



Radiotherapy Needs Assessment
West Sussex

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Introduction

West Sussex, despite having a low age-standardised rate of incidence of cancer, has a high crude rate of incidence of cancer due to its age structure. The incidence of cancer is projected to increase over time, mainly due to the projected increase in population in the older age bands. It has been suggested that 52% of newly-diagnosed cancer patients would benefit from radiotherapy treatment i.e. the access rate for radiotherapy should be 52%. There is, however, no provision for radiotherapy treatment within the West Sussex borders; at present patients have to travel to Guildford in the north, Portsmouth in the west, and Brighton in the east to receive such treatment. West Sussex is covered by three cancer networks, Surrey West Sussex and Hampshire Cancer Network (SWSHCN), Sussex Cancer Network (SCN), and Central South Coast Cancer Network (CSCCN). Each of these cancer networks has reviewed their services and resources in line with recommendations from the National Radiotherapy Advisory Group (NRAG). One of these recommendations is that no cancer patient should have to travel longer than 45 minutes to access radiotherapy services. Consultation is ongoing between NHS West Sussex and the cancer networks as to where satellite radiotherapy centres may be sited in order to optimise accessibility for the population of West Sussex.

Incidence of cancer

The incidence of cancer (excluding non-malignant melanoma skin cancer) in West Sussex in 2006 is shown in table 1. West Sussex has a relatively healthy population, the indirectly age-standardised incidence (SSR) of malignant neoplasms is lower than the England rate. However, as West Sussex has a more aged population than the national profile, the crude rate of cancer registration is above the national figure; in 2006 the crude rate of cancer registration in West Sussex was 512.0 per 100,000 population. This compares with the national crude rate of 477.1 per 100,000. The West Sussex crude rate of registration varies from 417.0 per 100,000 population in Horsham (87.4% of England rate) to 634.2 per 100,000 population in Arun (133.0% of England rate).

Table 1: Crude rate and indirectly age-standardised rate (SSR) of cancer registration (ICD 10 C00 – C99 excluding C44), 2006, by local authority

Source: Office for National Statistics Mid Year Estimates 2006 and National Centre for Health Outcomes Development (NCHOD)

	No. registrations (2006)	Population (2006 MYE)*	Crude rate per 100,000	SSR (England = 100)
Adur	330	60.3	547.3	92
Arun	924	145.7	634.2	92
Chichester	623	108.9	572.1	89
Crawley	424	99.9	424.4	96
Horsham	535	128.3	417.0	80
Mid Sussex	560	129.1	433.8	84
Worthing	550	98.7	557.2	94
West Sussex	3946	770.8	511.9	89

England	242184	50762.9	477.1	100
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**Figures may not sum due to rounding*

The percentage of cancers which occur in people aged over 75 by district is shown in table 2 (pooled data 2004 – 2006).

Table 2 : Cancer registration (ICD 10 C00 – C99 excluding C44), pooled 2004-2006, by age, by local authority

Source: National Centre for Health Outcomes Development (NCHOD)

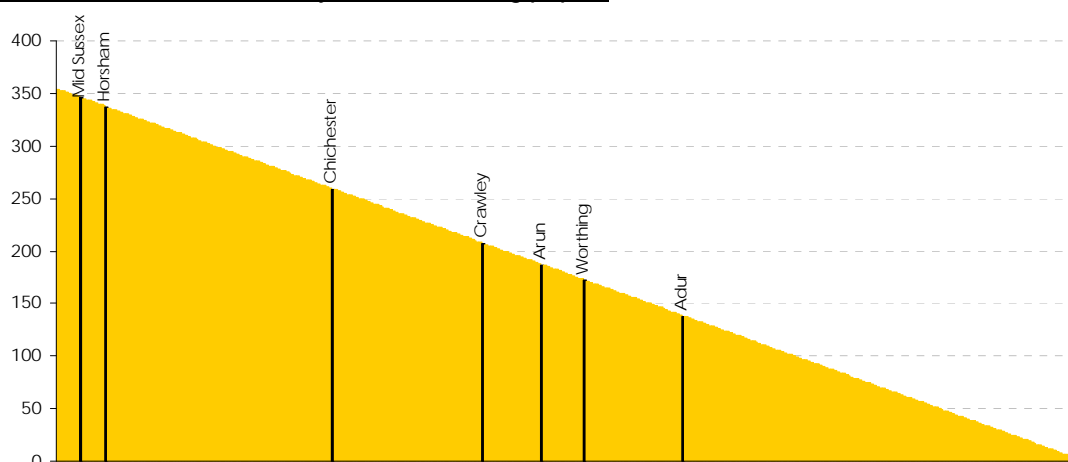
	Number of registrations		
	under 75	75+	% 75+
Adur	575	399	41.0
Arun	1582	1257	44.3
Chichester	1165	814	41.1
Crawley	702	489	41.1
Horsham	1002	670	40.1
Mid Sussex	1106	714	39.2
Worthing	883	711	44.6
West Sussex	7015	5054	41.9

Overall in West Sussex approximately 42% of cancers are registered to people aged 75 or over. While age will not affect the treatment of a particular cancer, this demonstrates that many people travelling to radiotherapy will be elderly and may have specific access issues.

The National Cancer Intelligence Network (NCIN) report on cancer incidence by deprivation¹ suggests that the ratio of incidence between the most deprived geographical areas and the least deprived was 1.2 to 1. Figure 1. shows the position of West Sussex local authorities in the ranking of all local authorities in England according to their Index of Multiple Deprivation (IMD) 2007 score.

