Using data to drive clinical improvements in sarcoma

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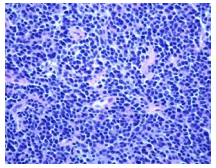
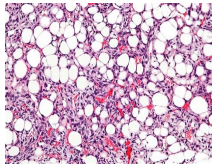
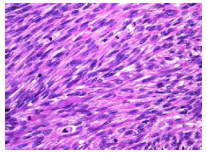
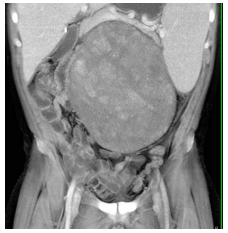
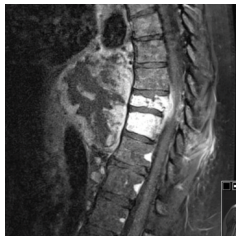
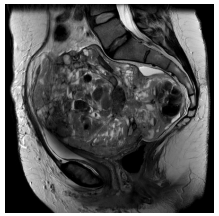
NHS England Specialist Services National Sarcoma Lead

NDRS - COSD & Cancer Data Roadshow- 24 January 2024

Background - challenge of sarcomas

- rare cancers arising from ‘mesenchymal tissue’/ connective tissue
- generally quoted as ~ 1% of cancers

Challenges

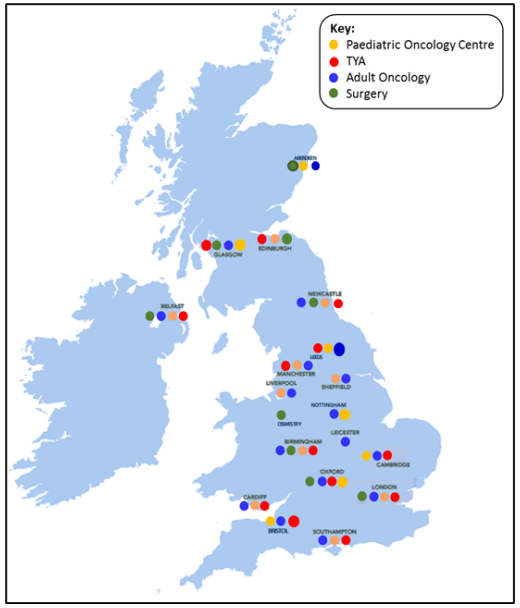
- there are > 100 subtypes, divided into “bone and soft tissue”
- they can occur anywhere in the body:
- they affect patients of all ages from 0 - 100+- so include children and TYA
- they often require complex multi-modality treatment
- many have poor outcomes
- some subtypes are ‘ultra rare’ and have no defined standard of care systemic therapy

Sarcoma service organisation

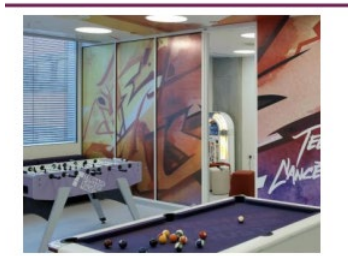
- In England and Wales "**Improving Outcomes Guidance" (**IOG) NICE, published in 2006, provides underlying principles for organisation of sarcoma services.
- Soft tissue and bone sarcomas should be **treated under the care of a sarcoma multi-Disciplinary Team at a specialist sarcoma centre**.
- Updated in 2019- **sarcoma service specification** now implemented - **all patients with a suspected sarcoma referred to a specialist MDT**
- also Children and TYA should be discussed in age –specific and treated in age-appropriate centres and adult services

Sarcoma Specialist Centres

Details of the sarcoma specialist centres / multidisciplinary teams (MDTs) in the UK.



- 5 bone sarcoma MDTs
- 13 soft tissue sarcoma across England
- chemotherapy and radiotherapy – designated centres within MDT



Improving sarcoma outcomes

- Recent publications from France and Spain demonstrated improved outcomes for patients managed with sarcomas specialist services [1,2]
- To improve outcome, we need to identify patients at risk of poor outcome and ensure patients are able to access equitable care across the country
- Due to rarity and complexity, coding and reporting was not possible within PHE and NCRAS infra-structure to understand provision of services across England

1. Blay, et al Ann Oncol, 2019 2. Brotto, et al, Oncologist, 2018

In 2019 developed a 3 yr partnership with Sarcoma UK

Overall Aim: To improve outcome in sarcoma through analysis and interrogation of national cancer data

- To understand population-based sarcoma care across England, including patterns and processes of care and the associated outcomes.
- **To understand variation of care of sarcoma patients treated in England, and the impact of specialist care across subgroups to identify those adversely affected**

→ analyst who employed for 18 months, then had hiatus for 18 months, 2nd analyst- from 09/22

Methodology

1. **define cohorts of interest using anatomical site codes, morphology codes & behaviour codes (ICD-O-3)**
2. **define treatment for relevant cohorts of interest**

   a) Define **Surgery** by extracting and reviewing extracting OPCS4 codes from Hospital Episodes statistics (HES)

   b) Define **Chemotherapy** by using SACT, assigning relevant regimens to STS, GIST and bone subgroups.

   c) Define **Radiotherapy** by using RTDS, defining which radiotherapy treatments are relevant to their disease (Proton beam therapy –not available for paitents who had treatment abroad - data to follow).

3. **assess the impact of factors on survival outcome**

   - Including impact of specialist centres

CANCER EPIDEMIOLOGY

Incidence and survival of soft tissue sarcoma in England between 2013 and 2017, an analysis from the National Cancer Registration and Analysis Service

Andrew Bacon[1] | Kwok Wong[1] | Malee S. Fernando[2] | Brian Rous[1,3] | Roger J. W. Hill[1] | Shane D. Collins[1,4] | John Broggio[1] | Sandra J. Strauss[1,4]

Developed methodology - ~ 100 morphological subtypes, multiple anatomical sites

Int. J. Cancer. 2023;152:1789–1803.

Incidence of common and ultra-rare subtypes

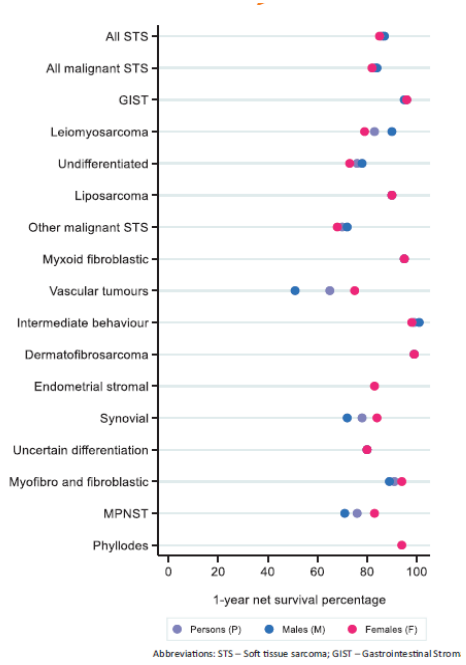
TABLE 1 Incidence of all soft tissue sarcomas diagnosed in England per million, per year between 2013 and 2017

Morphological description	Total diagnosed	Median age	Average per year	Persons			
				Crude	ASR	LCI	UCI
All soft tissue sarcomas	19 717	65	3943	72.00	78.36	77.25	79.47
Gastrointestinal stromal tumour (GIST)	3976	68	795	14.52	15.95	15.46	16.46
Tumours of uncertain differentiation	425	46	85	1.55	1.57	1.42	1.73
Alveolar soft part sarcoma[a]	28	27	6	0.10	0.10	0.07	0.14
Clear cell sarcoma (except of kidney M8964/3)[a]	44	33	9	0.16	0.16	0.11	0.21
Clear cell sarcoma of kidney[a]	14	3	3	0.05	0.04	0.02	0.07
Desmoplastic small round cell tumour[a]	59	23	12	0.22	0.21	0.16	0.27

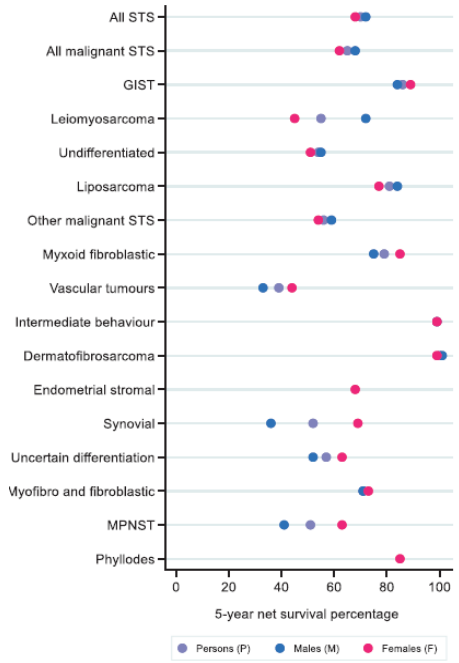
Survival - 1 and 5 yr net survival and overall survival

- 5 year survival for GIST 86%; all malignant STS 65%
- Leiomyosarcoma 53%; worst for vascular sarcomas = 39%

