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**Travel times and distances to Radiotherapy  
Centres for Head and Neck cancer patients in  
England (2006-2008)**

**Oxford Cancer Intelligence Unit**



The report has been produced in collaboration with the National Cancer Intelligence Network (NCIN) Head and Neck Cancers Site Specific Clinical Reference Group and is based on the information collected and quality assured by the regional cancer registries in England.

[www.ukacr.org](http://www.ukacr.org); [www.ncin.org.uk](http://www.ncin.org.uk)

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## Summary

Between 2006 and 2008, there were 48 radiotherapy centres in England providing treatment for head and neck cancer patients. Almost half (47.4%) of head and neck cancer patients, diagnosed between 2006 and 2008, received radiotherapy.

The National Radiotherapy Advisory Group, in its report to Ministers in 2007, recommended a maximum travel time of 45 minutes to a radiotherapy centre as a good practice guideline. 92.4% of all patients with head and neck cancers lived within 45 minutes of a radiotherapy centre. An almost identical proportion (92.5%) of head and neck cancer patients, who received radiotherapy, lived within 45 minutes of a radiotherapy centre. It is important to note that the travel times have been estimated for off-peak travel times, using private transport. It has not been possible to estimate travel times for public transport users. The times will be longer for those travelling in peak time and possibly also for those using public transport.

Average travel distance to a radiotherapy centre in England was 14 miles. The median travel distance varied from 3.7 miles in North West London to 26 miles in Humber and Yorkshire Coast. Some patients had to travel 50 to 70 miles for radiotherapy in North of England, East Midlands, Peninsula, Three Counties and Anglia, and more than 70 miles in Lancashire and South Cumbria. Even within London, the maximum travel distance varied from 8.2 miles to 27.6 miles.

Since 2008, a number of additional radiotherapy centres have been established to reduce the travel times for patients in areas that were less well served. An additional radiotherapy centre has opened at Taunton (2009), and satellite centres have been established at Oldham (2010), Peterborough (2011), Aintree (2011), Salford (2011) and Bracknell (2011). This will mean shorter travel times for patients in some of the areas highlighted with longer travel times in the period of this study. For increasing numbers of head and neck cancer patients, however, access to complex radiotherapy (e.g. (IMRT) Intensity Modulated Radiotherapy Treatment) is required. Currently, at least one radiotherapy centre in every cancer network is able to provide IMRT but few currently have sufficient capacity to deal with demand.

For patients requiring long courses of radiotherapy, perhaps daily for more than 6 weeks, longer travel times may be a discouraging factor when considering the choice of radiotherapy over surgery, particularly if both treatment modalities provide similar benefits. Alongside the establishment of satellite centres, providers have been looking at other ways of minimising the impact of travel times on patients e.g. by organising hostel/hotel accommodation for patients near to the radiotherapy centre.

## **1. Introduction**

Radiotherapy services in England have been centralised with the view that more specialised knowledge, better facilities and sufficient patient throughput would promote expertise and better patient care. These advantages were expected to outweigh any disadvantage of longer travel times for some patients [1]. There is, however, concern that increased travel times for longer treatments such as radiotherapy may lead to decreased uptake (the distance decay factor). For head and neck cancer patients, longer travel time is a particular concern because radiotherapy is administered on an out-patient basis over a number of days, and some patients may require up to 35 separate treatment sessions. This may lead to more patients and clinicians opting for surgery instead of radiotherapy for the treatment of those cancers where both modalities of treatment offer similar benefits.

The National Radiotherapy Advisory Group, in its report [2] to Ministers in 2007, recommended a maximum travel time of 45 minutes to a radiotherapy centre as a good practice guideline.

## **2. Purpose of this paper**

This paper describes the travel times and distances to radiotherapy centres in England for patients with head and neck cancers (excluding thyroid cancer) diagnosed between 2006 and 2008. The aim is to identify areas of the country with longer travel times and distances. This work was commissioned by the National Cancer Intelligence Network (NCIN) Head and Neck Cancer SSCRG (Site Specific Clinical Reference Group). It was identified as a priority area for work by patient representatives on the SSCRG.

## **3. Methodology**

All new (incident) head and neck cancer cases (excluding thyroid cancer cases) diagnosed in residents of England between 2006 and 2008, were included in this study.

All radiotherapy centres providing radiotherapy to head and neck cancer patients in England between 2006 and 2008 were included.