Figure 1: Position of West Sussex local authorities in the ranking of all local authorities in England according to their Index of Multiple Deprivation (IMD) 2007 score

Source: West Sussex County Council briefing paper²



It can be seen from this that Mid Sussex and Horsham are the least deprived local authorities in West Sussex, with Adur as the most the most deprived. It would be expected that Adur would have a higher incidence of cancer than Mid Sussex. However, as can be seen from figure 2, this is not the case. West Sussex as a county has a reduced age-standardised incidence of cancer compared to England, and among the local authorities only Chichester has an incidence not significantly lower than the England rate. Among local authorities there is no significant difference between the incidence of cancer in Adur and that in Mid Sussex or Horsham (data not shown). One possible reason for this is that breast and prostate cancer have an inverse relationship with deprivation i.e. there is a higher incidence of these cancers in more affluent areas, partly due to an increased uptake of screening. Mid Sussex has the highest rate of both breast cancer and prostate cancer in West Sussex (significantly above both the England and West Sussex rates in the case of prostate cancer) whereas Adur has the lowest rates of both types of cancer in the county (prostate cancer rate significantly below those of England and West Sussex,

¹ NCIN Cancer Incidence by Deprivation England, 1995-2004

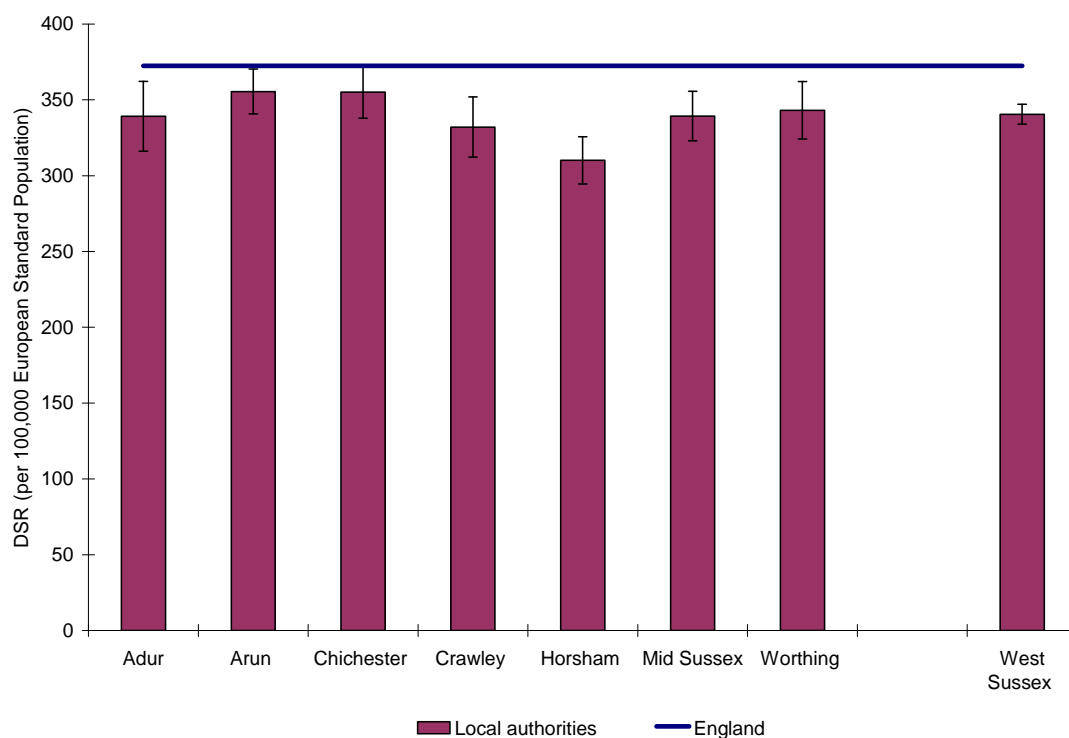
² http://www.westsussex.gov.uk/ccm/cms-service/stream/asset/?asset_id=3724993

breast cancer rate significantly below the England rate; data not shown, source: National Centre for Health Outcomes Development (NCHOD)).

Figure 2: Incidence of all cancers (ICD 10 C00 – C99 excluding C44)

Directly age-standardised registration rates: All ages: 2004-06 (pooled): per 100,000 European Standard population

Source: National Centre for Health Outcomes Development (NCHOD)



Survival rates and staging

The one year age-standardised relative survival rate for each of the three cancer networks which cover West Sussex are shown in table 3. Surrey, West Sussex and Hampshire Cancer Network, and Central South Coast Cancer Network have no relative survival rates which are significantly different from the England rates, whereas the one year relative survival rates for lung and stomach cancers in the Sussex Cancer Network are significantly lower than those of England.

Table 3: One year directly age-standardised relative survival rates by cancer network; patients diagnosed 2000-2002, followed up to 31 December 2003

Source: : National Centre for Health Outcomes Development (NCHOD)

	1 year survival											
	England			SCN			CSCCN			SWSHCN		
	% relative survival	LL	UL	% relative survival	LL	UL	% relative survival	LL	UL	% relative survival	LL	UL
Bladder	74.3	73.8	74.9	72.2	68.3	76.1	75.1	72.3	77.8	75.2	71.5	79.0
Colon	68.4	67.9	68.8	71.3	68.7	73.9	70.7	68.8	72.7	67.9	65.0	70.8
Lung	26.6	26.3	26.9	23.9	21.8	25.9	26.8	25.1	28.5	26.9	24.6	29.3
Oesophagus	33.4	32.7	34.1	32.7	28.4	37.0	35.8	32.5	39.2	36.1	30.9	41.2
Stomach	36.9	36.2	37.5	29.3	24.6	34.0	41.2	37.5	44.8	38.4	33.3	43.5
Prostate (males)	91.4	91.2	91.7	91.7	90.2	93.2	91.6	90.3	92.8	89.6	87.7	91.5
Breast (females)	94.1	93.9	94.2	94.7	93.8	95.6	93.7	92.9	94.6	95.0	93.9	96.1
Cervix (females)	81.9	80.9	82.8	79.6	72.1	87.1	85.1	80.5	89.7	88.9	80.3	97.5

The NCIN has provided a set of target figures for the best one year survival figures in Europe. It is based on 1995-99 EUROCCARE data, and uses the highest age-standardised survival rates where there is 100% coverage of the population of a country. The West Sussex survival rates are lower than the NAEDI consensus target for each of the named cancers, although these are not age-standardised (and should not therefore be used to compare against age-standardised figures) and in the absence of confidence intervals or other statistical analysis, significance cannot be assessed.

