	84.4%	2,012
N54	167	7.0%	291	12.2%	1,920	80.7%	2,378
N55	92	4.7%	201	10.2%	1,673	85.1%	1,966
N56	89	4.3%	265	12.9%	1,703	82.8%	2,057
N57	107	5.1%	281	13.5%	1,699	81.4%	2,087
N58	91	5.1%	167	9.3%	1540	85.7%	1798
N59	40	5.4%	71	9.6%	628	85.0%	739
N60	78	6.5%	126	10.4%	1,002	83.1%	1,206
N61	109	4.5%	231	9.5%	2098	86.1%	2,438
Total	**1,051**		**2,498**		**17,029**		**20,578**

Trust level analysis – the proportion of patients receiving a ‘curative’ radiotherapy treatment pattern examined by treating trust

The dataset used for these analyses was limited to those individuals with NHL recorded as having radiotherapy in the RTDS (3,549) as attendance patterns were available only for this group.

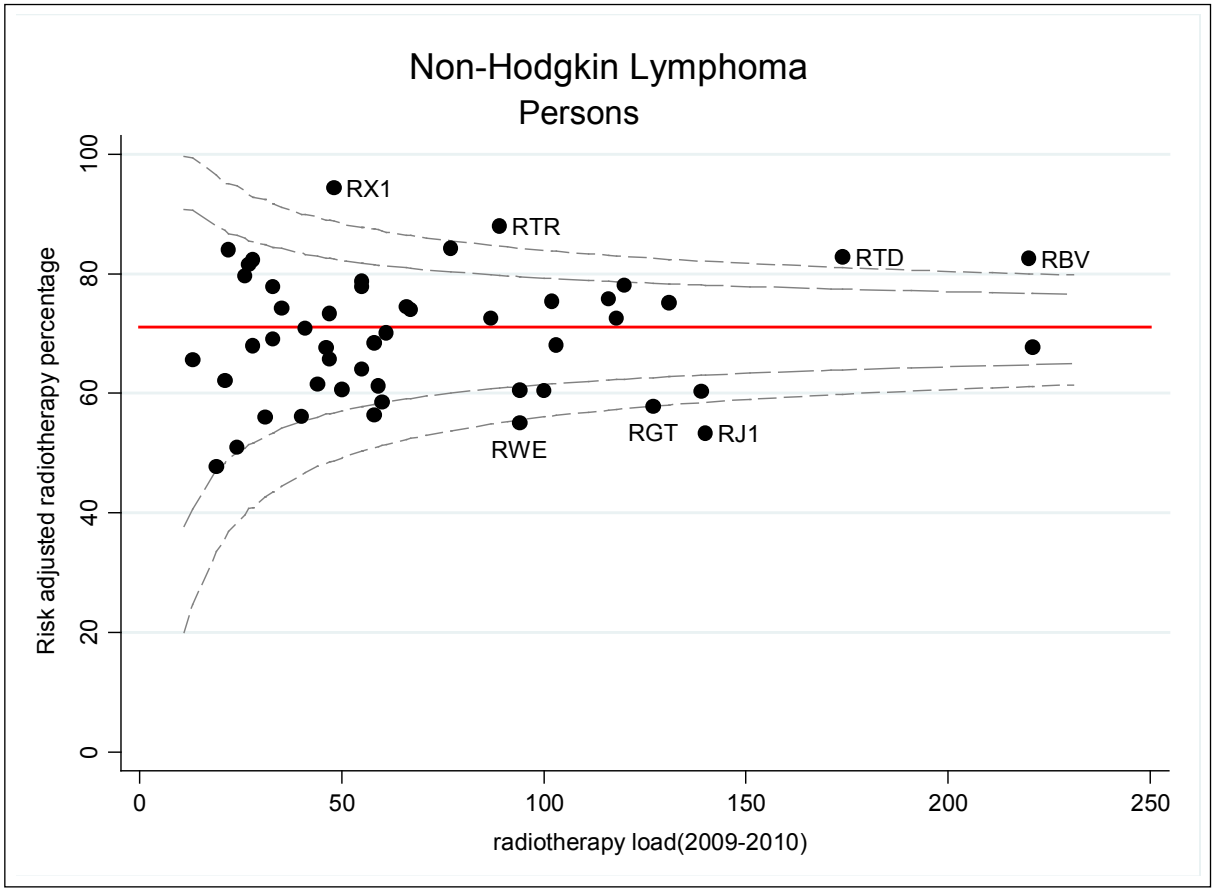
The unadjusted results in Figure 10 show that patients receiving radiotherapy at The Christie NHS Foundation Trust (82.5%), The Newcastle Upon Tyne Hospitals (82.6%), South Tees Hospitals NHS Foundation Trust (88.6%) and Nottingham University Hospitals NHS Trust (93.5%) were significantly more likely to have ‘curative pattern’ treatment with radiotherapy recorded, while those in Guy's and St Thomas' NHS Foundation Trust (54.2%) and University Hospitals of Leicester NHS Trust (55.2%) were signficantly less likely to have ‘curative pattern’ radiotherapy recorded. Adjustment of these proportions for (age, sex, IMD income domain, co-morbidities and routes to diagnosis) resulted in one additional trust being identified as outlier Cambridge University Hospitals NHS Foundation Trust (57.8%), (Figure 11).

Figure 10. Unadjusted trust level funnel plot for the proportion of radiotherapy patients with NHL recorded as receiving 'curative' radiotherapy by trust (2009-2010)