### **3.1. Literature review**

A literature review was carried out in August 2011 to identify published original research articles on possible impact of travel times to radiotherapy centres on treatment decisions. Embase and Medline databases were searched.

The Department of Health and NHS Information Centre websites were searched to identify any relevant guidelines and reports.

### **3.2. Head and neck cancers in England between 2006 and 2008**

Data on new cases of head and neck cancer and on radiotherapy treatments in England between 2006 and 2008 were extracted from the NCDR (National Cancer Data Repository). The ICD-10 (International Classification of Diseases, 10th Revision) codes used in data extraction are in Appendix I.

### **3.3. Travel times and distances to radiotherapy centres in England**

A geographical information system (GeoExploit) was used to map the radiotherapy centres in England and to estimate travel times from each patient's residence to their nearest radiotherapy centre. Those who resided outside the boundaries of the English Cancer Registries were excluded. Duplicate records were removed. Travel times were assessed using digital NAVTEQ road network to measure off-peak private car journey times. The average travel distances for patients were estimated for every postcode location to the nearest radiotherapy centres, regardless of whether this was the actual centre for treatment.

The detailed methodology is in Appendix II.

## **4. Results**

### **4.1. Literature review**

Two studies were identified which examined the effect of geographical accessibility on treatment of cancer [1, 3], but no studies were found which specifically examined the effect on treatment of head and neck cancer.

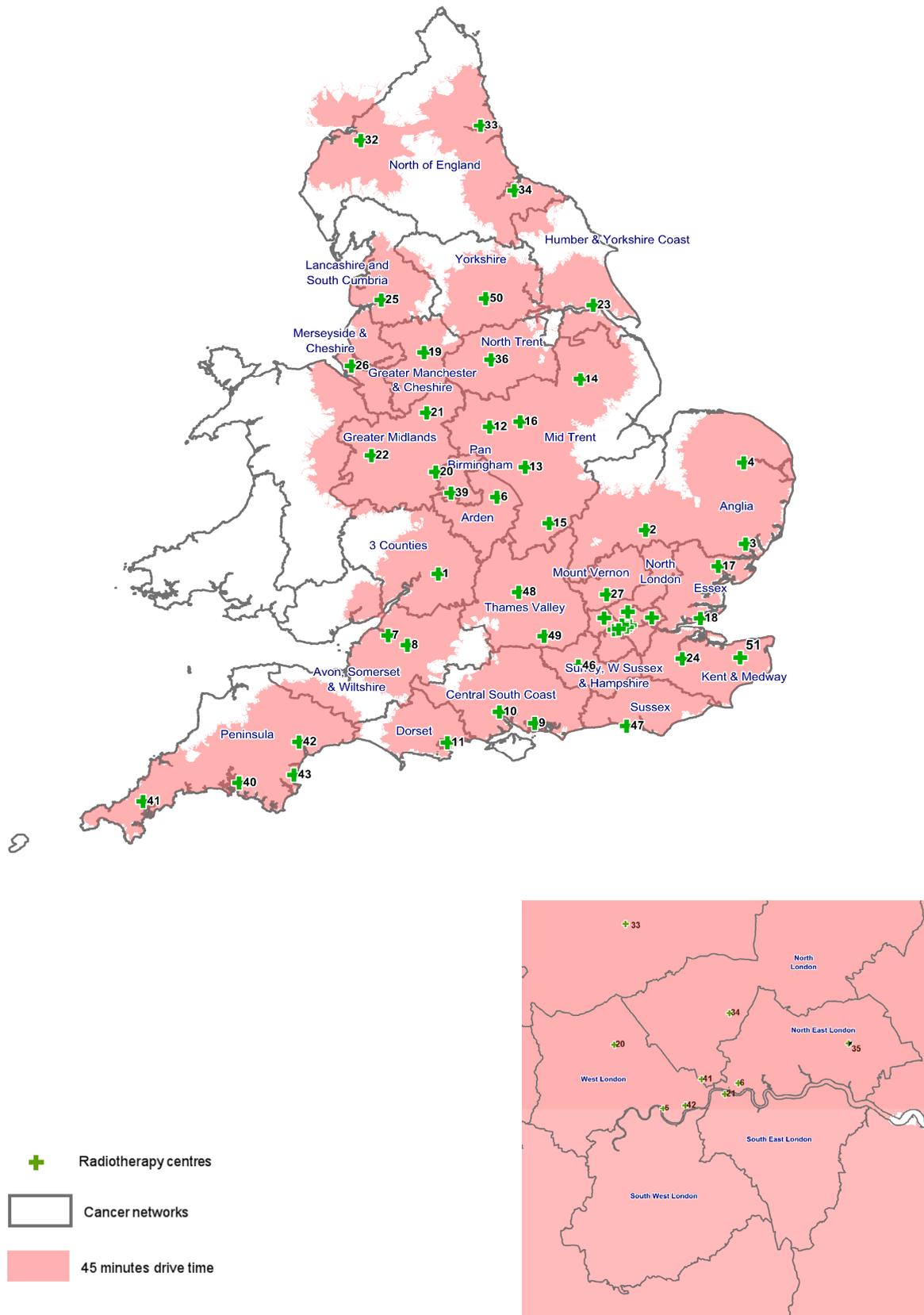
Jones et al [1] used data from the Northern and Yorkshire Cancer Registry between 1994 and 2002 to examine the relationship between radiotherapy and travel distance in 117,097 patients with breast, colon, rectum, lung and prostate cancers. They found that, after adjusting for age, sex and deprivation, the odds ratios for receiving radiotherapy were significantly lower in the patients who had to travel more than 50 minutes compared to those who had to travel less than 25 minutes [0.80 (95% confidence interval {CI} 0.73-0.87) for breast cancer, 0.64 (95% CI 0.57-0.73) for rectal cancer, 0.86 (95% CI 0.80-0.91) and 0.88 (95% CI 0.79-0.99) for prostate cancer. However it was not significant in patients with colon cancer (odds ratio 0.80, 95% CI 0.60-1.1).