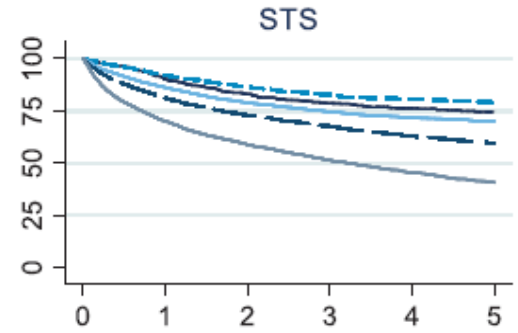
1- year net survival

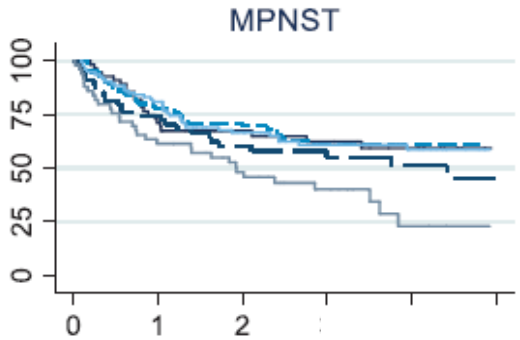


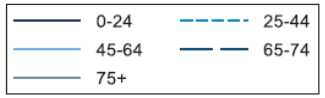
5- year net survival



- Differences between men and women
- Differences according to age

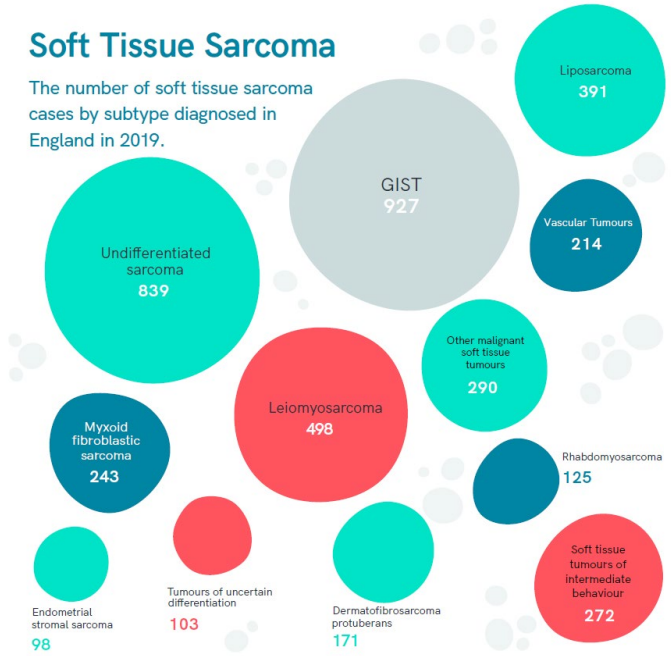






Identified patients with poor outcomes and resource for the community

- Patients from most deprived cohorts 23% higher chance of dying within 5 years*
- Patients presenting as an emergency 2.3 x more likely to die within 5 years*
- Can look up all STS subtypes- resource for the community



Info graphics developed by sarcoma UK

NDRS
NATIONAL DISEASE REGISTRATION SERVICE

NHS England

2. Analysis of specific sarcoma anatomic groups

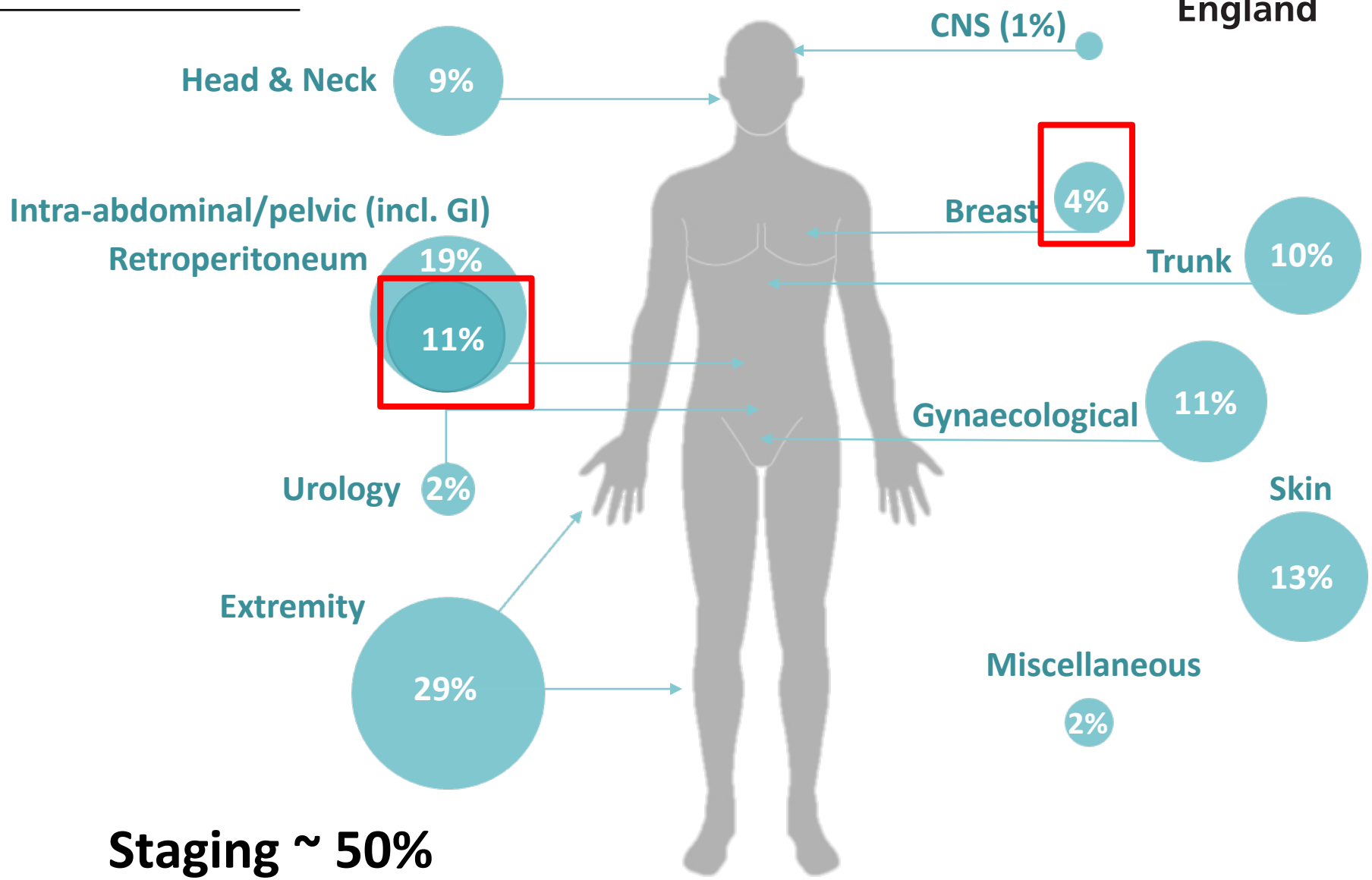
Sarcoma UK
The bone & soft tissue cancer charity

UCL

STS – 17,862 Tumours (2013-18)

- Excludes GIST
- Malignant tumours only

Anatomical Site	Tumour Count
Extremity	5,105
Intra-abdominal/pelvic	3,368
Skin	2,336
Gynaecological	2,013
Retroperitoneum	1,879
Trunk	1,874
Head & Neck	1,663
Breast	688
Urology	384
Miscellaneous	324
CNS	107



Staging ~ 50%

Retroperitoneal Sarcoma

Primary retroperitoneal sarcoma: A comparison of survival outcomes in specialist and non-specialist sarcoma centres☆

Fabio Tirotta [a,*], Andrew Bacon [b], Shane Collins [b,c], Anant Desai [a], Hanhua Liu [b], Lizz Paley [b], Dirk Strauss [d], Sandra J. Strauss [b,c,**]

[a] Department of Sarcoma and General Surgery, University Hospital Birmingham NHS Foundation Trust, Birmingham, UK
[b] National Cancer Registration and Analysis Service, NHS Digital, Wellington Place, Leeds LS1 4AP, UK
[c] Research Department of Oncology, University College London Cancer Institute, London, UK
[d] Sarcoma Unit, Department of Academic Surgery, The Royal Marsden Hospital NHS Foundation Trust, London SW3 6JJ, UK