Table 4: NAEDI consensus target; one year age-adjusted relative survival rates, adults diagnosed 1995-99 (EUROCCARE-4 STUDY) and one year relative survival rates (not age-adjusted) for West Sussex 2002-2006 5-year rolling average
Source: NCIN and NCAT Local Awareness and Early Diagnosis Baseline Assessments: A Guide for Cancer Networks and Primary Care Trusts and Sussex Cancer Network NAEDI Baseline Assessment

	Breast	Colorectal	Prostate	Lung
NAEDI Consensus Target EUROCCARE-4 1995-1999	97	79	96	37
West Sussex Survival Rates 2002-2006 5 year rolling average	93.9	71.35	91.18	26.53

Early diagnosis gives the best possible outcome for cancer survival. For many cancer types patients with a more advanced stage of disease at diagnosis will have a worse prognosis than those with an earlier stage. Staging where possible is performed by the Thames Cancer Registry, this information is available for more patients than clinical staging.

The TCR staging is as follows:

Stage 1: Local (tumour confined to organ of origin).

Stage 2: Direct extension (tumour has extended into surrounding tissues and organs).

Stage 3: Nodal involvement (local nodes are involved).

Stage 4: Metastases (distant metastases are present).

N/K: Not known

The stage at diagnosis in West Sussex for selected cancer types is shown table 5.

Table 5: TCR Stage at diagnosis , West Sussex patients diagnosed 2007

Source: Thames Cancer Registry via Sussex Cancer Network NAEDI Baseline Assessment

	1		2		3		4		NK		Total
	#	%	#	%	#	%	#	%	#	%	
Colon	64	18%	96	27%	73	21%	83	23%	39	11%	355
Rectal	101	40%	21	10%	38	16%	36	13%	37	21%	233
Breast	406	56%	8	1%	189	26%	36	5%	92	13%	731
Prostate	394	74%	10	2%	0	0%	40	7%	91	17%	535
Lung	187	42%	17	4%	15	3%	160	36%	66	15%	445

West Sussex performs relatively well on stage at diagnosis; the majority of breast and prostate cancers are diagnosed at stage 1, and more cases of lung and rectal cancers are diagnosed at stage 1 than at any other stage. However, nearly a quarter of colon cancers and over a third of lung cancers are diagnosed at stage 4, where the cancer has metastasised and prognosis is poor.

Cancer incidence projections

In order to estimate the demand for radiotherapy treatment in the future it is necessary to ascertain the change in cancer incidence over the next few years. An interactive toolkit has been produced by the National Radiotherapy Advisory Group (NRAG), this in part provides an indication of the increase in cancer incidence by cancer network, old PCT (pre-2006) and new PCT³. The increase in incidence of cancer references Moller et al (2007)⁴, which predicts little change in age-standardised incidence rates but an increase in incidence by 33% between 2001 and 2020, mainly due to population growth and ageing. Any local increase is assumed to be equivalent to the national projection. The increase in population is calculated from the ONS 2006-based subnational population projections⁵. The baseline is the actual number of cancer registrations in 2005, obtained from the National Cancer Information Service (NCIS). The predicted number of cancer registrations for West Sussex in 2016 is shown in table 6, and the projected crude rate of cancer registration for the county for the same year is shown in table 7.

³ <http://www.canceruk.net/downloads/nrag/Interactive%20toolkits/>

⁴ Moller, H., Fairley, L., Coupland, V., Okello, C., Green, M., Forman, D., Moller, B. and Bray, F. (2007). The future burden of cancer in England; incidence and numbers of new patients in 2020. *British Journal of Cancer* **96** 1484 - 1488

⁵ Office for National Statistics 2006-based subnational population projections – Table 7: Population for SHAs and PCOs, ONS June 2008

Table 6: Number of cancer registrations in West Sussex 2005, projected to 2016

Source: NRAG model incidence projections

	2005 (actual)	2016 (projected)
Bladder	149	200
Brain	74	80
Breast	645	878
Cervix	21	19
Colon	339	359
Corpus uteri	86	105
Head & neck	88	118
Hodgkins lymphoma	23	26
Kidney	97	103
Leukaemia	123	139
Lung	469	448
Malignant melanoma	135	164
Multiple myeloma	64	81
Non-Hodgkins lymphoma	153	204
Oesophagus	118	146
Ovary	105	121
Pancreas	141	156
Prostate	509	569
Rectum	218	265
Stomach	87	91
Testis	34	43
ALL	4105	4785

The number of cancer registrations in West Sussex is predicted to increase from 4105 in 2005 to 4785 in 2016, an increase of 17% over this time period.

The crude rate of cancer registration in West Sussex was 535 per 100,000 population in 2005, compared with an overall England rate of 473 per 100,000. The crude rate of cancer incidence for West Sussex is projected to increase to 582 per 100,000 population by 2016. The rate of incidence of cancer has been projected at old PCT level, and table 7 shows the variance in projected cancer incidence in West Sussex for 2016.

Table 7: Incidence of cancer in West Sussex by old PCT, 2005 (actual) and 2016 (projected)

Source: NRAG model

	Incidence per 100,000 population	
	2005	2016
AAW	559	610
Crawley	370	407
Horsham	418	457
Mid Sussex	481	533
Western	652	720
West Sussex	535	582
England	473	518

Review of radiotherapy provision

Radiotherapy is the use of high energy x-rays in the treatment of cancer. It can be used for both radical (to cure) and palliative (symptom relief) treatment. The NRAG interactive toolkit, used for projecting future cancer incidence, also models current and future radiotherapy need. The appropriate rates of radiotherapy and fractions per site are taken from treatment trees by cancer site (2007)⁶. Modelling on the basis of this suggests that 52% of cancer patients should receive radiotherapy as part of their treatment. At present the access rate for SWSHCN is 47%, for CSCCN it is 37%, and for SCN it is 35%. The national access rate is 38%.