Cosford et al [3] found no significant association between travel time for radiotherapy and radiotherapy uptake among cancer patients in Hertfordshire and Bedfordshire in 1991. The number of patients included in the study was not mentioned.

### **4.2. Head and neck cancer radiotherapy centres**

There were 50 radiotherapy centres in England, during 2006-2008, which provided radiotherapy to head and neck cancers patients, excluding thyroid cancers (source National Cancer Action Team). These centres are mapped in figure 1.

**Fig 1 Head and neck radiotherapy centres in England and areas within 45 minutes drive time by private transport during off-peak period**



The radiotherapy centres are named in Appendix III.

#### **4.3. Head and neck cancer incidence rates and travel times for all patients with head and neck cancer to nearest radiotherapy centre**

The age standardised head and neck cancer incidence rate for England for the three years between 2006 and 2008 was 11.17 (95% CI 11.00 – 11.33) per 100,000 population. Among cancer networks, this varied from 9.22 (95% CI 8.53 – 9.91) per 100,000 in Thames Valley to 14.17 (95% CI 13.28 – 15.07) per 100,000 in Merseyside and Cheshire.

92.4% (range 65.3% -100%) of patients with head and neck cancer lived within 45 minutes of the nearest radiotherapy centre. The figures were 69% (range 39.3% - 100%) and 29.2% (range 7.8% - 80.8%), for those residing within 30 minutes and 15 minutes respectively, of the nearest radiotherapy centre.

These are shown in table 1. The cancer networks are arranged in ascending order by age-standardised incident rates.

**Table 1 Percentage of patients with incident head and neck cancer residing within 15, 30 and 45 minutes of a head & neck radiotherapy centre by cancer network 2006 – 2008**