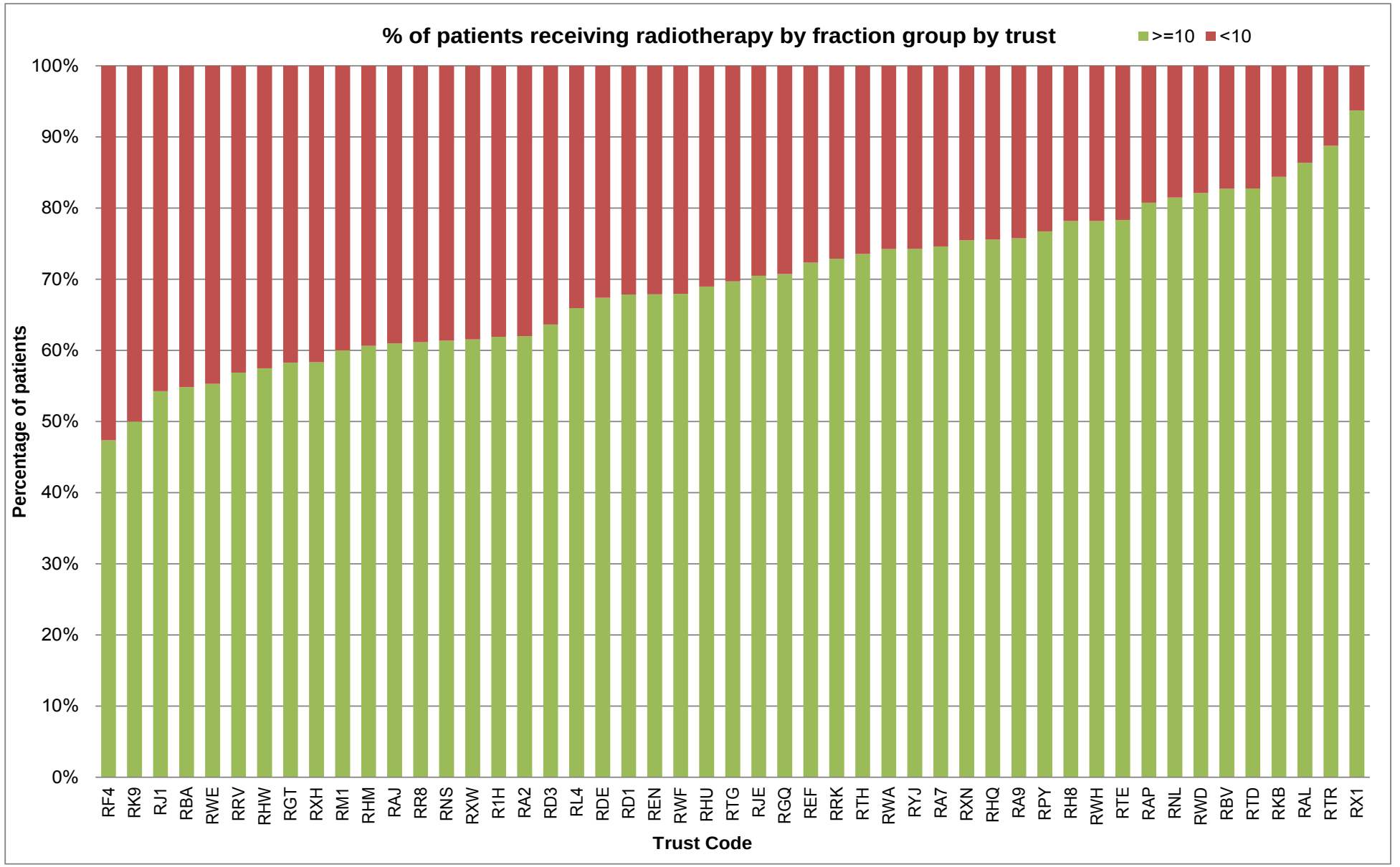
Trust outliers	
Code	**Trust**
RBV (82.5%)	The Christie NHS Foundation Trust
RTD (82.6%)	The Newcastle Upon Tyne Hospitals NHS
RTR (88.6%)	South Tees Hospitals NHS Foundation Trust
RX1 (93.5%)	Nottingham University Hospitals NHS Trust
RJ1 (54.2%)	Guy's and St Thomas' NHS Foundation Trust
RWE (55.2%)	University Hospitals of Leicester NHS Trust

Figure 11. Adjusted trust level funnel plot for the proportion of radiotherapy patients with NHL recorded as receiving 'curative' radiotherapy by trust (2009-2010)



Trust outliers	
Code	**Trust**
RX1 (94.3%)	Nottingham University Hospitals NHS Trust
RTR (88.0%)	South Tees Hospitals NHS Foundation Trust
RTD (82.8%)	The Newcastle Upon Tyne Hospitals NHS Foundation Trust
RBV (82.6%)	The Christie NHS Foundation Trust
RJ1 (53.3%)	Guy's and St Thomas' NHS Foundation Trust
RGT (57.8%)	Cambridge University Hospitals NHS Foundation Trust
RWE (55.0%)	University Hospitals of Leicester NHS Trust

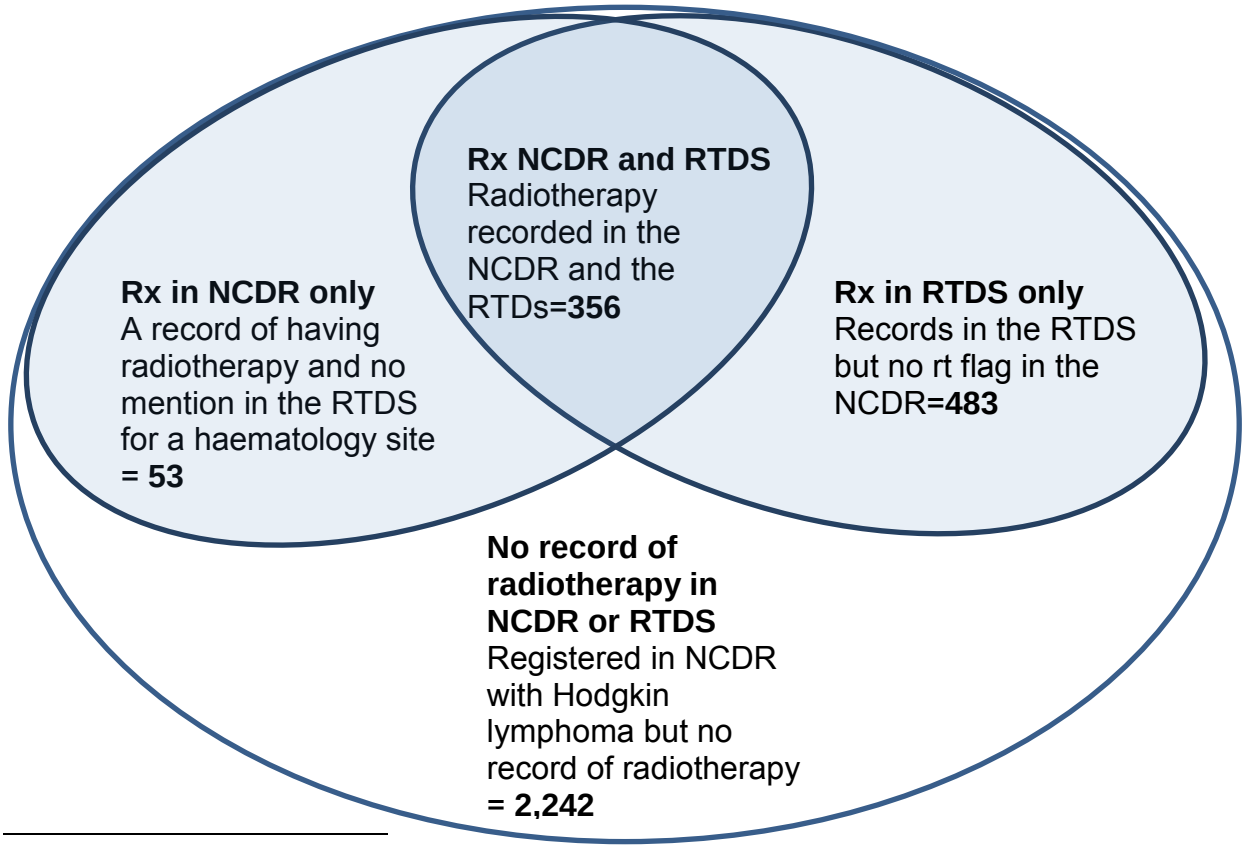
Figure 12. Variation in non-Hodgkin lymphoma radiotherapy use across English NHS trusts (treated patients only) - unadjusted