In 2007 the National Radiotherapy Advisory Group (NRAG) published a report “Radiotherapy; developing a world class service for England”, in which it states there is a 63% gap between current radiotherapy activity levels and optimal treatment levels. It published a series of recommendations to address this shortfall, a summary of these is presented in appendix 1.

The NRAG model suggests the radiotherapy requirement for West Sussex in 2006 was 51,922 fractions per million population. This is projected to increase to 54,415 pmp in 2011, to 57,041 pmp in 2016, and to 59,505 pmp in 2021.

Actual numbers of radiotherapy fractions have been supplied by CSCCN for 2009 for West Sussex residents, and data included in the Oncology Outreach and Repatriation document (2009) produced by SWSHCN indicates the actual number of

⁶ Department of Health Scenario Subgroup - Appendix A - Treatment Trees by Cancer Site, Department of Health, January 2007

fractions delivered to West Sussex residents (table 6). Data from Sussex Cancer Network is for financial year 2009/10, and so rates of radiotherapy delivery for the whole of West Sussex can be calculated.

Table 8: Number of radiotherapy fractions administered to the population of West Sussex (2009) and incidence of cancer (2006)

Source: CSCCN, SWSHCN and SCN

Cancer Network	Approximate population of West Sussex in cancer network	Fractions/Million population	Number of fractions	Approximate incidence of cancer in WS portion of cancer network (per 100,000)	Approximate fractions delivered per incidence of cancer*
SWSHCN	171,400	29,166	4999	416	7.0
CSCCN	199,200	39,101	7789	593	6.6
SCN	409,700	32,268	13223	500	6.4

**Due to different years' data used in the calculation this figure is only indicative of the activity of the cancer networks.*

The overall rate of radiotherapy delivery to the population of West Sussex in 2009 was 33,335 fractions per million population. NRAG has proposed a rate of delivery of 40,000 fractions per million population by 2010/11 as an interim towards the delivery of 54,000 fractions per million population by 2016. The delivery of radiotherapy fractions to the West Sussex population in 2009 was 83% of this interim figure. This is an average figure for the whole of West Sussex, the rate of delivery of radiotherapy fractions varies among the three cancer networks, from 29,166 fractions per million in SWSHCN to 39,101 fractions per million in CSCCN. It would appear at first glance that the West Sussex population of SWSHCN is disadvantaged with respect to radiotherapy treatment, with a rate of fraction delivery less than 75% of that delivered to the West Sussex population of CSCCN. However, the crude incidence of cancer is much higher in the CSCCN areas of West Sussex (Chichester and Arun) than in the SWSHCN areas (Crawley and Horsham) and so it is to be expected that this population receives more radiotherapy fractions. An analysis of the ratio of rate of radiotherapy fractions delivered to incidence of cancer suggests that patients in the SWSHCN are currently receiving slightly higher rates of radiotherapy treatment, indicating that cancer patients in the north of the county are not disadvantaged in terms of access to radiotherapy. This could arise by either a greater access rate (i.e. more cancer patients receiving radiotherapy treatment) in SWSHCN, the patients receiving an overall higher number of radiotherapy fractions, or a combination of the two. However, it assumes that all cancer patients in a geographical area in West

Sussex are being treated in the cancer network covering that area i.e. not going outside the network for treatment.

Proposed expansion of radiotherapy provision

The three cancer networks which cover West Sussex have reviewed their service provision in line with the NRAG report. Taking into account the increase in incidence, population increases and the requirement to increase access to 52%, along with the optimisation of fraction delivery to 8,700 fraction per linac per year, NRAG has estimated the number of linacs which will be required by 2016. It has also recommended that no radiotherapy site should have fewer than two linacs because of the impact on patients if it should be out of action, nor should it have more than eight due to the problems with cohesion and communication which arise with this number. The number of linacs each cancer network will need, along with proposed sites for these centres, are summarised below.

SWSCN

Estimated demand by 2016 – 9 linacs + service efficiency machine

Presently has 6 linacs at St Luke's cancer centre in Guildford. It has proposed two additional linked sites, both with two linacs, in the north of the network at Ashford, and in the east of the network at one of East Surrey Hospital in Redhill, Crawley Hospital, or a proposed healthcare provider at Pease Pottage.

CSCCN

Estimated demand by 2016 – 13/14 linacs

Presently has 6 linacs in Southampton Hospital and 4 linacs at Queen Alexandra Hospital in Portsmouth. The network had been considering plans to create satellite centres at Salisbury, Basingstoke and/or St Richards Hospital in Chichester. The network has since reviewed the service requirements based on the NRAG model, and has concluded that demand will not be as high as predicted. It now plans to optimise the output of the existing linacs at Southampton and Portsmouth, make use of the CancerPartnersUK linacs at the Spire hospital sites within the network, especially Havant for patients from West Sussex, and expand the linac facility at Portsmouth as and when necessary.

SCN

Estimated demand by 2016 – 10 linacs + service efficiency machine

Currently there are 4 linacs at the Sussex cancer centre at the Royal Sussex County Hospital in Brighton, although one is not used due to staffing issues. There are plans to create a linked site at Eastbourne, with two linacs, to address the access problem in the east of the network. Also under consideration are plans to site a satellite centre with 2 linacs at Worthing Hospital.

Estimate of demand

In order to assess the appropriateness of a site it will be necessary to estimate the demand for radiotherapy and the number of linacs an area could support. The Royal College of Radiologists has developed a formula for estimating the number of linacs required, N

$$N = \frac{P \times A \times I \times C_p \times E_x}{W}$$

where P is population served in millions; A, access rate; I, cancer incidence per million; C_p, course per patient; E_x, exposures per course; w workload in exposures per year per linac

Assuming access rate of 50%, 1.5 courses per patient, 15 exposures per course, and an average of 8,700 fractions per linac per year in 2016, and using the latest ONS population projections (released May 2010), along with the NRAG toolkit projected incidence rate (by old PCT), the number of linacs a catchment area could support can be calculated.