Cancer network	Average annual number of cases	Age standardised incident head & neck cancer rate per 100,000 (95% CI within brackets)	Percentage of all patients residing within 45 min of a radiotherapy centre	Percentage of all patients residing within 30 min of a radiotherapy centre	Percentage of all patients residing within 15 min of a radiotherapy centre
England	6,563	11.17 (11.00 – 11.33)	92.4	69.0	29.2
Thames Valley	239	9.22 (8.53 – 9.91)	99.0	62.9	18.0
Surrey, West Sussex and Hampshire	132	9.27 (8.33 – 10.21)	100.0	68.9	12.1
Kent and Medway	183	9.27 (8.47 – 10.07)	99.8	88.7	19.8
Dorset	93	9.36 (8.17 – 10.56)	86.0	64.6	30.1
Mount Vernon	132	9.46 (8.51 – 10.41)	100.0	88.7	19.9
Essex	165	9.5 (8.63 – 10.37)	99.7	86.2	29.8
Three Counties	131	9.64 (8.65 – 10.63)	84.7	52.9	17.2
Central South Coast	240	9.64 (8.91 – 10.38)	90.6	68.1	26.7
Anglia	338	9.97 (9.34 – 10.61)	84.5	45.8	18.9
Sussex	157	10.21 (9.24 – 11.19)	88.8	49.3	22.2
Avon, Somerset and Wiltshire	237	10.23 (9.45 – 11.00)	84.2	56.6	31.1
Peninsula	234	10.37 (9.56 – 11.18)	90.1	78.1	40.8
East Midlands	506	10.61 (10.06 – 11.16)	91.5	74.7	37.1
Arden	126	10.78 (9.67 – 11.89)	100.0	92.9	33.7
North London	156	10.97 (9.95 – 11.99)	100.0	95.0	74.5
Greater Midlands	262	11.04 (10.24 – 11.83)	100.0	91.7	40.9
North Trent	243	11.50 (10.65 – 12.36)	98.3	58.5	20.9
Yorkshire	340	11.67 (10.94 – 12.40)	95.9	65.0	23.1
Pan Birmingham	236	11.78 (10.89 – 12.67)	100.0	94.0	35.7
Humber and Yorkshire Coast	159	11.85 (10.76 – 12.94)	65.3	39.3	25.2
South West London	188	12.10 (11.07 – 13.12)	100.0	76.2	19.4
North West London	214	12.58 (11.59 – 13.58)	100.0	100.0	74.2
North East London	172	12.85 (11.72 – 13.99)	100.0	100.0	80.8
North of England	473	12.94 (12.25 – 13.63)	93.0	72.5	29.7
Lancashire and South Cumbria	239	13.12 (12.13 – 14.11)	85.0	41.1	7.8
South East London	185	13.15 (12.02 – 14.27)	100.0	81.0	32.0
Greater Manchester and Cheshire	446	13.24 (12.51 – 13.96)	100.0	68.9	19.7
Merseyside and Cheshire	337	14.17 (13.28 – 15.07)	95.4	41.1	12.8

#### 4.4. Travel times for patients receiving radiotherapy

Table 2 shows the percentage of head and neck cancer patients who lived within 45 minutes of a radiotherapy centre, the percentage that had radiotherapy and the percentage that had radiotherapy and lived within 45 minutes of a radiotherapy centre. Table 2 has been arranged in descending order by percentage of all head and neck cancer patients residing within 45 minutes of a radiotherapy centre.

**Table 2 Percentage of all patients with incident head and neck (H&N) cancer in England between 2006 and 2008, (a) who resided within 45 minutes of a radiotherapy centre, (b) who received radiotherapy and (c) who received radiotherapy and resided within 45 minutes of a radiotherapy centre**