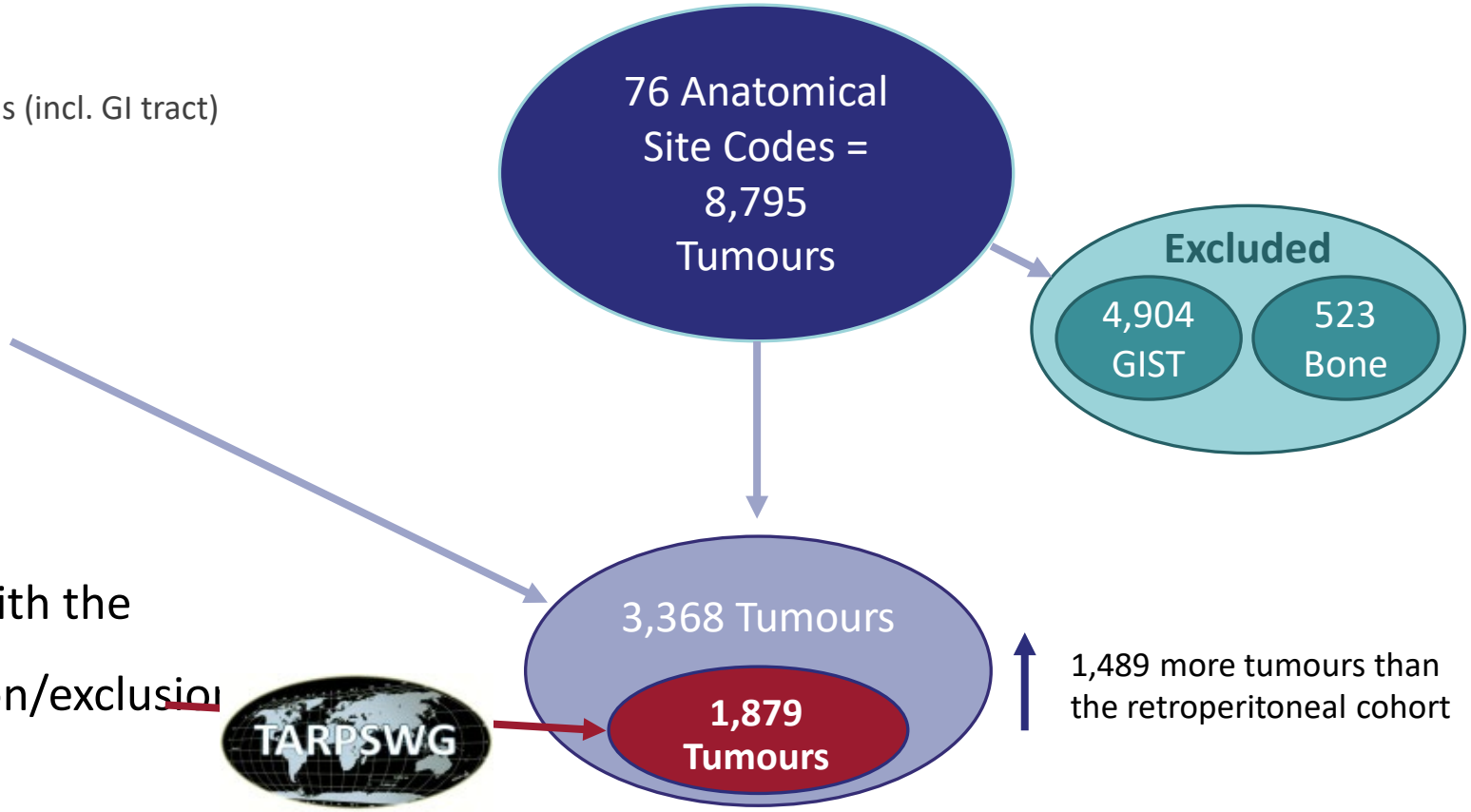
Received 6 March 2023; Received in revised form 5 April 2023; Accepted 10 April 2023

How we defined our cohorts

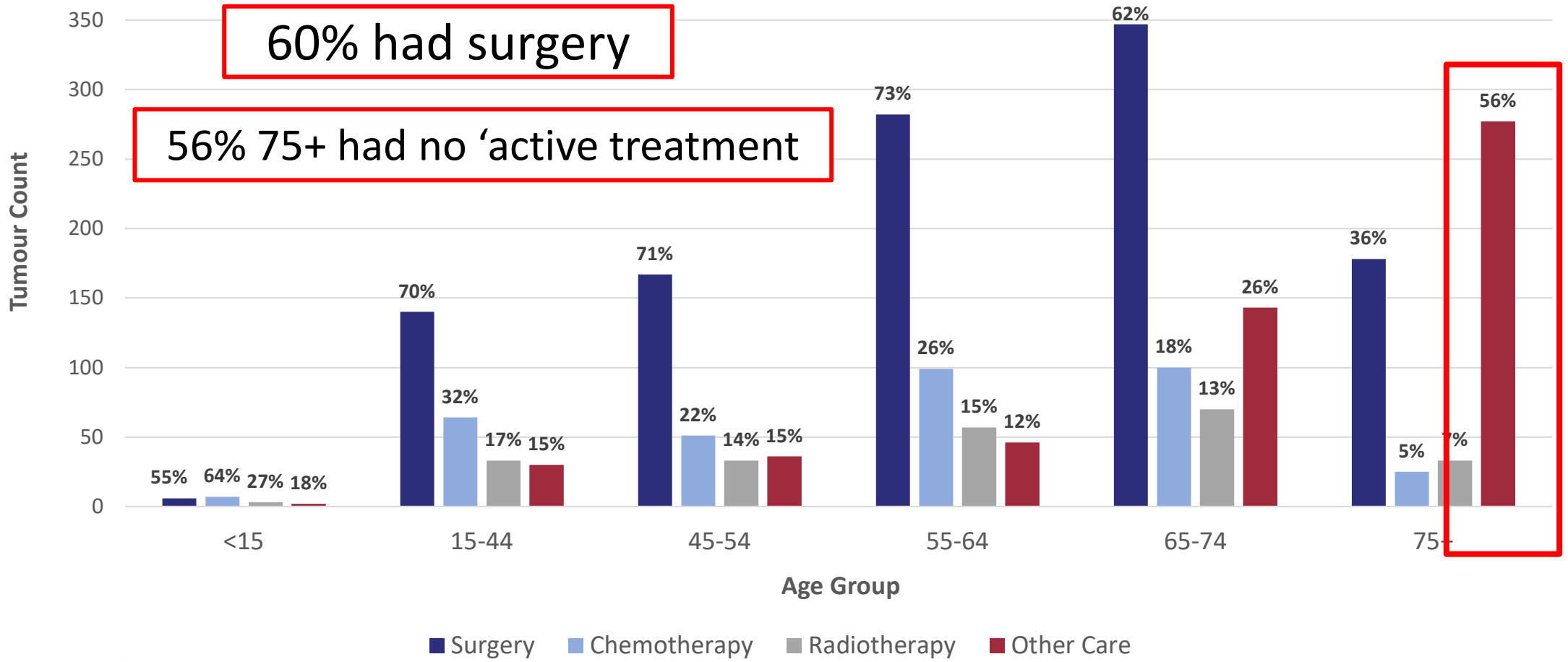
2013-2018 data

- Intra-Abdominal & Pelvic Cohort
  - → 76 anatomical site codes in the abdomen & pelvis (incl. GI tract)
  - → Excludes gynaecological & urology anatomy
  - → STS morphology only (excl. bone & GIST)
  - → Includes the retroperitoneal cohort

- **Retroperitoneal Cohort**
  - → Retroperitoneal group (aligned with the TransAtlantic working group inclusion/exclusion criteria).