Adur, Arun and Worthing

$$N = \frac{.332 \times .5 \times 6100 \times 1.5 \times 15}{8700} = 2.6$$

Chichester

$$N = \frac{.1201 \times .5 \times 7200 \times 1.5 \times 15}{8700} = 1.1$$

Mid Sussex

$$N = \frac{.1365 \times .5 \times 5330 \times 1.5 \times 15}{8700} = 0.9$$

Horsham

$$N = \frac{.1355 \times .5 \times 4570 \times 1.5 \times 15}{8700} = 0.8$$

8700

Crawley

$$N = \frac{.1137 \times .5 \times 4070 \times 1.5 \times 15}{8700} = 0.6$$

8700

The population of West Sussex will need access to a total of 6 linacs by 2016. The distribution of need among the communities of West Sussex will suggest where the linacs could be sited.

The projected 2016 figures suggest the cancer incidence in Adur, Arun and Worthing would be sufficient to support 2.6 linacs, with 85% of its local cancer population being treated here this is reduced to 2.3 linacs. Chichester could support 1.1 linacs if 100% of those requiring radiotherapy treatment were to receive it there, but 0.9 linacs if 15% of the local cancer patients required specialist treatment at a cancer centre.

The calculation can be performed for the north of the county, for Crawley and the SWSHCN portion of Horsham (approximately 54% of the Horsham and Chanctonbury population)

$$N = \frac{0.187 \times 0.5 \times 4274 \times 1.5 \times 15}{8700} = 1.0$$

8700

The SWSHCN population of West Sussex would need access to 1.0 linac by 2016. If the radiotherapy treatment centre were to be sited in Crawley it would be reasonable to suggest the catchment area would include East Grinstead, Haywards Health and north rural Mid Sussex.

$$N = \frac{0.255 \times 0.5 \times 4580 \times 1.5 \times 15}{8700} = 1.5$$

8700

Including the approximate population and incidence rates for this geographical area suggests a requirement of 1.5 linacs for this catchment population. Crawley would also be a catchment area for a substantial area of SWSHCN outside West Sussex, and so the demand would support a 2 linac centre on this site.

Travel times to radiotherapy centres

One of the recommendations made by NRAG was that no cancer patient should have to travel more than 45 minutes for radiotherapy treatment. An exercise was

undertaken in order to determine the travel times of West Sussex residents for such treatment.

For the purposes of this exercise the population of West Sussex was divided into 23 residential areas and the centroid postcode of each area used to derive travelling times to actual and putative radiotherapy centres. The times taken to travel between the centroid postcode and the postcode of the possible radiotherapy sites were ascertained by the AA route planner. This suggests the quickest and easiest, but not necessarily the shortest, route based on average off-peak driving conditions. The direction of travel was from the residence to the radiotherapy; the calculated time taken may vary by a few minutes depending on the direction of travel. The results are shown in table 9.

All residential areas within SCN can access the cancer centre at Royal Sussex County Hospitals in Brighton within 45 minutes. All but one of the residential areas within CSCCN can access the cancer centre at Portsmouth Hospitals Trust within 45 minutes; the exception to this is South of Chichester, which can access the centre in 50 minutes. However, no residential area within SWSCN can access St Luke's cancer centre at the Royal Surrey County Hospital in Guildford within 45 minutes. These areas can access the cancer centre in Brighton within 45 minutes, but this is the centre for SCN; these areas are not part of this network. The Royal Surrey County Hospital in Guildford offers the shortest journey time for radiotherapy delivery to patients living in East of Midhurst and North of Midhurst but these areas are not part of SWSHCN, and so patients here are directed to Portsmouth, the nearest cancer centre for CSCCN.

Table 9: Journey times (in minutes, by car, off peak) between West Sussex residential areas and possible sites of radiotherapy treatment

Cancer Network	Town/area	Car time (minutes) to									
		Residential Centroids Selected	Royal Sussex County Hospital	QAH, Portsmouth	Royal Surrey County Hospital	Worthing Hospital	East Surrey Hospital	Crawley Hospital	Pease Pottage	Spire Havant	Royal Marsden Sutton
			BN2 5BE	PO6 3LY	GU2 7XX	BN11 2DH	RH1 5RH	RH11 7DH	RH11 9AG	PO9 5NP	SM2 5PT
WSx in SCN	Worthing	BN14 7HG	26	53	72	3	59	43	43	49	81
	Adur East	BN43 6NN	15	61	77	14	53	37	37	57	75
	Adur West	BN15 8HS	20	56	76	5	54	38	38	53	76
	Arun East	BN16 3NN	39	50	77	17	66	50	50	46	88
	Burgess Hill	RH15 9TD	24	81	63	34	39	24	23	77	61
	Haywards Heath	RH16 2EW	30	83	65	40	41	26	25	79	63
	Rural Mid Sx - South	BN6 9XZ	19	77	64	29	40	24	24	73	62
	Rural Mid Sx - North	RH10 4LF	42	95	51	52	27	17	19	91	49
	East Grinstead	RH19 2HA	41	95	49	51	26	16	19	91	47
	Horsham Rural South	RH20 3HN	35	59	63	18	52	36	36	55	74
Horsham - Billingshurst	RH14 9TZ	37	58	46	29	46	29	31	56	67	
WSx In SWSH	Horsham - Southwater	RH13 9UF	36	70	52	28	43	23	25	67	61
	Horsham Town	RH13 5HE	39	75	50	33	35	15	18	71	57
	Crawley - West	RH11 8HA	33	85	49	43	21	3	10	81	47
	Crawley - East	RH10 7EL	38	91	47	47	21	7	14	87	45
WSx in CSC	Arun North	PO22 0EU	47	37	74	27	74	58	58	34	96
	Arun West	PO22 9JQ	52	33	72	32	79	64	64	29	101
	East of Midhurst	GU28 0DU	49	45	41	38	59	41	43	43	78
	North of Midhurst	GU27 3PS	74	42	27	62	62	65	68	40	70
	Chichester City	PO19 7NT	50	25	65	30	77	61	61	21	99
	W of Chichester	PO10 8LZ	64	19	58	45	91	76	76	10	102
	N of Chichester	PO18 0PP	56	36	61	36	83	68	67	32	104
S of Chichester	PO20 0DT	78	50	89	58	105	90	90	46	127	

The radiotherapy centres are listed below, along with the residential areas afforded the shortest journey time (*italics indicate an area outside the cancer network to which the radiotherapy centre belongs*).