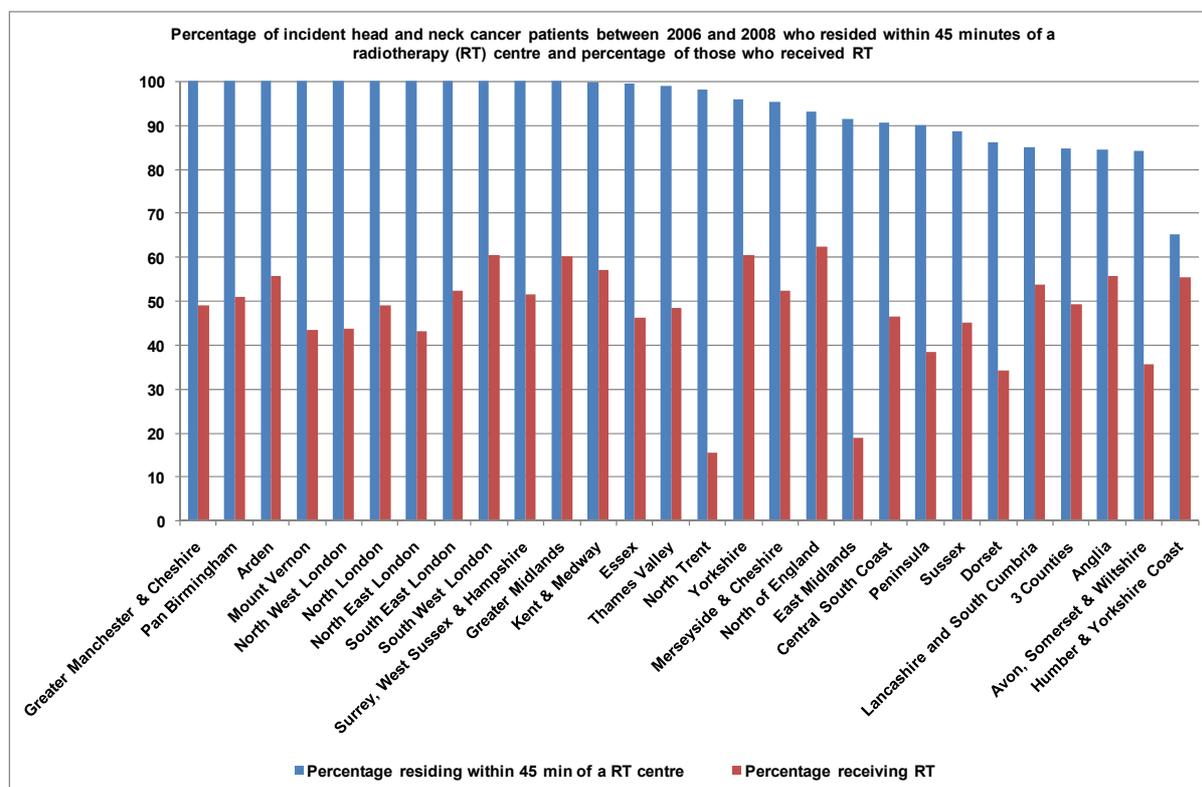
Cancer network	Percentage of all H&N cancer patients residing within 45 min of a radiotherapy centre (a)	Percentage of H&N cancer patients receiving radiotherapy (b)	Percentage of patients receiving radiotherapy who resided within 45 min of a radiotherapy centre (c)
England	92.4	47.4	92.5
Greater Manchester and Cheshire	100.0	48.9	100.0
Pan Birmingham	100.0	51.1	100.0
Arden	100.0	55.7	100.0
Mount Vernon	100.0	43.5	100.0
North West London	100.0	43.7	100.0
North London	100.0	48.9	100.0
North East London	100.0	43.1	100.0
South East London	100.0	52.5	100.0
South West London	100.0	60.4	100.0
Surrey, West Sussex and Hampshire	100.0	51.5	100.0
Greater Midlands	100.0	60.1	100.0
Kent and Medway	99.8	57.0	100.0
Essex	99.7	46.1	99.6
Thames Valley	99.0	48.6	99.3
North Trent	98.3	15.5*	96.6
Yorkshire	95.9	60.4	97.0
Merseyside and Cheshire	95.4	52.4	96.0
North of England	93.0	62.5	91.9
East Midlands	91.5	18.9*	86.2
Central South Coast	90.6	46.4	93.6
Peninsula	90.1	38.5	86.4
Sussex	88.8	45.1	89.7
Dorset	86.0	34.2	86.1
Lancashire and South Cumbria	85.0	53.8	85.5
Three Counties	84.7	49.2	84.2
Anglia	84.5	55.7	84.7
Avon, Somerset and Wiltshire	84.2	35.5	82.2
Humber and Yorkshire Coast	65.3	55.4	65.0

\* The very low radiotherapy rates reflect known problems with data completeness, which are being addressed by the Trent Cancer Registry working with the radiotherapy centres.

Table 2 shows that 47.4% of patients with newly diagnosed head and neck cancer in England between 2006 and 2008 had radiotherapy. 92.5% of these patients who received radiotherapy (range 65% in Humber and Yorkshire Coast to 100% in Greater Manchester, London, Pan Birmingham, Arden, Mount Vernon, Surrey, West Sussex and Hampshire and Greater Midlands) resided within 45 minutes of a radiotherapy centre.

Figure 2 compares the percentage of head and neck cancer patients diagnosed between 2006 and 2008 who lived within 45 minutes of a radiotherapy centre with the percentage of patients undergoing radiotherapy for each of the cancer networks in England.

**Figure 2 Percentage of head and neck cancer patients in England diagnosed between 2006 and 2008 who resided within 45 minutes of a radiotherapy centre and percentage of head and neck cancer patients who received radiotherapy by cancer network**



\* The very low radiotherapy rates for North Trent and East Midlands Cancer Networks reflect known problems with data completeness, which are being addressed by the Trent Cancer Registry working with the radiotherapy centres.