Hodgkin lymphoma

In total 3,134 individuals were registered in the NCDR between 2009 and 2010 as having Hodgkin lymphoma of whom 839 had an eligible record for linkage in the RTDS. In addition, 53 individuals registered in the NCDR with Hodgkin lymphoma were recorded as having radiotherapy in the NCDR but had no matching information in the RTDS. These analyses were limited to individuals with a record of Hodgkin lymphoma in the NCDR, individuals recorded in the RTDS as having Hodgkin lymphoma but without a NCDR record for Hodgkin lymphoma during 2009-2010 were not included at this point [116][3]. Figure 13 shows what information on radiotherapy was available for the 3,134 registered individuals with Hodgkin lymphoma. In total 892 individuals with Hodgkin lymphoma had a record of receiving radiotherapy (28.5% of all registered cases) of whom 39.9% had treatment captured by both NCDR and RTDS, 54.1% were captured only in the RTDS and 5.9% only in the NCDR.

Figure 13. Venn diagram, cases in the NCDR vs. cases recorded on the RTDS (Hodgkin lymphoma)



[3] Of these 116 patients recorded as having treatment for Hodgkin Lymphoma (C81) on the Rtd and no record of a Hodgkin lymphoma on the NCDR for 2009-2010, 99 cases (85%) did have a haematological malignancy on the NCDR. The remaining cases are recorded on the NCDR with a different cancer type.

Table 3. Table of characteristics

Characteristic of study group

		Radiotherapy use				
		Yes		No		
		Yes	%	No	%	P-value
Sex	Male	518	29%	1,262	71%	
	Female	374	28%	980	72%	0.36
Age at diagnosis	<40	454	30%	1,039	70%	<0.05
	>=40	438	27%	1,203	73%	
IMD income category	Most affluent	152	26%	428	74%	
	2	179	29%	435	71%	
	3	174	28%	442	72%	0.41
	4	199	31%	442	69%	
	Most deprived	188	28%	495	72%	
Route to diagnosis	Emergency presentation	95	20%	388	80%	
	Non-emergency presentation	727	30%	1,679	70%	
	Unknown	70	29%	172	71%	<0.01
	Death certificate only –excluded from analysis and this test			3	100%	
Diagnosis year	2009	432	27%	1,146	73%	0.18
	2010	460	30%	1,096	70%	
Co-morbidities	Known co-morbidities	50	24%	158	76%	0.14
	No known co-morbidities	842	29%	2,084	71%	

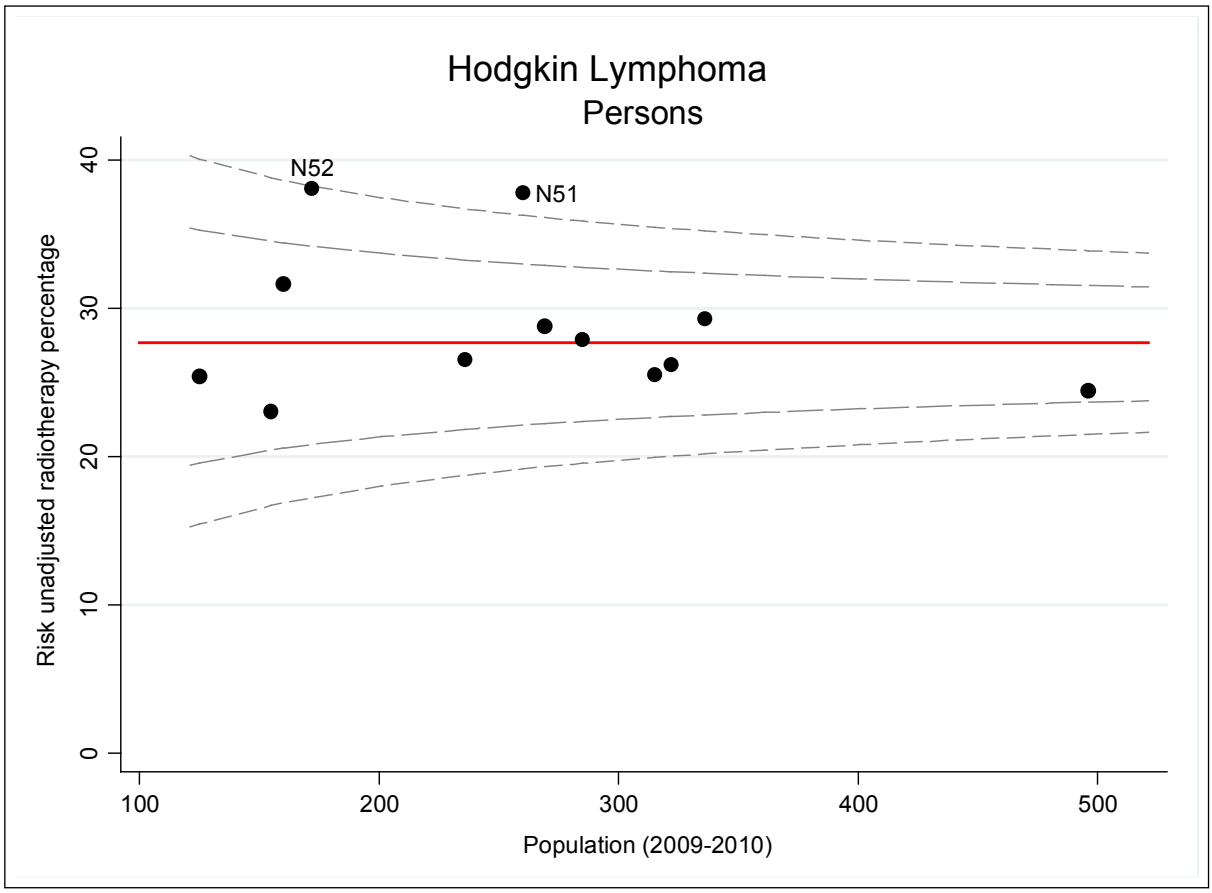
Population level analysis – the proportion of patients receiving a 'curative' radiotherapy treatment pattern examined by SCN

Population-level analysis was carried out to identify any variation between Strategic Clinical Networks (SCNs) in the proportion of individuals registered with Hodgkin lymphoma with a record of radiotherapy.