Present radiotherapy provision (map 1)



Map 1

Royal Sussex County Hospital, Brighton – Worthing, Adur East, Adur West, Arun East, Burgess Hill, Haywards Heath, South Rural Mid Sussex, North Rural Mid Sussex, East Grinstead, Horsham Rural South, Horsham Southwater, *Horsham Billingshurst, Horsham Town, Crawley West, Crawley East*

Royal Surrey County Hospital, Guildford – *East of Midhurst, North of Midhurst*

Queen Alexandra Hospital, Portsmouth – Arun North, Arun West, Chichester City, West of Chichester, North of Chichester, South of Chichester (50 minutes)

Additional radiotherapy provision at Worthing, Crawley and Havant (map 2)



Map 2

Worthing Hospital - Worthing, Adur East, Adur West, Arun East, Horsham Rural South, *Arun North, East of Midhurst.*

Royal Sussex County Hospital, Brighton – Burgess Hill, South Rural Mid Sussex

Crawley Hospital – *Haywards Heath, North Rural Mid Sussex, East Grinstead, Horsham Southwater, Horsham Billingshurst, Horsham Town, Crawley West, Crawley East.*

Royal Surrey County Hospital, Guildford – *North of Midhurst*

Spire Hospital, Havant – Arun West, Chichester City, West of Chichester, North of Chichester, South of Chichester (46 minutes).

Additional radiotherapy provision at Worthing, Redhill and Havant (map 3)



Map 3

Worthing - Worthing, Adur East, Adur West, Arun East, Horsham Billingshurst Horsham Rural South, *Arun North, East of Midhurst, Horsham Southwater, Horsham Town*

Royal Sussex County Hospital, Brighton – Haywards Heath, Burgess Hill, South Rural Mid Sussex

East Surrey Hospital, Redhill –*North Rural Mid Sussex, East Grinstead, Crawley West, Crawley East*

Royal Surrey County Hospital, Guildford – *North of Midhurst*

Spire Hospital, Havant – Arun West, Chichester City, West of Chichester, North of Chichester, South of Chichester (46 minutes).

Additional radiotherapy provision at Worthing, Pease Pottage and Havant (map 4)



Map 4

Worthing - Worthing, Adur East, Adur West, Arun East, Haywards Heath, Horsham Rural South, *Arun North, East of Midhurst, Horsham Billingshurst*

Royal Sussex County Hospital, Brighton – Burgess Hill, South Rural Mid Sussex

Pease Pottage –*North Rural Mid Sussex, East Grinstead, Haywards Heath, Horsham Southwater, Crawley West, Crawley East, Horsham Town*

Royal Surrey County Hospital, Guildford – *North of Midhurst*

Spire Hospital, Havant – Arun West, Chichester City, West of Chichester, North of Chichester, South of Chichester (46 minutes)

South of Chichester cannot access a radiotherapy treatment centre within 45 minutes under the proposed combinations discussed above. It could access a site at Chichester within this time, but for the reasons discussed previously this is not likely to be an option. The population of this area could access the CancerPartnersUK site at the Spire Hospital in Havant in 46 minutes. All the other residential sites in West Sussex can access a radiotherapy treatment centre within their home cancer network with all of the above proposed combinations of sites. Although this is the case, many would face shorter journey times if they were to be treated at a radiotherapy treatment centre in a neighbouring cancer network.

From the analysis of the demand for radiotherapy treatment by the West Sussex population, along with the travel times from each residential area to proposed treatment sites, it is reasonable to suggest that a 2 linac site in Worthing and a further 2 linac site to service the population of the north of the county would be the preferred option to meet the needs of West Sussex in 2016. A centre sited at Crawley would afford a shorter time journey for the greatest number of West Sussex patients. However, as Crawley is not an acute hospital it would not be able to treat as high a percentage of cancer patients as an acute site such as East Surrey

Hospital at Redhill; in this case a number of patients would therefore face a longer journey to Guildford for appropriate radiotherapy treatment.

If this configuration of radiotherapy treatment centres is implemented, patients may choose to attend the most accessible site for treatment. In many cases this will involve crossing cancer network boundaries. At present cancer treatment is managed by a multi-disciplinary team based at a network's cancer centre. The alignment of patient pathways may need to be re-assessed in order to maximise access, not just for radiotherapy but for all types of cancer treatment.

Limitations of the NRAG model

The NRAG model references the ONS 2006-based subnational population projections, released in June 2008. These have subsequently been revised (released May 2010), and demonstrate a 2% increase on the original estimates (837,500 compared to 822,700). West Sussex County Council has also projected population figures, to take into account policies in the approved West Sussex Structure Plan 2001-2016, their figure for the population in 2016 is 832,700, but this was based on previous ONS projections which were lower than those recently released. The revised ONS projections were used in the calculation of demand.

The age-standardised increase in cancer incidence was determined for England as a whole, and this percentage increase was applied to all geographical areas. This does not take into account any differences in age profiles; increase in incidence would be overestimated in areas with a younger profile and underestimated in areas with an older profile. There is also estimated to be up to a $\pm 20\%$ error in the projection of each individual cancer type.

NRAG has recommended that all new and replacement linacs should be capable of 4-D adaptive technology, Image Guided Radiotherapy (IGRT) and Intensity Modulated Radiotherapy (IMRT). The rate of fraction delivery will be less with these machines, this has not been included in the model, though it is believed that efficiency will increase as this technology becomes more common.

Williams and Drinkwater (2009)⁷ investigated the difference between the theory (from the NRAG model) and practice of radiotherapy provision (from national audit data) in 2007. There was some discrepancy between the theoretical treatment of cancer types, and their treatment in practice, and the authors suggest the model should be updated to reflect professional opinion and activity in England. Also, access rates and retreatment rates differed between those used in the model and those observed in practice. It was suggested that each cancer organisation undertakes a review of its actual practice against the that employed in the model; CSCCN has done this and has concluded that demand for radiotherapy will not be as great as that predicted.