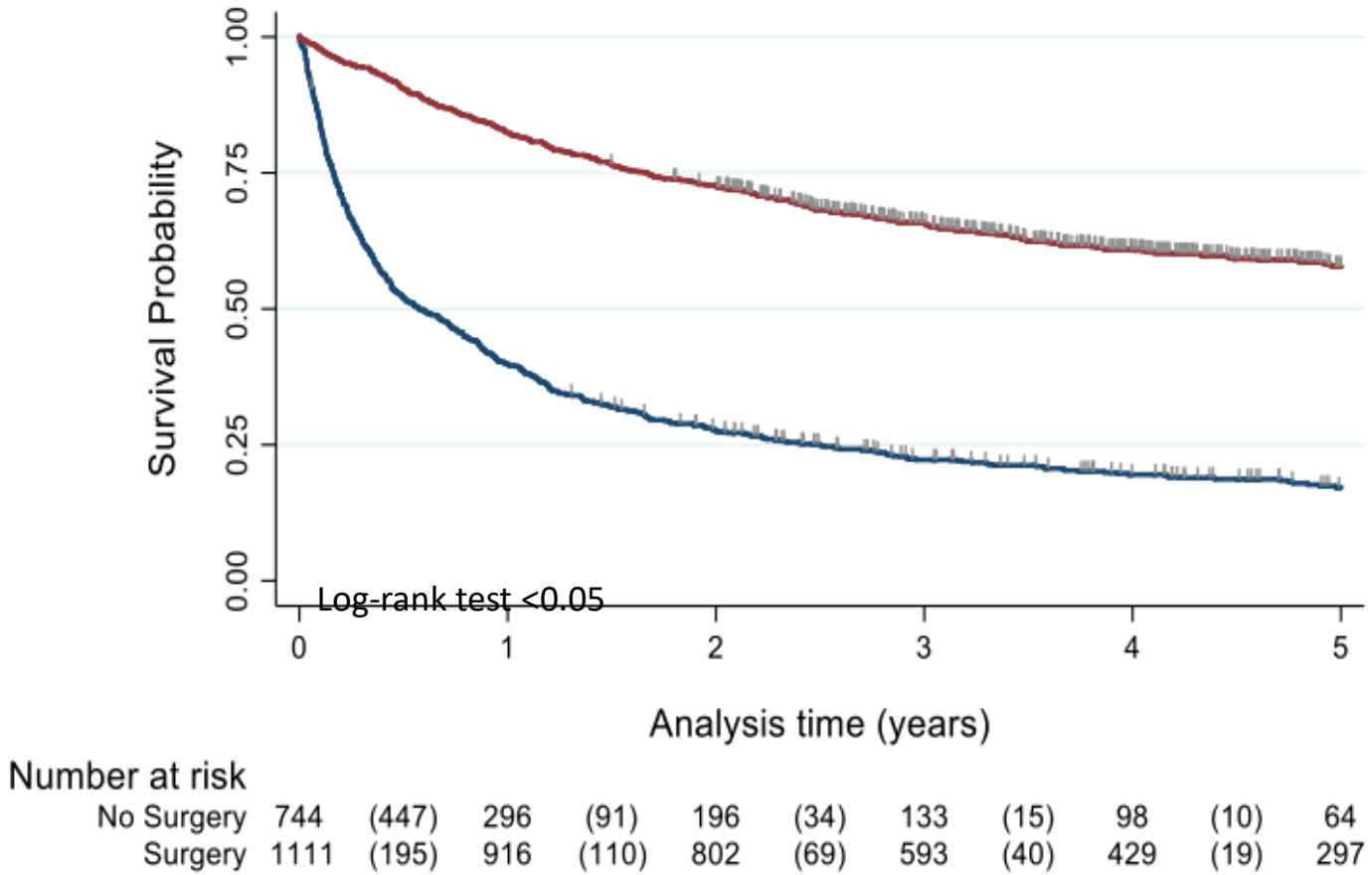


Retroperitoneal Sarcoma Treatment according to Age



OUTCOME OF COHORT ACCORDING TO SURGICAL STATUS (N= 1879)

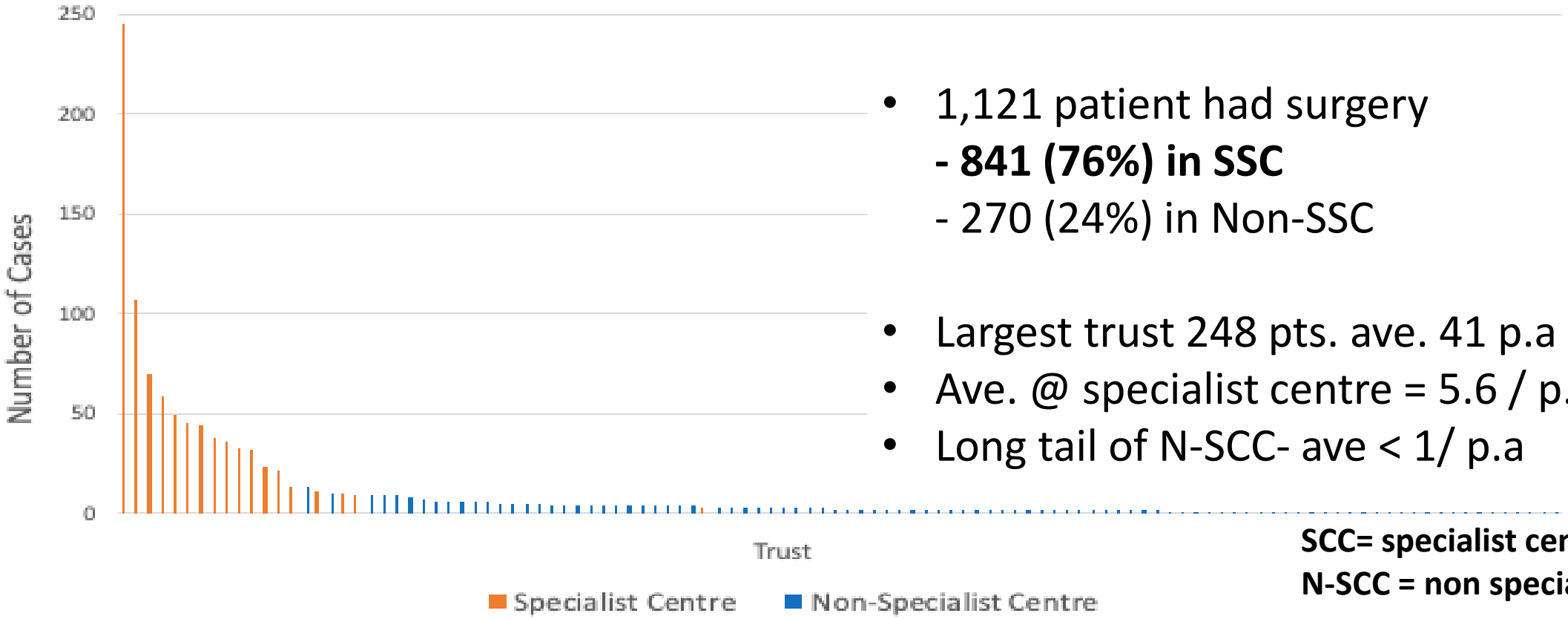
Kaplan-Meier survival analysis according to surgical status



Surgery Status	1 year Overall Survival (unadjusted)	5 year Overall Survival (unadjusted)
Surgery	**82% (CI:80-85%)**	**58% (CI: 55-61%)**
No Surgery	**40% (CI:36-43%)**	**17% (CI: 14-20%)**

SURGERY ACCORDING TO TRUST - SCC AND N-SSC

Number of RPS patients who underwent surgery by Trust from 2013 to 2018



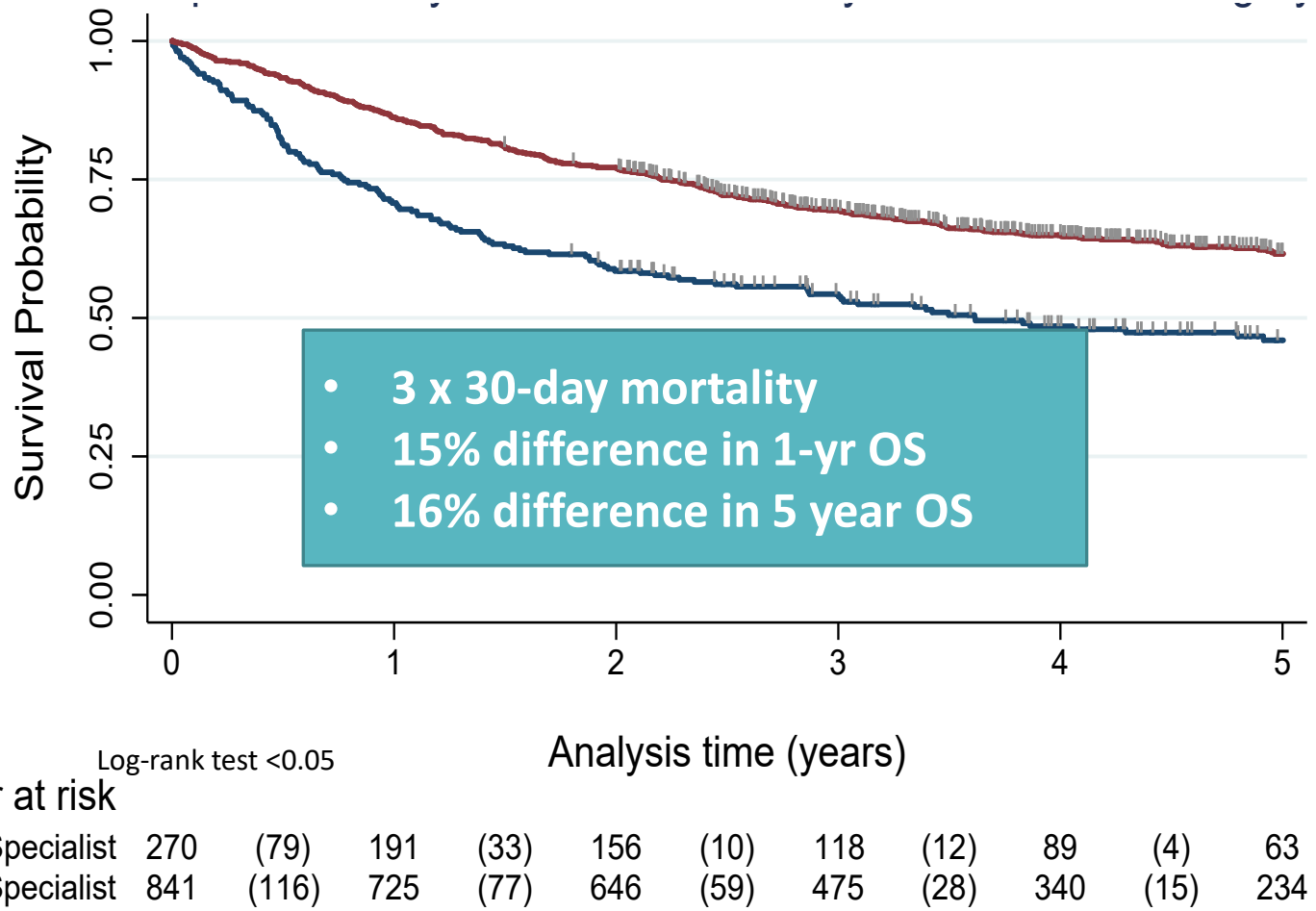
- 1,121 patient had surgery
  - 841 (76%) in SSC
  - 270 (24%) in Non-SSC