Cases were assigned a flag to indicate whether or not they had received radiotherapy (0=no, 1=yes), 838 cases were identifed on the radiotherapy dataset and 37 were identifed on the NCDR but not on the radiotherapy dataset, 892 cases were identifed as receiving radiotherapy (28.5%)

Results showed that there was no significant variation at trust level in the proportion of patients receiving curative versus palliative treatment for Hodgkin with most patients receiving curative treatment and as such funnel plots were not produced.

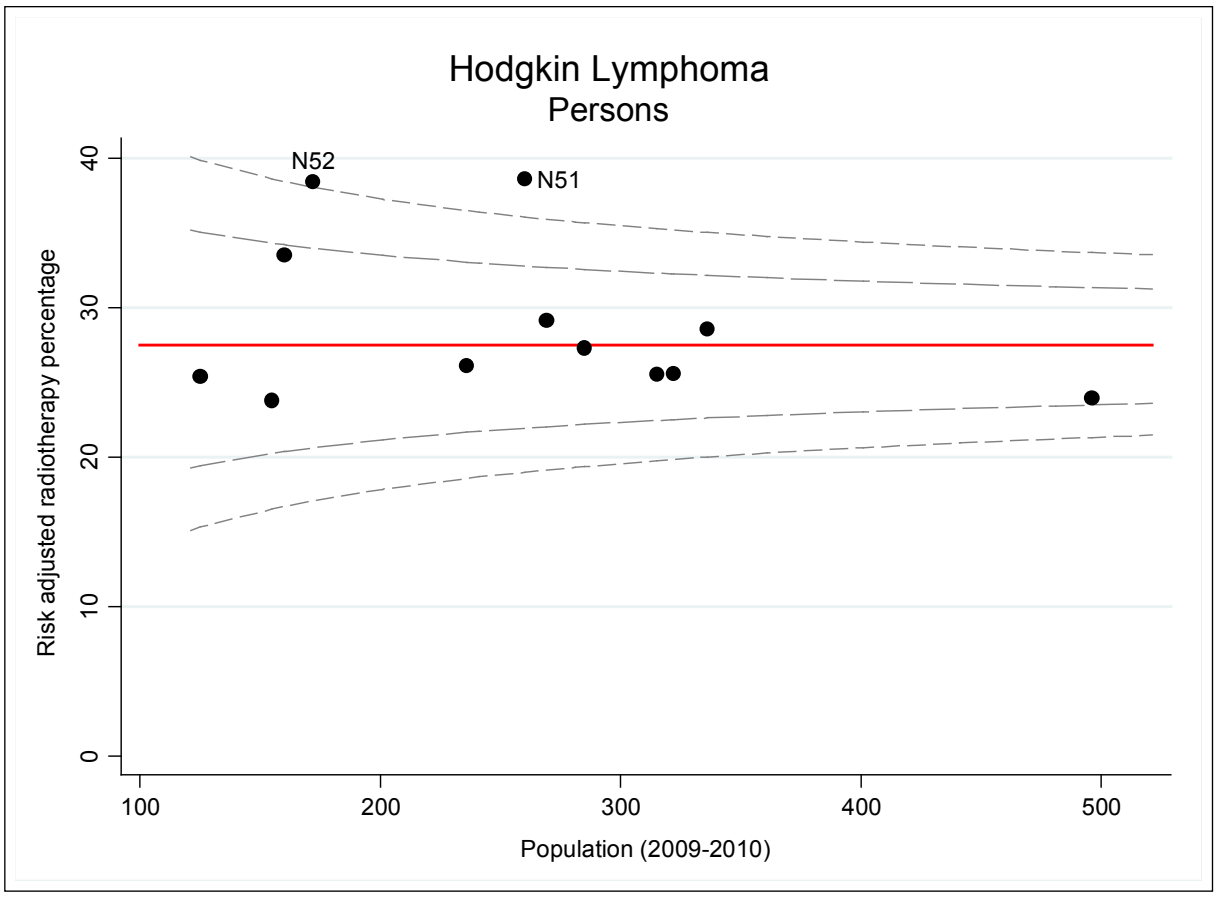
Figure 14. Unadjusted population funnel plot for the proportion of patients with Hodgkin lymphoma recorded as receiving radiotherapy by Strategic Clinical Network (2009-2010)



SCN outliers	
Code	**Name**
N51 (37.8%)	Greater Manchester Lancashire and South Cumbria
N52 (38.1%)	Northern England

The unadjusted results in Figure 14 show that patients with Hodgkin lymphoma diagnosed in the Greater Manchester Lancashire and South Cumbria (37.8 %) and Northern England (38.1%) SCNs were significantly more likely to have treatment with radiotherapy recorded. Adjustment of these proportions for (age, sex, IMD income category, co-morbidities and routes to diagnosis) resulted in no additional SCNs being identified as an outlier, (Figure 15).

Figure 15. Adjusted population funnel plot for the proportion of patients with Hodgkin lymphoma recorded as receiving radiotherapy by Strategic Clinical Network (2009-2010)



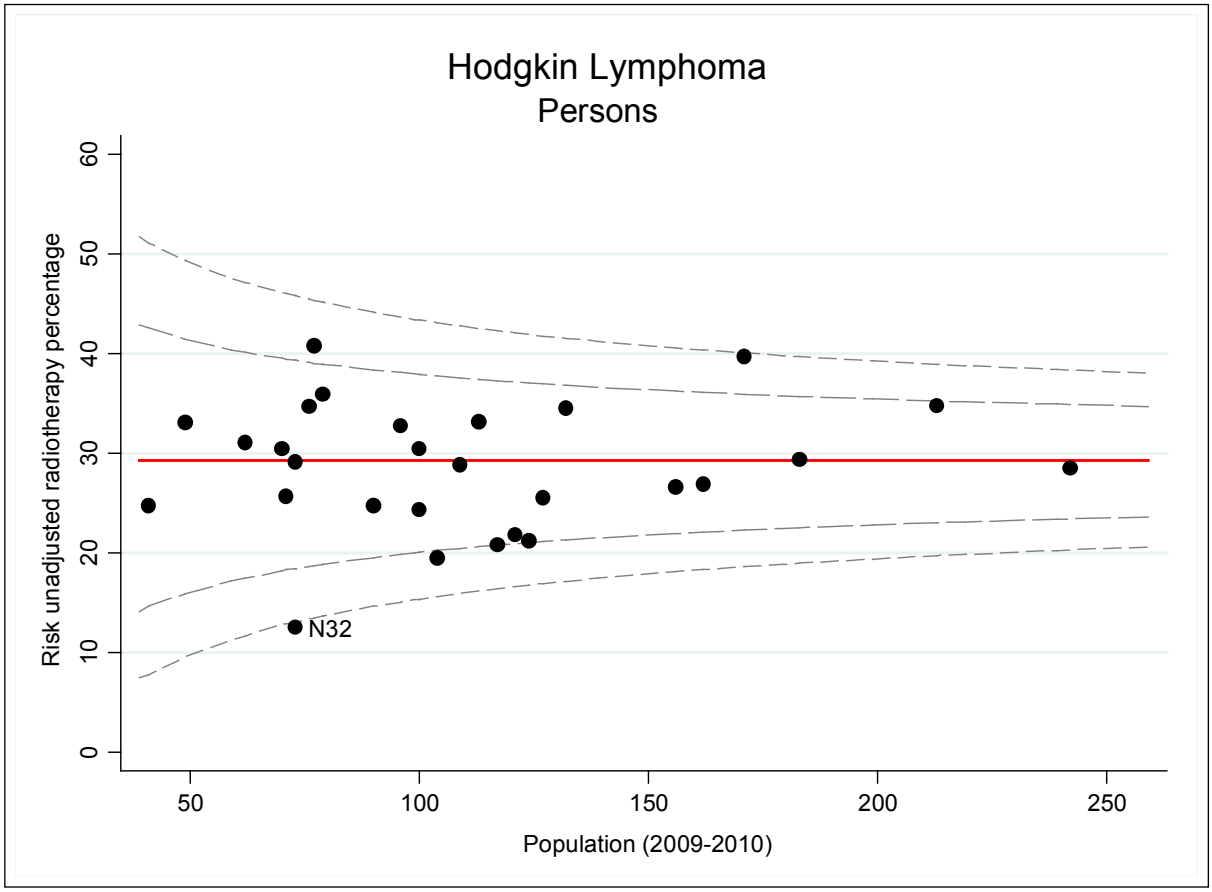
SCN outliers	
Code	**Name**
N51 (38.6%)	Greater Manchester Lancashire and South Cumbria
N52 (38.4%)	Northern England