Public engagement

There have been a number of public engagement exercises across the cancer networks, to gauge public opinion on the provision of cancer services. Surveys were conducted by NHS East Sussex Downs and Weald/NHS Hastings and Rother, NHS West Sussex and SWSHCN. The sample population is small, with only a total of 279 replies. The response rate for the East Sussex survey was 5%, the response rate for the other two surveys is not known. The results are summarised below.

Most people who responded to the surveys have a reasonable journey to radiotherapy treatment, although a minority find it fairly or very difficult. In general patients do not refuse treatment due to travel issues, although some prostate cancer patients have opted for hormonal treatment in preference to radiotherapy treatment. Problems with travel have, however, caused people to be late for or miss appointments.

There are significant issues associated with having to travel for treatment. Often the patient needs to take time off work, and it may be recommended that a friend or relative takes the patient to the appointment; their time also needs to be taken into consideration. Not all patients have someone they can readily call upon, and may feel uncomfortable asking for help from neighbours, friends and family. The expense of driving and parking may be quite high, traffic conditions and availability of parking add to an already stressful situation.

⁷ Williams, M. V. and Drinkwater, K. J. (2009). Radiotherapy in England in 2007: Modelled demand and audited activity. *Clinical Oncology* **21** 575 - 590

Ease of travel is the most important factor for cancer patients, including proximity to home, avoiding traffic, ease and cost of car parking. Also of importance was flexibility around treatment times to suit work commitments, childcare, or the commitments of carers who may be providing transport.

One of the recommendations in the NRAG report, to increase radiotherapy provision, is to offer treatment outside office hours i.e. early morning, evening, or weekend appointments. There was some support for this by those surveyed, with some preference for appointments outside the normal treatment times e.g. 7-8 am and 5-9 pm. Weekend appointments were acceptable to many, with Saturday appointments being preferred over Sunday appointments.

The full reports of the SWSHCN and East Sussex survey can be viewed here.



SWSH Patient survey



East Sussex Patient
and Public Engagement

Workforce

During the 1990s it was predicted that the importance of radiotherapy as a method of treatment for cancer would fall as other treatment regimes became more efficacious. As a result the projected need for radiotherapy was underestimated and there is now a significant gap between current activity levels and optimal treatment levels. There is a worldwide shortage of radiotherapists and medical physicists, and the UK does not have sufficient equipment or workforce to meet the current demand for radiotherapy within acceptable waiting times; the therapeutic radiotherapy workforce represents the rate-limiting step in any future service growth to meet patient need. The NRAG recommendations aimed at increasing the provision of radiotherapy will require a 30% increase in all radiotherapy professions, not just radiographers. The pressures on the workforce, and the difficulty in releasing staff for training, will have implications for the introduction of new technology, such as IMRT and IGRT.

NRAG has also made recommendations to increase the available workforce in radiotherapy provision. This includes a 4-tier skills mix model, to provide a career progression framework for radiographers up to consultant level. Nationally implementation of this framework has been patchy, and the cancer centres within CSCCN, SWSHCN and SCN have no consultant posts.

There are high attrition rates (35%) from training. One of the reasons for this may be the poor experience of students on clinical placements. An increase in training capacity may reduce pressure on existing clinical services. The cancer centres at Southampton and Portsmouth have increased their clinical placement capacity for therapeutic radiographer students from Portsmouth University to 18 places. The Sussex Cancer Centre at Brighton has close links with links with Portsmouth University and Southbank University, and there are plans for a future School of Radiography at Brighton & Sussex Medical School. St Luke's radiotherapy department in Guildford has close links to Kingston University for undergraduate training, and supports 9 commissions annually for student placement.

Improving the placement experience for students may be achieved by the introduction of the Virtual Environment for Radiotherapy Training (VERT), which simulates radiotherapy equipment and treatment rooms. The use of such a facility reduces pressure on clinical service departments, whilst allowing students to learn in a safe environment. Staff other than radiographers can be trained using these facilities. Portsmouth University has installed VERT for use in its degree courses, St Luke's cancer centre in Guildford and the Sussex cancer centre in Brighton have installed VERT for training purposes.

Recruitment and retention of staff is challenging for all networks. The proximity of Guildford to London means that radiotherapy staff may prefer to work in London due to London weighting. The cancer centres in CSCCN have to compete with private radiotherapy providers in the area, and have lost senior staff to these providers. The introduction of satellite radiotherapy centres will increase the demand for suitably qualified staff, and all cancer networks are reviewing their workforce strategy in the light of this.

Appendix 1 – Summary of NRAG recommendations

Estimates that by 2016 the NHS will need to deliver an average of 54,000 fractions per million population.

All linacs to deliver at least 8,000 fraction with immediate effect, building to 8,700 fractions per annum per linac by 2016.

Each linac to deliver 4 – 4.5 fractions per hour.

Linacs to run an average of 9.2 hours per day, with a minority running an extended 11.5 hours per day.

Radiotherapy departments to operate 239 days per year (5 day week, closing for only 3 bank holidays with 50% working on remaining bank holidays), up to 19 days allowed for QA/servicing. Some palliative radiotherapy on Saturdays, CHART (continuous hyperfractionated accelerated radiotherapy to treat non-small cell lung cancer) to take place on Saturdays & Sundays.

A service machine should be in place to deal with peaks in workload, provide cover for machine breakdown etc.

All linacs (except service machine) to operate at 87% efficiency.

One linac only services are not supported given the potential impact on patient treatment if the machine is out of action.

The maximum size of a department should not be in excess of 8 linacs, communication and cohesiveness issues become apparent if the centres are larger than this.

Linacs to be replaced after 10 years, software to be upgraded at least every three years.

52% of cancer patients should receive radiotherapy as part of their treatment.