- Largest trust 248 pts. ave. 41 p.a
- Ave. @ specialist centre = 5.6 / p.a
- Long tail of N-SCC- ave < 1/ p.a

SCC= specialist centre
N-SCC = non speciaiist centre

RESULTS – OUTCOMES VARY BETWEEN SSC AND N-SSC

Kaplan-Meier curves showing survival outcomes between specialist and non-specialist centres



Trust	30 day Mortality (unadjusted)	1 yr OS (unadjusted)	5 yr OS (unadjusted)
SSC	**1.78% (CI:1.08-2.94%)**	**86% (CI:84-88%)**	**62% (CI: 58-65%)**
N-SSC	**5.19% (CI: 3.1-8.6%)**	**71% (CI:65-76%)**	**46% (CI: 40-52%)**
	P<0.05	**P<0.05**	**P<0.05**

SURGERY

Differences in patients treated at SSC compared to non-SSC

N=1,121 (60%) patients underwent surgery

Older patients less likely to have surgery

Stage and grade not sufficient to evaluate

Patient presenting as an emergency more likely to not have an operation or have surgery at a non-SSC

Factor	Non-Operated patients		Operated patients				
	N	Statistic	N	SSC	N	N-SSC	p-value
Age at Diagnosis (Years)	758	71 (IQR 60-80)	847	64 (IQR 53-71)	273	62 (IQR 52-72)	0.79
Sex (% Male)	396	52%	431	51%	124	45%	0.13
Ethnicity	758		847		273		0.58
White		662 (87%)		753 (89%)		239 (88%)	
BAME		96 (13%)		94 (11%)		34 (12%)	
Indices of Multiple Deprivation (IMD)	758		847		273		0.35
1 – most deprived		118 (16%)		121 (14%)		42 (15%)	
2		143 (19%)		143 (17%)		55 (20%)	
3		153 (20%)		201 (24%)		50 (18%)	
4		166 (22%)		192 (23%)		66 (24%)	
5 – least deprived		178 (23%)		190 (22%)		60 (22%)	
Charlson Comorbidity Index	758		847		273		0.80
0		595 (79%)		718 (85%)		229 (84%)	
1		69 (9%)		73 (9%)		27 (10%)	
≥ 2		94 (12%)		56 (7%)		17 (6%)	
Tumour Histology	758		847		273		**<0.001**
DDLPS + other LPS		205 (27%)		354 (42%)		75 (27%)	
WDLPS		37 (5%)		131 (15%)		7 (3%)	
LMS		185 (24%)		214 (25%)		101 (37%)	
Other		331 (44%)		148 (17%)		90 (33%)	
Route to Diagnosis	758		847		273		**<0.001**
GP referral		184 (24%)		287 (34%)		63 (23%)	
Emergency presentation		195 (26%)		86 (10%)		55 (20%)	
TWW		119 (16%)		206 (24%)		64 (23%)	
Other outpatient		71 (9%)		88 (10%)		40 (15%)	
I/P elective, unknown		189 (25%)		181 (21%)		51 (19%)	

Surgery in a higher volume centre is associated with better outcome

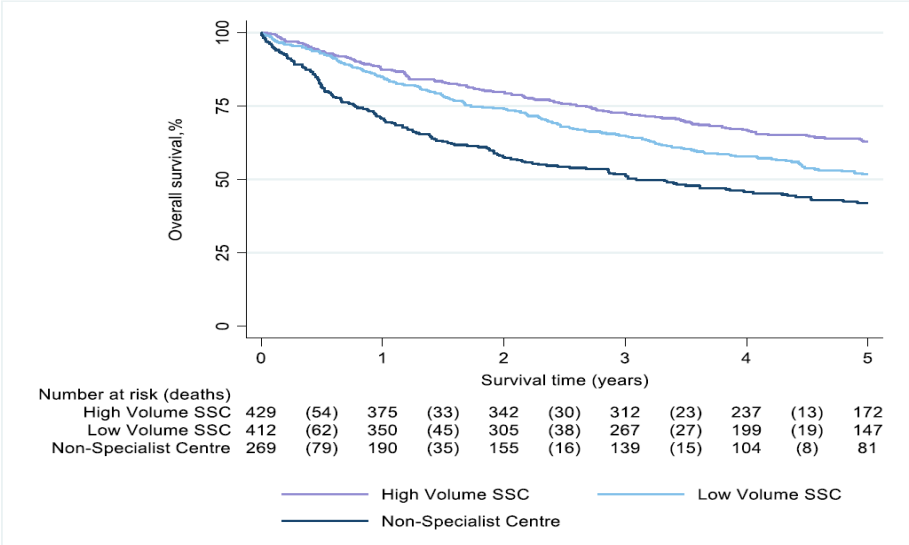


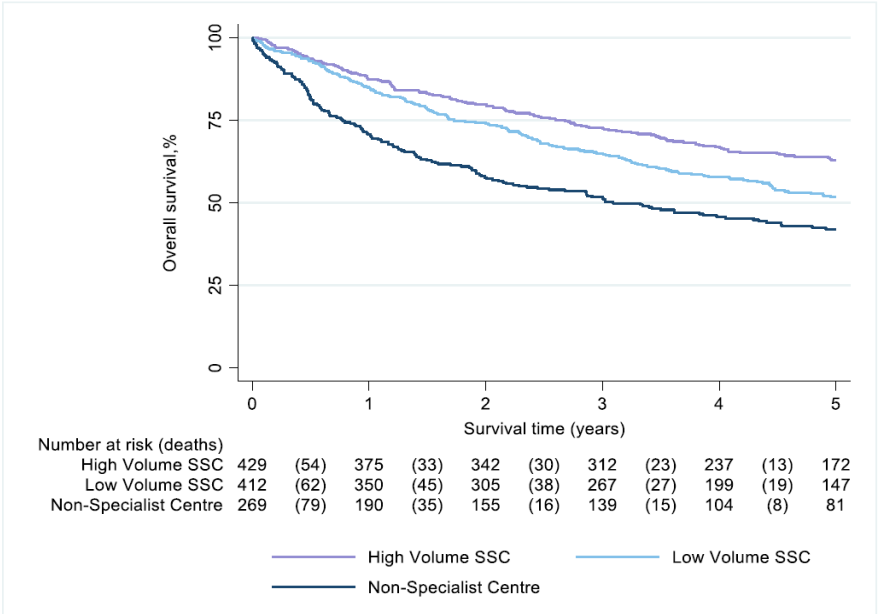
Table 3 – Uni- and Multi-variate analysis of overall survival for patients treated with surgery

	Univariate analysis				Multivariate analysis			
	Haz. ratio	LCI	UCI	p-value	Haz. ratio	LCI	UCI	p-value
Age at Diagnosis (Years)								
15-44	1.00	-	-	-	1.00	-	-	-
45-54	0.78	0.52	1.15	0.21	0.90	0.61	1.34	0.61
55-64	1.24	0.89	1.73	0.20	1.41	1.01	1.98	**<0.05**
65-74	1.50	1.10	2.06	**0.01**	1.86	1.33	2.58	**<0.01**
75+	2.06	1.47	2.89	**<0.01**	2.26	1.60	3.21	**<0.01**
Route to Diagnosis								
TWW	1.00	-	-	-	1.00	-	-	-
GP referral	0.88	0.69	1.12	0.31	0.96	0.75	1.22	0.72
Other outpatient	0.87	0.62	1.21	0.40	0.88	0.62	1.23	0.45
Emergency presentation	2.28	1.74	2.99	**<0.01**	2.06	1.56	2.72	**<0.01**
Inpatient / unknown	1.04	0.79	1.36	0.80	1.09	0.82	1.43	0.56
Type of centre*								
N-SSC	1.00	-	-	-	1.00	-	-	-
LV-SSC (vs. N-SSC)	0.69	0.56	0.85	**<0.01**	0.79	0.63	0.98	**<0.05**
HV-SSC (vs. N-SSC)	0.50	0.40	0.62	**<0.01**	0.61	0.48	0.77	**<0.01**
HV-SSC (vs. L-SSC)	0.72	0.58	0.89	**<0.01**	0.78	0.62	0.96	**0.02**

Initially, all factors were entered into separate univariate Cox regression models. All factors were then entered

- **First analysis of English data to demonstrate OS difference in specialist centres and impact of volume**
- **Prioritised by SAG to engage with NHS E about potentially reducing the number of specialist centres to reduce inequalities in outcome: presented at programme of care board**