Table 4. Cases identified on the RTDS

SCN	<10 attendances n *(%)*		>=10 attendances n *(%)*		No recorded radiotherapy in RTDS n *(%)*		Total
N50	2	1%	49	31%	109	68%	160
N51	3	1%	96	37%	162	62%	260
N52	3	2%	55	32%	114	66%	172
N53	6	2%	74	23%	242	75%	322
N54	3	1%	92	27%	241	72%	336
N55	6	2%	72	25%	207	73%	285
N56	6	2%	70	22%	240	76%	315
N57	6	2%	64	24%	200	74%	269
N58	3	1%	57	24%	176	75%	236
N59	4	3%	27	22%	94	75%	125
N60	4	3%	30	19%	121	78%	155
N61	2	0%	105	21%	389	78%	496
Total	**48**		**791**		**2295**		**3134**

Most patients diagnosed with Hodgkin lymphoma will receive between 10 and 15 fractions if the treatment intent is curative and a much lower number of fractions if the treatment intent is palliative. The results in Table 4 show that 791 patients (25%) diagnosed with Hodgkin lymphoma had an attendance pattern suggesting the treatment intent was curative.

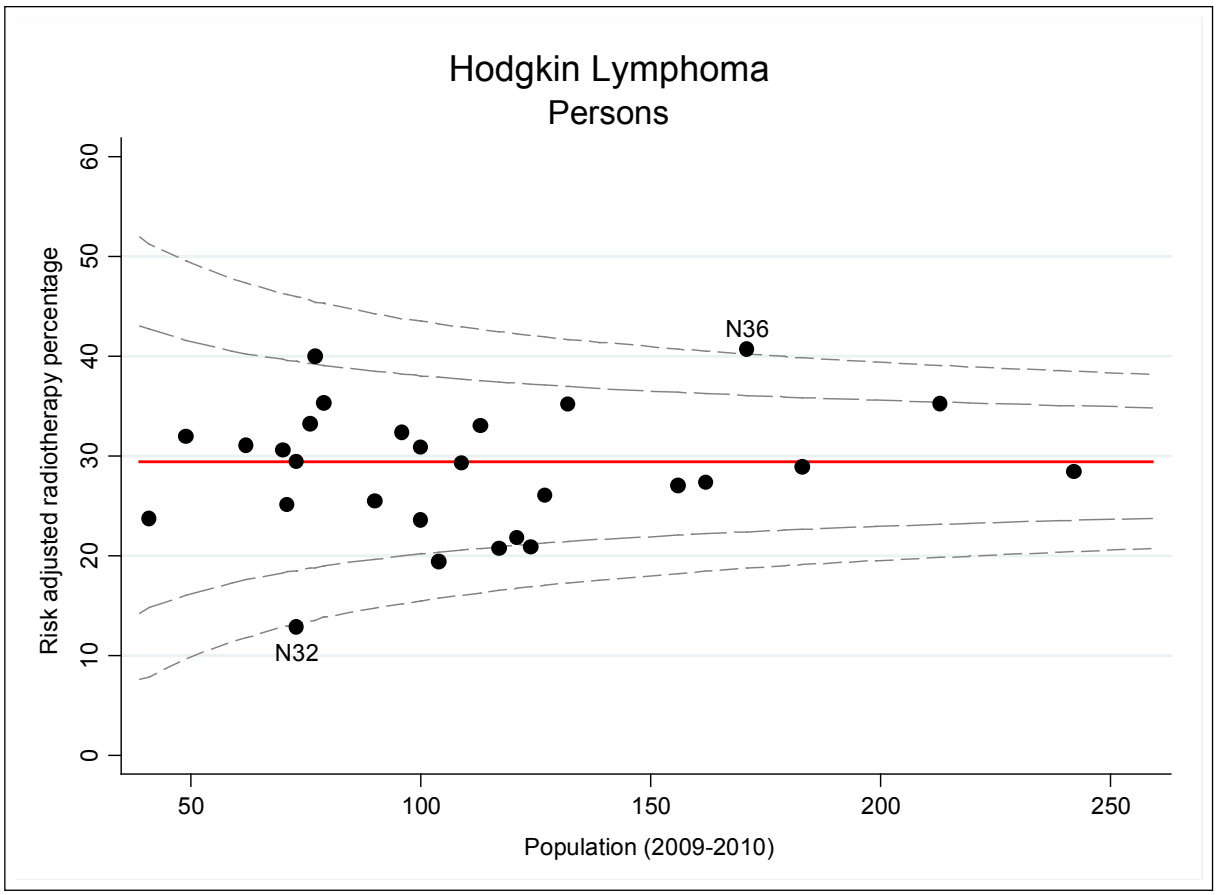
Figure 16. Unadjusted population funnel plot for the proportion of patients with Hodgkin lymphoma recorded as receiving radiotherapy by historical Cancer Network (2009-2010)



Cancer Network outliers	
Code	**Name**
N32 (12.5%)	Surrey, West Sussex and Hampshire CN