The Joint Council for Clinical Oncology has suggested the following maximum waiting times

48 hours	urgent radiotherapy
2 weeks	palliative radiotherapy
4 weeks	radical radiotherapy

Appendix 2 – Performance of Cancer Networks

Central South Coast Cancer Network

Central South Coast Cancer Network is currently undertaking an analysis of the treatment trees used in the NRAG model, to compare against current working practice. Initial findings suggest that, while the demand for radiotherapy within the cancer network will grow, it will not do so at the rate predicted by the NRAG model. Surrey, West Sussex and Hampshire Cancer Network have concluded that the NRAG model is appropriate for estimating the increase in demand for radiotherapy for its population.

NRAG recommendations suggest that Central South Coast Cancer Network should be delivering a total of 57,000 fractions per million population by 2016, indicating there should be 13 – 14 linacs available for routine service by 2016 (excluding service machines, 31 day target or other targets, and the extended use of IGRT or IMRT). Presently there are 6 linacs at Southampton University Hospitals NHS Trust and 4 at Portsmouth Hospitals NHS Trust. There are also two linacs established by private provider CancerPartnersUK, in Havant and Southampton on SPIRE Healthcare hospital sites; these machines are equipped for IGRT and IMRT. If all appropriate private patients were referred to these sites this would account for 7-8% of radiotherapy treatment within CSCCN.

The access rate for the population of CSCCN was 37% in 2006, this is suggested to be 52% by 2016.

CSCCN had been considering installing a linac at Chichester (March 2008). Review of the NRAG recommendations suggests that demand will not be as high as indicated, so strategy has been refined. Recommendations are now to optimise use of existing NHS linacs at Southampton and Portsmouth, where appropriate to make use of CancerPartnersUK linac in Havant to treat West Sussex PCT patients who would otherwise be treated at Portsmouth. Linac capacity to be increased as required, PHT has a spare bunker.

There is a worldwide shortage of radiotherapists and medical physicists; the radiotherapy workforce represents the rate-limiting step in any future service growth to meet patient need. The CSCCN has produced a workforce strategy to address this shortfall.

Significant vacancy rates in therapeutic radiography and medical physics
Difficulties in releasing staff for training while maintaining service delivery

Difficulties in meeting staff training requirements to support the implementation of IMRT

Surrey, West Sussex and Hampshire Cancer Network

The main radiotherapy centre for SWSHCN is St Luke's Cancer Centre, the Royal Surrey County Hospital in Guildford. This site has 5 relatively new linacs and one older linac. A 6th new linac is due to be installed in 2010.

At present, two linacs are operational for 8.5 hours/day, the others for 7.5 hours/day, giving a total of 39.5 clinical machine hours/day. With 6% downtime this equates to 9,440 machine hours per year, delivering 40,000 – 44,000 fractions per million population (depending on the population estimate). It is currently working at 100% capacity, recommendation is 87% capacity.

NRAG recommendations suggest a total of 7 linacs (including service efficiency machine) will provide adequate capacity until 2011. By 2016 it may need up to 9 linacs (inc. SE machine). An extra 1 linac would be required if SWSH were to repatriate 11% of Surrey population currently treated in central London hospitals, making a total of 10 linacs by 2016.

Suggested that a pair of linacs be situated in the east of the region, possibly through joint venture with West Sussex. Acute site (e.g. Redhill) could deliver up to 85% of radiotherapy required by local population. Non-hospital site (e.g. Pease Pottage) could up to 65% of RT. Non-acute hospital (e.g. Crawley) could deliver somewhere in between. Subsequent pair to be situated in Ashford.

The access rate for SWSHCN is 47%.

As SWSHCN has a lower incidence of cancer than the national average, it is predicted from the NRAG model that the network should be delivering a total of 48,600 fractions per million population by 2016 (national rate 54,000 fractions per million population).

Indications are that the NRAG model is reasonable to use in the SWSH cancer network, prediction for 2006 close to the actual provision in 2007.

Each of St Luke's linacs is now delivering an average of 8,750 fractions per year. St Luke's RT department has close links to Kingston University for undergraduate training, supports 9 commissions annually for student placement. RSCH has installed the Virtual Environment for Radiotherapy Training (VERT) in dedicated training room.

Survey conducted in October 2008, 483 patients completed questionnaire, of those that travelled by car, 41% took longer than 45 minutes to attend a RT appointment.

34% of patients are routinely having to travel more than 45 minutes, particularly a problem for the east of the network (including Crawley and Horsham).

All RSCH linacs can perform IMRT, one can perform IGRT. NRAG recommends that all new linacs are capable of 4D adaptive radiotherapy (which allows for IGRT).

Treatment trees used in the NRAG model did not consider developments such as CHART or techniques such as IMRT or IGRT; these will have impact on number of fractions per treatment and on duration of fractions delivered, no predictions made by NRAG but RSCH has predicted a 35% increase in time per patient by 2016.

New technologies will increase the time taken to deliver each fraction, but as these procedures become more common the efficiency of delivery may improve.

Sussex Cancer Network

Recruitment and retention of radiographers challenging, links with Portsmouth University as well as Southbank University, plans for School of Radiography at Brighton & Sussex Medical School, but not yet in place.

Access rate for SCN is 35%, nationally recommended to increase to 52% by 2016.

Delivery rates modelled to be 56,700 fractions per million population by 2016 (nationally 54,000 fractions per million population).

BSUH has 4 linacs. From the NRAG equation, SCN will require access to 10 linacs (plus service efficiency machine) over next 10 years.

BSUH delivers 2000 fractions per annum to private patients from the SCN area.

Suggested expansion of 2 linac linked site at Eastbourne.

4 linacs are installed at the Sussex Cancer Centre but only 3 are in use due to insufficient staffing levels. These 3 are working beyond the normal day, giving 100% capacity, beyond 23.75 hours clinical.

No equipment capable of delivering IGRT (IGRT needs to be in place before full IMRT implemented).

CHART for lung not possible until weekend working

Implementation of the NRAG recommendations, including repatriation of H&R patients from Kent, will require access to 10-11 linacs in SCN by 2016.