Surgery in a higher volume centre is associated with better outcome



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65-74	1.50	1.10	2.06	**0.01**	1.86	1.33	2.58	**<0.01**
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Type of centre*								
N-SSC	1.00	-	-	-	1.00	-	-	-
LV-SSC (vs. N-SSC)	0.69	0.56	0.85	**<0.01**	0.79	0.63	0.98	**<0.05**
HV-SSC (vs. N-SSC)	0.50	0.40	0.62	**<0.01**	0.61	0.48	0.77	**<0.01**
HV-SSC (vs. L-SSC)	0.72	0.58	0.89	**<0.01**	0.78	0.62	0.96	**0.02**

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Other factors associated with poor outcome

Age and Emergency presentation,

: → *agreed to now analyse patients who did not have surgery*

2. Breast Sarcomas

- Very little national data on breast sarcomas
- Aim was to understand incidence and outcome, treatment and impact of specialist services

A. M et al. / European Journal of Cancer 174 (2022) 48–56

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Incidence and Outcome of Breast Sarcomas in England (2013–2018): An analysis from the National Cancer Registration and Analysis Service

Ahmed M [a,*], Collins S [b,c], Franks J [d], Lobo C [d], Bacon A [c], Paley L [c], Strauss SJ [a,b,c]

European Journal of Cancer 174 (2022) 48–56

2. Breast Sarcoma (n = 688)

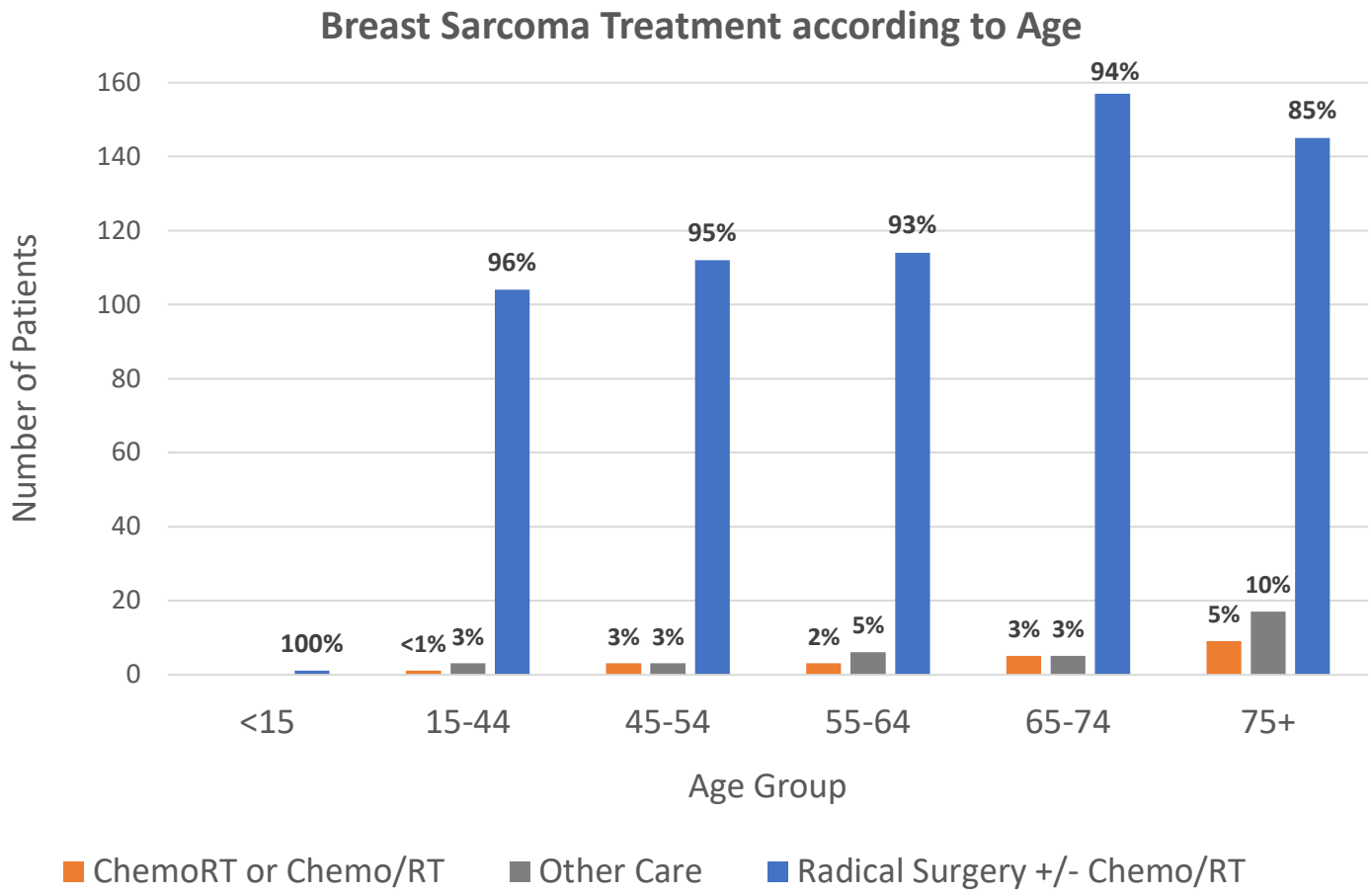
2013-18 data

Morphology Subgroup	Tumour Count
Phyllodes	357
Vascular Tumours	238
Other Morphology	93

- 32% with previous breast cancer
- 27% with previous breast RT

Treatment:

- → **92% undergo surgery**
- → 21% undergo radiotherapy
- → 10% undergo Chemotherapy
- → 5% other care



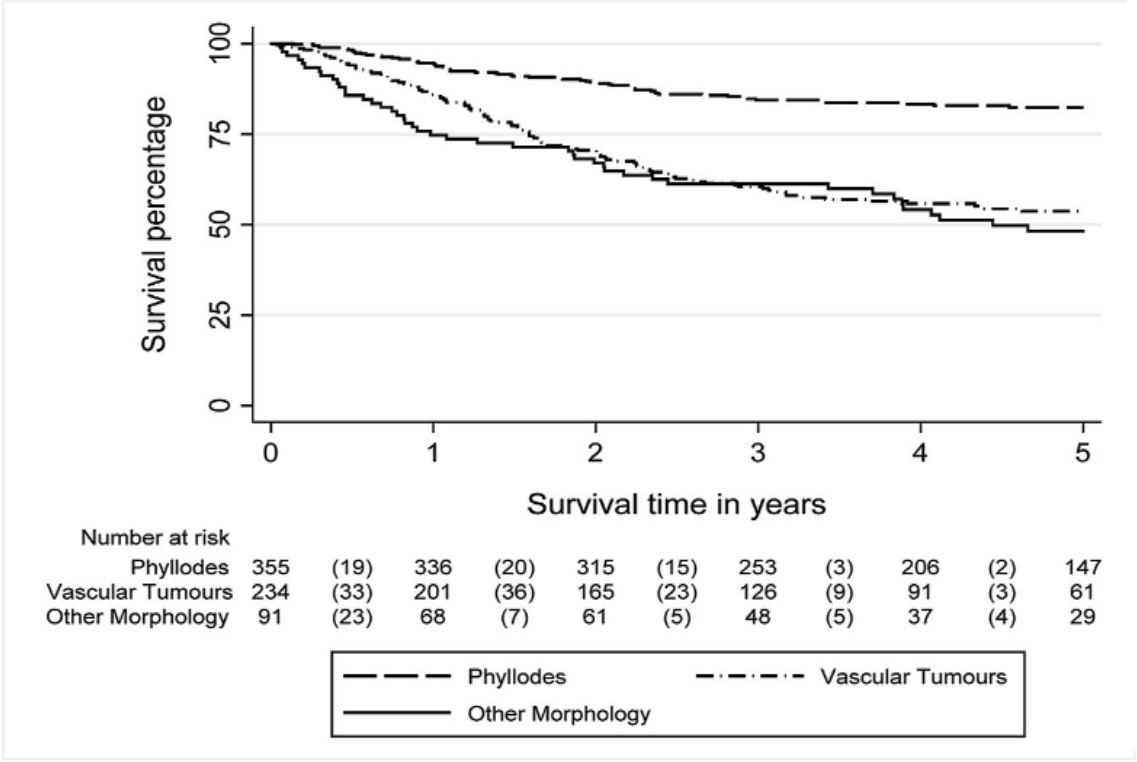
Sarcoma UK
The bone & soft tissue cancer charity