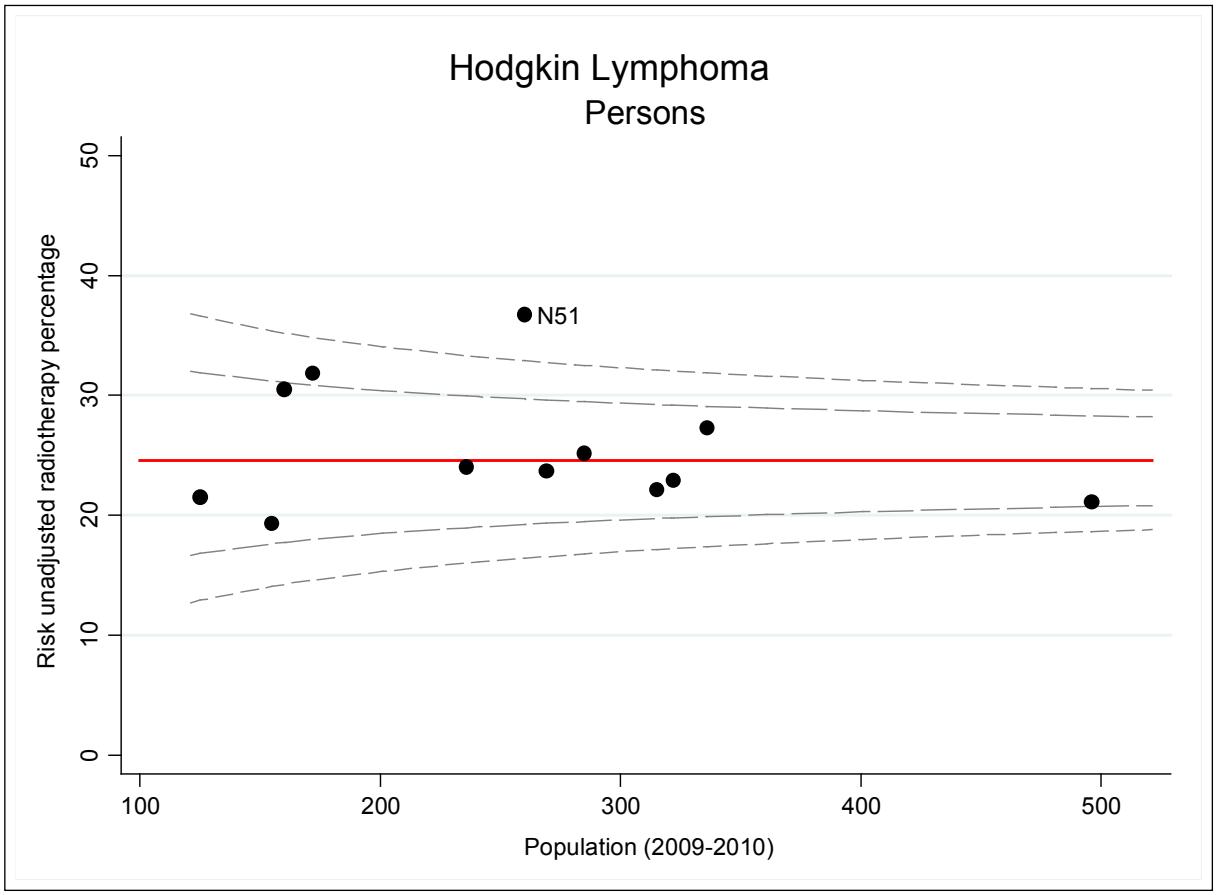
The unadjusted results in Figure 16 show that patients with Hodgkin lymphoma diagnosed in Surrey, West Sussex and Hampshire Cancer Network (12.5%) were significantly less likely to have treatment with radiotherapy recorded. Adjustment of these proportions for (age, sex, IMD income domain and route to diagnosis) resulted in an additional Cancer Network being identified as an outlier North of England Cancer Network (40.7%) where delivery of radiotherapy treatment was significantly higher, (Figure 17).

Figure 17. Adjusted population funnel plot for the proportion of patients with Hodgkin lymphoma recorded as receiving radiotherapy by historical Cancer Network (2009-2010)



Cancer Network outliers	
Code	**Name**
N36 (40.7%)	North of England CN
N32 (12.9%)	Surrey, West Sussex and Hampshire CN

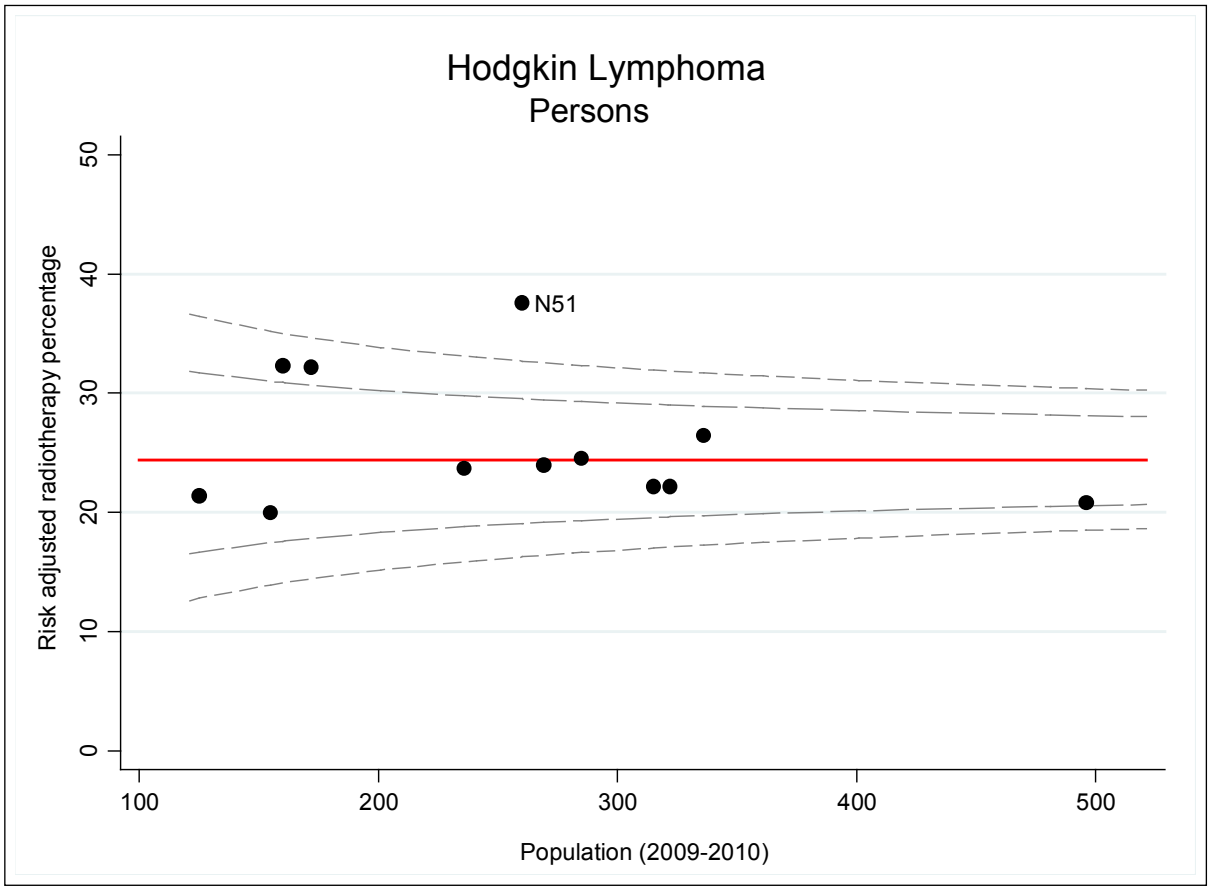
Figure 18. Unadjusted population funnel plot for the proportion of patients with Hodgkin lymphoma recorded as receiving 'curative' radiotherapy by Strategic Clinical Network (2009-2010)