Figure 2 shows that at cancer network level, there is no clear relationship between the percentage of patients undergoing radiotherapy and the percentage of patients living within 45 minutes of a radiotherapy centre. For example, in North East London, 100% of patients lived within 45 minutes of a radiotherapy centre and 43.1% received radiotherapy. In contrast, in Humber and Yorkshire Coast, only 65.3% of patients lived within 45 minutes of a radiotherapy centre, but 65% received radiotherapy.

#### 4.5. Travel distances

Table 3 shows the average, median, and maximum travel distances in miles from the nearest radiotherapy centre in England between 2006 and 2008. The table is arranged in ascending order by average distance to nearest radiotherapy centre.

The average distance to the nearest radiotherapy centre in England was 14 miles (range 4.2 miles in North East London to 22.8 miles in Lancashire and South Cumbria). The median distance to the nearest centre ranged from 3.7 miles in North West London to 26 miles in Humber and Yorkshire Coast. The maximum distance varied from 8.2 in North East London to 71.1 miles in Lancashire and South Cumbria.

**Table 3 Average, median and maximum distances in miles to nearest radiotherapy centre for incident head and neck cancer patients by cancer networks in England between 2006 and 2008**

Cancer network	Average distance in miles travelled to nearest radiotherapy centre for all patients with incident head and neck cancers	Median distance in miles travelled to nearest radiotherapy centre for all patients with incident head and neck cancers	Maximum distance in miles travelled to nearest radiotherapy centre for all patients with incident head and neck cancers
England	14.0	11.8	71.1
North East London	4.2	4.2	8.2
North West London	4.4	3.7	12.7
North London	6.0	4.1	27.6
South East London	7.7	7.1	20.2
Pan Birmingham	8.1	7.1	23.4
South West London	9.3	9.2	21.4
Greater Midlands	10.2	8.3	34.7
Arden	10.6	10.3	30.4
Essex	11.5	12.4	29.5
Greater Manchester and Cheshire	12.2	10.8	28.5
East Midlands	13.2	10.2	56.5
Mount Vernon	13.4	13.4	27.3
Central South Coast	13.9	11.8	36.4
North of England	14.3	11.9	68.8
Kent and Medway	14.3	15.0	30.2
Yorkshire	14.5	14.1	36.8
North Trent	14.8	15.3	34.5
Peninsula	15.0	11.8	56.2
Surrey, West Sussex and Hampshire	15.5	15.0	29.9
Merseyside and Cheshire	15.9	15.6	30.5
Dorset	16.3	11.1	43.2
Thames Valley	16.3	17.2	36.7
Sussex	18.3	17.2	39.9
Avon, Somerset and Wiltshire	18.8	17.1	46.9
Three Counties	20.7	20.3	55.4
Anglia	21.8	21.8	51.8
Humber and Yorkshire Coast	22.1	26.0	49.9
Lancashire and South Cumbria	22.8	19.6	71.1

## 5. Discussion

92.4% of patients with incident head and neck cancer residing in England and diagnosed between 2006 and 2008 lived within 45 minutes of a radiotherapy centre. This headline figure is reassuring but it masks considerable variation between networks. Though the median distance was 26 miles or less in all cancer network areas, a wide variation was seen

in different parts of England. In four cancer network areas (East Midlands, Peninsula, Three Counties and Anglia) some patients had to travel between 50 and 60 miles for radiotherapy. In North of England some patients had to travel between 61 and 70 miles and in Lancashire and South Cumbria, some patients had to travel more than 70 miles to access radiotherapy. Within London the maximum travel distance varied from 8.2 miles to 27.6 miles. It should also be noted that not all patients received radiotherapy in their nearest radiotherapy centre. Established clinical pathways may lead to referrals to somewhere other than the nearest centre. For example, patients from Walsall undergo radiotherapy in Birmingham instead of in Wolverhampton, which is their nearest centre.

Since 2008, a number of additional and satellite radiotherapy centres have been established and this was intended to reduce the travel times for patients in areas that were less well served. An additional radiotherapy centre has opened at Taunton (2009), and satellite centres have been established at Oldham (2010), Peterborough (2011), Aintree (2011), Salford (2011) and Bracknell (2011). This will mean shorter travel times for patients in some of the areas highlighted with longer travel times in the period of this study. For increasing numbers of head and neck cancer patients, however, access to complex radiotherapy (e.g. (IMRT) Intensity Modulated Radiotherapy Treatment) is required. Currently, at least one radiotherapy centre in every cancer network is able to provide IMRT but few currently have sufficient capacity to deal with demand.