UCL

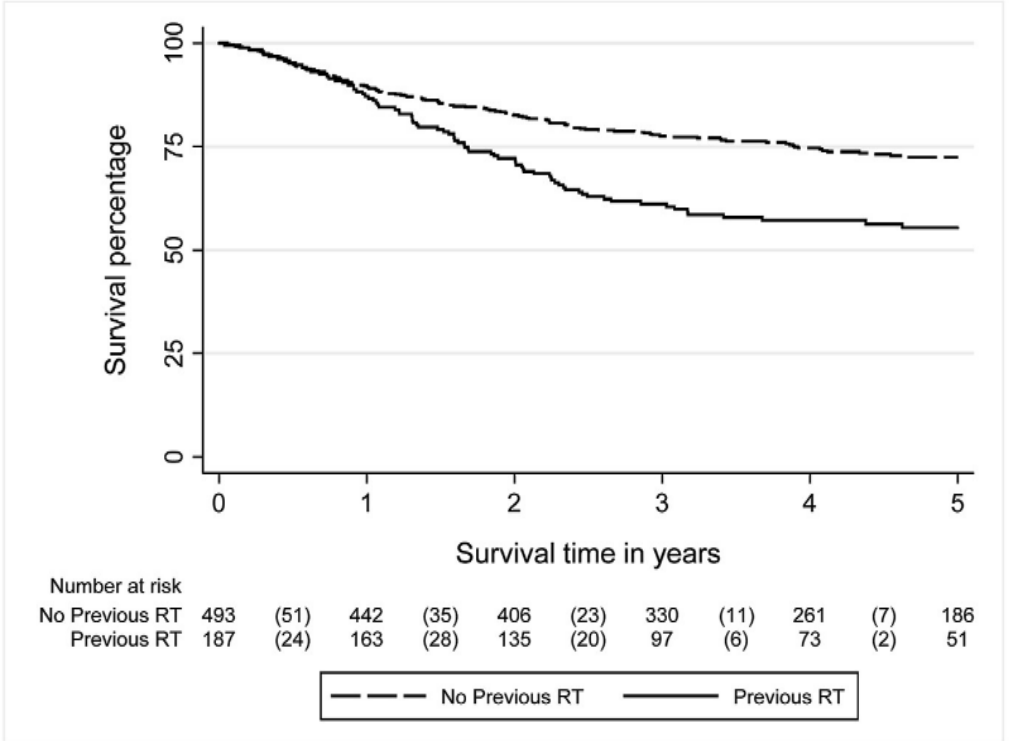
Patients with phyllodes had a good outcome

Patients with previous RT had a worse outcome

Kaplan-Meier Overall survival



Kaplan-Meier Overall survival



Breast Sarcoma results and conclusions

- 33% of patients had their first surgery at a ‘specialist centre’,
- Location of first surgery (specialist vs. non-specialist) had no impact on survival outcomes (low numbers per trust).
- **Specialist centres; higher rate of biopsy prior to surgery & lower rates of multiple surgeries**

→Presented at Breast surgical Oncology meeting, engagement with breast surgeons for the first tine

→ new national guidelines written

Contemporary management of phyllodes tumours: Guidelines from the Association of Breast Surgery

Mai K. Bishr*[a], Alex Humphreys*[b], **Mahbubl Ahmed**[c], Karina Cox[d], Adam Hughes[e], Jen Isherwood[f], Sarah Pinder[g], Dionysios Dennis Remoundos[h], Elinor Sawyer[i], Muhammad S. Tamimy[j], Lisa Whisker[k]

Bone Sarcomas

NDRS
NATIONAL DISEASE REGISTRATION SERVICE

NHS England

- New partnership in 2022
- Incidence and outcome
- Impact of treatment
- Identify inequalities – geographical, age, pathways to diagnosis

BONE CANCER RESEARCH TRUST
UNTIL THERE'S A CURE

Sarcoma UK
The bone & soft tissue cancer charity

Reuben Hastings

Bone Sarcomas

Incidence and survival of malignant bone sarcoma diagnosed in England between 1995 and 2020; an analysis from the National Cancer Registration and Analysis Service

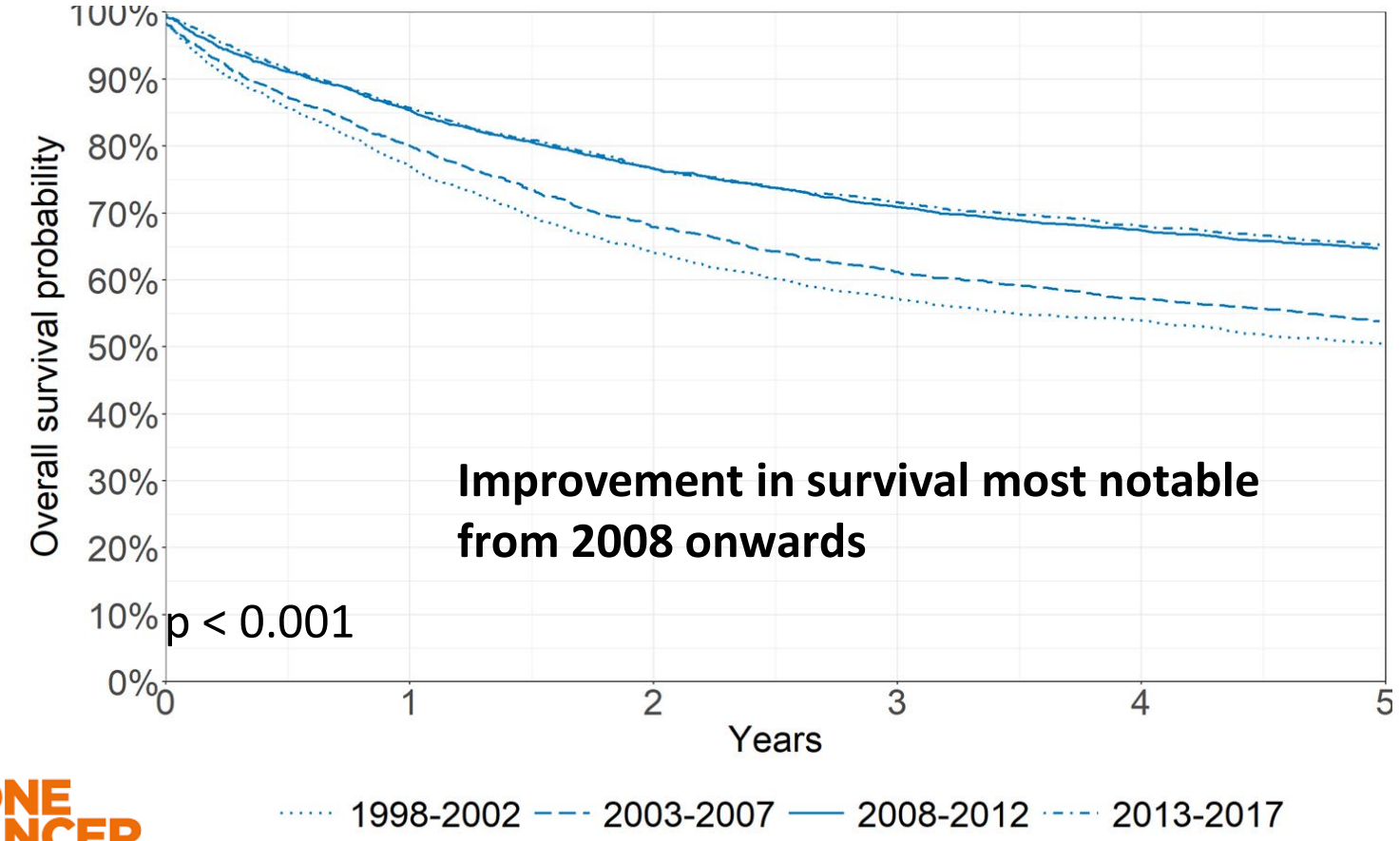
Reuben A. Hastings[1,2], Andrew Bacon[1], Victoria Vinader[3], Sean McPhail[1], Lizz Paley[1], Martin McCabe[4], Craig Gerrand[5], Sandra J. Strauss[1]

ctos® 2023 ANNUAL MEETING

Age-standardised incidence rates (ASR) per million (2013-2020)

Morphological description	Total Diagnosed	Median Age	Average per year	ASR	LCL	UCL
All MBS	4,146	44	**518**	9.6	9.3	9.9
Chondrosarcoma	1,406	55	**176**	3.3	3.2	3.5
Osteosarcoma	1,012	23	**127**	2.3	2.1	2.4
Ewing Sarcoma	852	20	**107**	1.9	1.8	2
Other malignant bone tumours	446	62	**56**	1.1	1.0	1.2
Chordoma	430	61	**54**	1.0	1.0	1.1

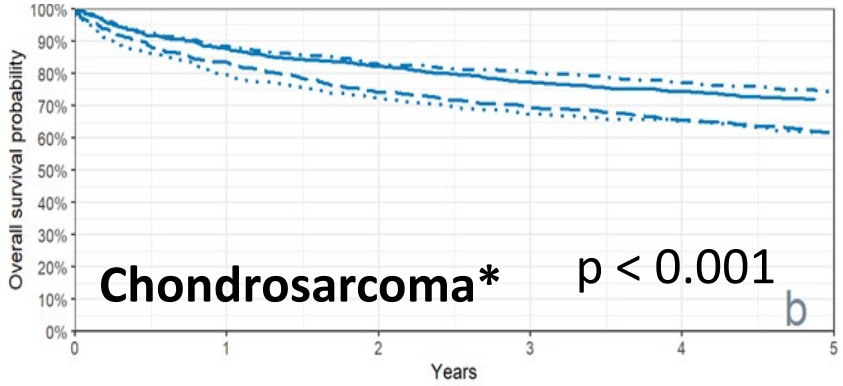
Change in survival, 1998-2017 (All Primary Bone Sarcomas)