Outlier SCNs	
Code	**Name**
N51 (36.8%)	Greater Manchester Lancashire and South Cumbria

The unadjusted results in Figure 18 show that patients diagnosed with Hodgkin lymphoma diagnosed in Greater Manchester Lancashire and South Cumbria SCN (36.8%) were significantly more likely to have 'curative pattern' treatment with radiotherapy recorded. Adjustment of these proportions for (age, sex, IMD income domain, co-morbidities and Route to diagnosis) resulted in no additional outliers being identified, (Figure 19).

Figure 19. Adjusted population funnel plot for the proportion of patients with Hodgkin lymphoma recorded as receiving 'curative' radiotherapy by Strategic Clinical Network (2009-2010)



Trust level analysis – the proportion of patients receiving a 'curative' radiotherapy treatment pattern examined by treating trust

The dataset used for these analyses was limited to those individuals with Hodgkin lymphoma recorded as having radiotherapy in the RTDS (839) as attendance patterns were only available for this group. Figure 20 shows no variation between trusts in the use of curative radiotherapy treatment. Adjustment of these proportions for (age, sex, IMD income domain and Routes to diagnosis) still resulted in no outliers being identified.

Figure 20. Variation in Hodgkin lymphoma radiotherapy use across English NHS trusts (treated patients only) – unadjusted

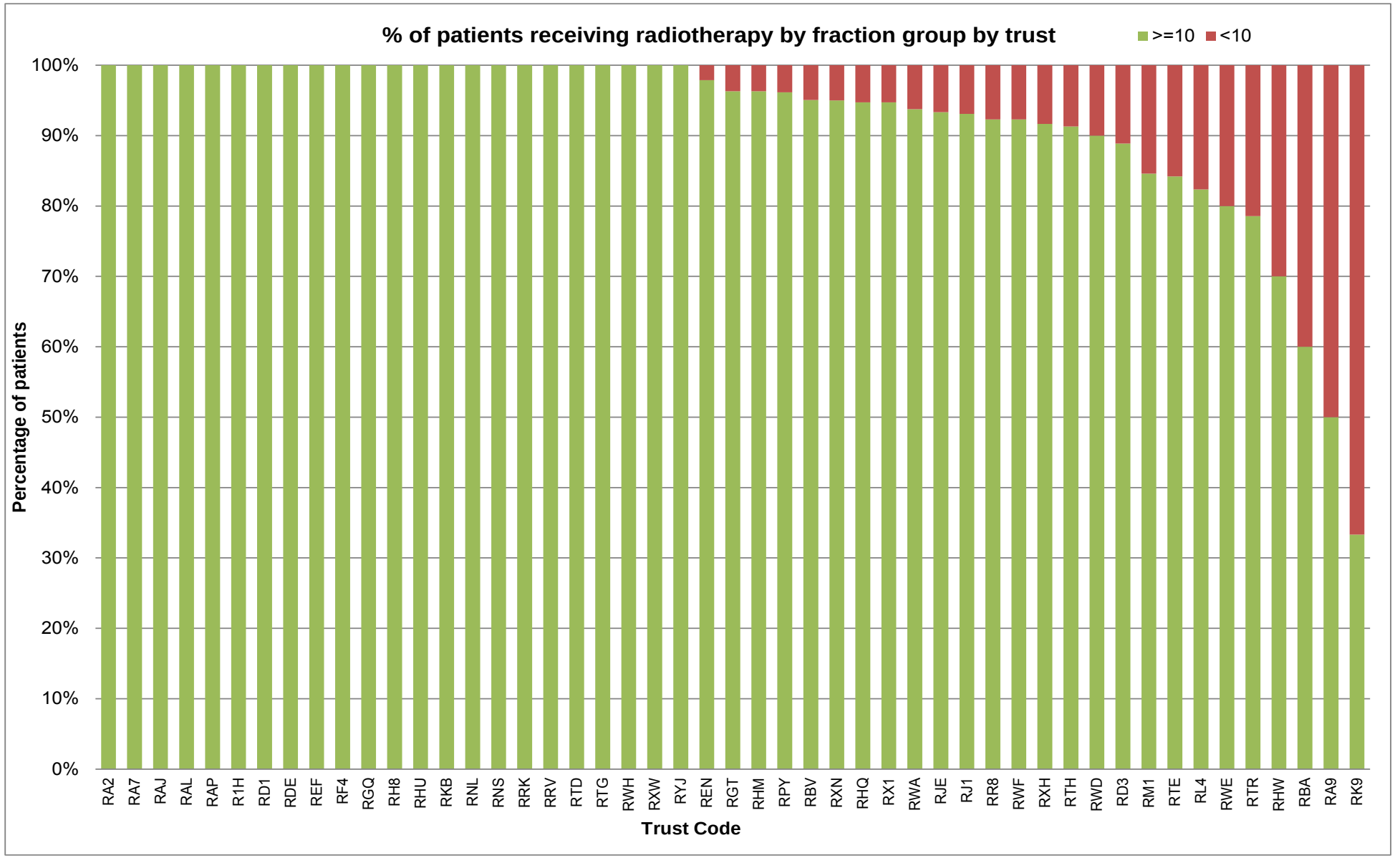


Figure 20 shows the proportion of patients who were treated with curative and palliative radiotherapy by trust. Plymouth Hospitals NHS Trust (RK9), South Devon Healthcare NHS Foundation Trust (RA9), and Taunton and Somerset NHS Foundation Trust (RBA) show a higher proportion of patients with Hodgkin lymphoma receiving palliative treatment compared to other trusts, however, the number of cases for these trusts were low, (Table 5).