It is important to note that the travel times have been estimated for off-peak travel times, using private transport. It has not been possible to estimate travel times for public transport users. The times will be longer for those travelling in peak time and possibly also for those using public transport. Travel times by ambulance or hospital transport may also be longer, with patients having to fit in with availability of transport. Those using private transport may find parking problems within the hospital grounds, which may add to their journey times. This means that actual travel times are often longer than predicted by the modelling data.

For patients requiring long courses of radiotherapy, perhaps daily for more than 6 weeks, longer travel times may be a discouraging factor when considering the choice of radiotherapy over surgery, particularly if both treatment modalities provide similar benefits. Alongside the establishment of satellite centres, providers have been looking at other ways of minimising the impact of travel times on patients e.g. by organising hostel/hotel accommodation for patients near to the radiotherapy centre.

## References

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## Appendix I

ICD-10 codes used to extract data

<b>Cancer Type</b>	<b>ICD-10 codes</b>
Oral cavity	C02, C03, C04 and C06
Salivary glands	C07 and C08
Oropharynx	C01, C09 and C10
Nasopharynx	C11
Hypopharynx	C12 and C13
Larynx	C32
Palate	C05

## Appendix II

### Methodology for estimating travel times and distances

Travel times to specialist centres were determined by creating isochrones around each of the radiotherapy centres at 15 minutes, 30 minutes and 45 minutes. Digital NAVTEQ road network was used to calculate travel distances and times. The road network included streets in urban areas and unclassified roads. Average speed on each road class (Motorways, Primary Roads, A Roads, B Roads, Unclassified Roads and Streets) was used. The proportion of patients within each of the 3 isochrones was estimated by a count of patient postcodes.

The average travel distances for patients were estimated for every postcode location to the nearest radiotherapy centres, regardless of whether this was the actual centre of treatment. The methodology for each travel distance within the GIS used 'shortest time' algorithm, rather than the 'shortest distance' in order to approximate real-life conditions in private transportation. The shortest time used a route with the least time for the patient from the point of origin (home postcode) to the point of treatment. The altered average speeds were used as per the isochrone calculation.

## Appendix III

### Key to radiotherapy centres

#### Three Counties

1 Cheltenham General Hospital

#### Anglia

2 Addenbrooke's Hospital

3 Ipswich Hospital

4 Norfolk & Norwich University Hospital

#### Arden

6 University Hospital, Coventry

#### Avon, Somerset & Wiltshire

7 Bristol Royal Infirmary

8 Royal United Hospital, Bath

#### Central South Coast

9 St Mary's Hospital, Portsmouth

10 Southampton General Hospital

#### Dorset

11 Poole General Hospital

#### East Midlands

12 Derbyshire Royal infirmary

13 Leicester Royal Infirmary

14 Lincoln County Hospital

15 Northampton General Hospital

16 Queen's Medical Centre Campus

#### Essex

17 Colchester General Hospital

18 Southend Hospital

#### Greater Manchester & Cheshire

19 Christie Hospital

#### Greater Midlands

20 New Cross Hospital

21 North Staffordshire Royal Infirmary

22 Royal Shrewsbury Hospital

#### Humber & Yorkshire Coast

23 Hull Royal Infirmary

#### Kent & Medway

24 Maidstone District General Hospital

51 Kent & Canterbury Hospital (satellite centre for Maidstone)

#### Lancashire & South Cumbria

25 Royal Preston Hospital

#### Merseyside & Cheshire

26 Clatterbridge Centre for Oncology

#### Mount Vernon

27 Mount Vernon Cancer Centre

#### North East London

28 Queen's Hospital

29 St Bartholomew's Hospital

#### North London

30 North Middlesex Hospital

31 University College London

#### North of England

32 Cumberland Infirmary

33 Freeman Hospital

34 James Cook University Hospital

#### North Trent

36 Royal Hallamshire Hospital

#### North West London

37 Charing Cross Hospital

38 Northwick Park Hospital

#### Pan Birmingham

39 Queen Elizabeth Hospital

#### Peninsula

40 Derriford Hospital

41 Royal Cornwall Hospital (Treliske)

42 Royal Devon & Exeter Hospital (Wonford)

43 Torbay District General Hospital