Table 5. Radiotherapy delivered in trusts with a small number of patients treated with radiotherapy

Trust	<10	>=10	Total
RK9	2	1	3
RA9	1	1	2
RBA	2	3	5

Discussion

As recognised in our previous data quality report, the NCDR does not capture radiotherapy effectively at a national level. Combining the NCDR and RTDS datasets has enabled the identification of patients with a diagnosis of lymphoma that have been recorded as having received radiotherapy.

Overall, 19.1% of the population with NHL and 28.5% of the population with Hodgkin lymphoma were recorded as receiving radiotherapy but with significant variation by region. For NHL the proportion of patients receiving radiotherapy ranged from 15.2% to 25.8%. For Hodgkin lymphoma the proportion of patients who receive radiotherapy ranges from 23.8% to 38.6%.

In analysing the proportion of patients receiving curative rather than palliative pattern radiotherapy at trust level there was no variation amongst patients treated for Hodgkin lymphoma but variation was observed amongst patients diagnosed with NHL.

Before commenting on the data it must be recognised that the radiotherapy dataset had a number of limitations, this resulted in assumptions being made. The radiotherapy dataset included total attendances for treatment rather than the prescribed number of fractions, this meant total attendances had to be used as a surrogate, clinical advice was sought as to how many fractions one would receive per hospital visit for a diagnoses of NHL and Hodgkin lymphoma, this was confirmed as one fraction per visit, it was also proposed that <10 fractions suggested palliative intent and >=10 curative intent. Treatment intent could not be used as this too was unreliable, one of the many rules that determined whether a patients treatment was palliative were episodes containing a treatment region code of metastatic, however, this item is not recorded by most centres. Finally, trust level analysis only contained patients that received radiotherapy at a given trust, it was not possible to assign all patients with lymphoma to a trust of care as a result of trusts not having populations. trust level analyses can tell us what proportion of patients received radiotherapy with curative intent.

Having identified that five SCNs have radiotherapy use for lymphoma that lie outside the 99% control limits on the funnel plot indicating a statistically significant level of variation in

radiotherapy use we need to consider whether this is of clinical relevance and how it might be explained and further investigated. Issues to consider include:

- stage of disease at diagnosis
- clinical oncologist representation at MDT
- presence of clinical oncologist in joint clinics
- lymphoma managed by haematologists v medical oncologists v clinical oncologists
- geography and access times for radiotherapy
- genuine clinical uncertainty regarding optimum treatment option
- increasing use of very low dose radiotherapy for low grade NHL in some centres

References

1. NCIN. Blood cancers data quality report [Internet]. London: National Cancer Intelligence Network: 2013 [cited 2014 July 16]. Available from: www.ncin.org.uk/publications

2. Engert A, Plu¨tschow A, Eich HT, et al: Reduced treatment intensity in patients with early-stage Hodgkin's lymphoma. N Engl J Med 363:640-652, 2010

Appendix 1

Trust code	Trust name
RF4	Barking, Havering and Redbridge University Hospitals NHS Trust
RWE	University Hospitals of Leicester NHS Trust
RXH	Brighton and Sussex University Hospitals NHS Trust
RBA	Taunton and Somerset NHS Foundation Trust
RD1	Royal United Hospital Bath NHS Trust
RHM	University Hospital Southampton NHS Foundation Trust
RGT	Cambridge University Hospitals NHS Foundation Trust
RJ1	Guy's and St Thomas' NHS Foundation Trust
RK9	Plymouth Hospitals NHS Trust
RHW	Royal Berkshire NHS Foundation Trust
RM1	Norfolk and Norwich University Hospitals NHS Foundation Trust
RRV	University College London Hospitals NHS Foundation Trust
RNS	Northampton General Hospital NHS Trust
REF	Royal Cornwall Hospitals NHS Trust
RDE	Colchester Hospital University NHS Foundation Trust
RHU	Portsmouth Hospitals NHS Trust
RAJ	Southend University Hospital NHS Foundation Trust
RR8	Leeds Teaching Hospitals NHS Trust
RA2	Royal Surrey County Hospital NHS Foundation Trust
RYJ	Imperial College Healthcare NHS Trust
RJE	University Hospital of North Staffordshire NHS Trust
REN	The Clatterbridge Cancer Centre NHS Foundation Trust
RD3	Poole Hospital NHS Foundation Trust
R1H	Barts Health NHS Trust
RL4	The Royal Wolverhampton NHS Trust
RRK	University Hospitals Birmingham NHS Foundation Trust
RXW	Shrewsbury and Telford Hospital NHS Trust
RWA	Hull and East Yorkshire Hospitals NHS Trust
RHQ	Sheffield Teaching Hospitals NHS Foundation Trust
RWF	Maidstone and Tunbridge Wells NHS Trust
RAL	Royal Free London NHS Foundation Trust
RA9	South Devon Healthcare NHS Foundation Trust
RAP	North Middlesex University Hospital NHS Trust
RGQ	Ipswich Hospital NHS Trust
RTE	Gloucestershire Hospitals NHS Foundation Trust
RTG	Derby Hospitals NHS Foundation Trust
RTH	Oxford University Hospitals NHS Trust
RXN	Lancashire Teaching Hospitals NHS Foundation Trust
RBV	The Christie NHS Foundation Trust
RPY	The Royal Marsden NHS Foundation Trust
RWH	East and North Hertfordshire NHS Trust
RH8	Royal Devon and Exeter NHS Foundation Trust
RKB	University Hospitals Coventry and Earwickshire NHS Trust
RA7	University Hospitals Bristol NHS Foundation Trust

Trust code	Trust name
RTD	The Newcastle Upon Tyne Hospitals NHS Foundation Trust
RNL	North Cumbria University Hospitals NHS Trust
RTR	South Tees Hospitals NHS Foundation Trust
RWD	United Lincolnshire Hospitals NHS Trust
RX1	Nottingham University Hospitals NHS Trust

Appendix 2

SCN code	SCN name
N50	Cheshire and Merseyside
N51	Greater Manchester Lancashire and South Cumbria
N52	Northern England
N53	Yorkshire and The Humber
N54	East of England
N55	East Midlands
N56	West Midlands
N57	South West
N58	South East Coast
N59	Thames Valley
N60	Wessex
N61	London

Cancer Network code	Cancer Network name
N01	Lancashire and South Cumbria
N02	Greater Manchester and Cheshire
N03	Merseyside and Cheshire
N06	Yorkshire
N07	Humber and Yorkshire Coast
N08	North Trent
N11	Pan Birmingham
N12	Arden
N20	Mount Vernon
N21	North West London
N22	North London
N23	North East London
N24	South East London
N25	South West London
N26	Peninsula
N27	Dorset
N28	Avon, Somerset and Wiltshire
N29	Three Counties
N30	Thames Valley
N31	Central South Coast
N32	Surrey, West Sussex and Hampshire
N33	Sussex
N34	Kent and Medway
N35	Greater Midlands
N36	North of England
N37	Anglia
N38	Essex
N39	East Midlands

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