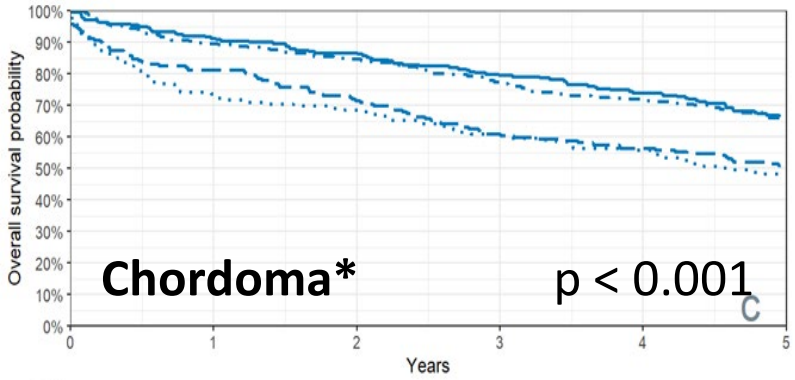


Years	**5yr OS %**	LCL	UCL
1998-2002	**49**	47	51
2003-2007	**52**	50	54
2008-2012	**61**	59	63
2013-2017	**61**	59	63

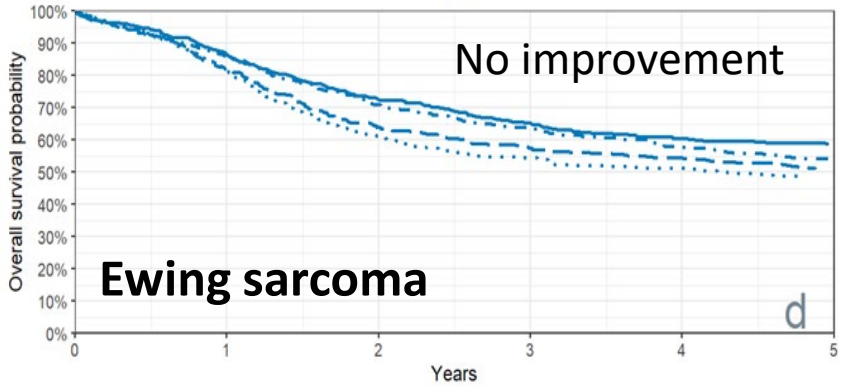
Change in survival, 1998-2017 –differences patterns across subtypes

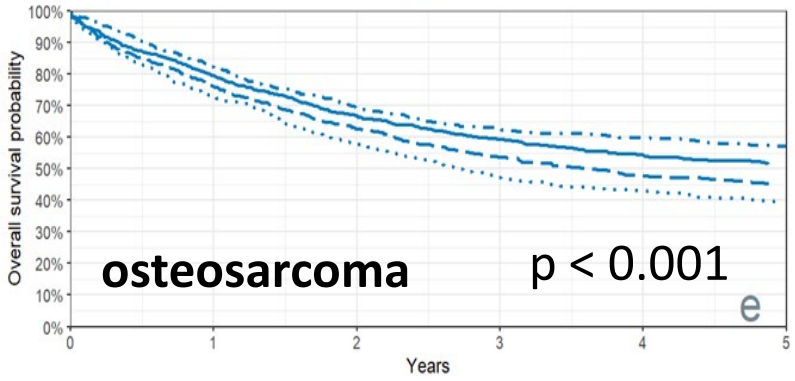
- Improvements from 2008





Improvements from 2008





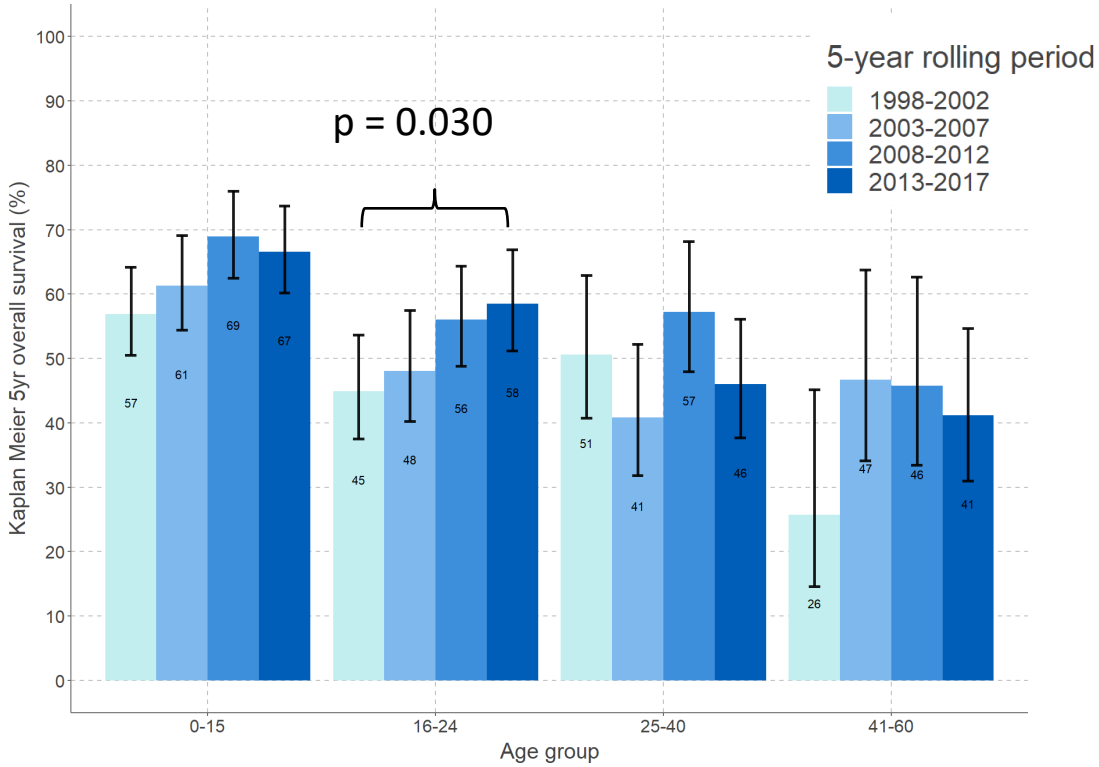
Improvements in successive cohorts**

1998-2002 2003-2007 2008-2012 2013-2017

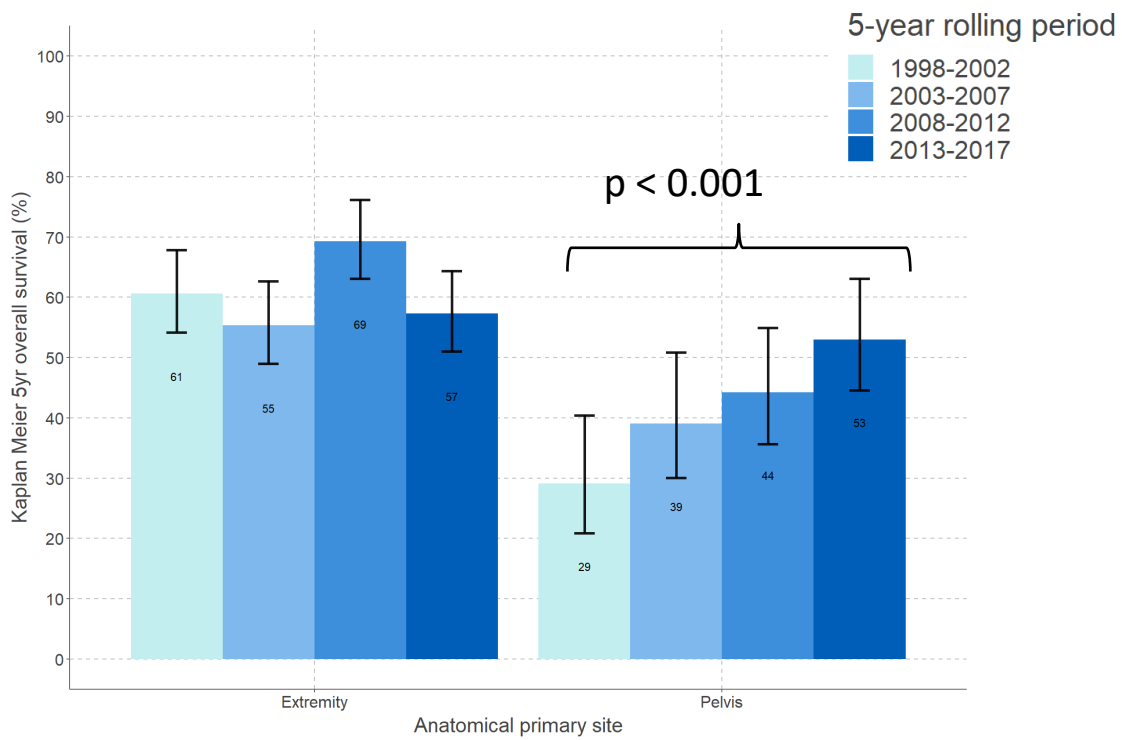
* Main treatment is surgery

Ewing sarcoma survival, 1998-2017- subgroups with improved outcome

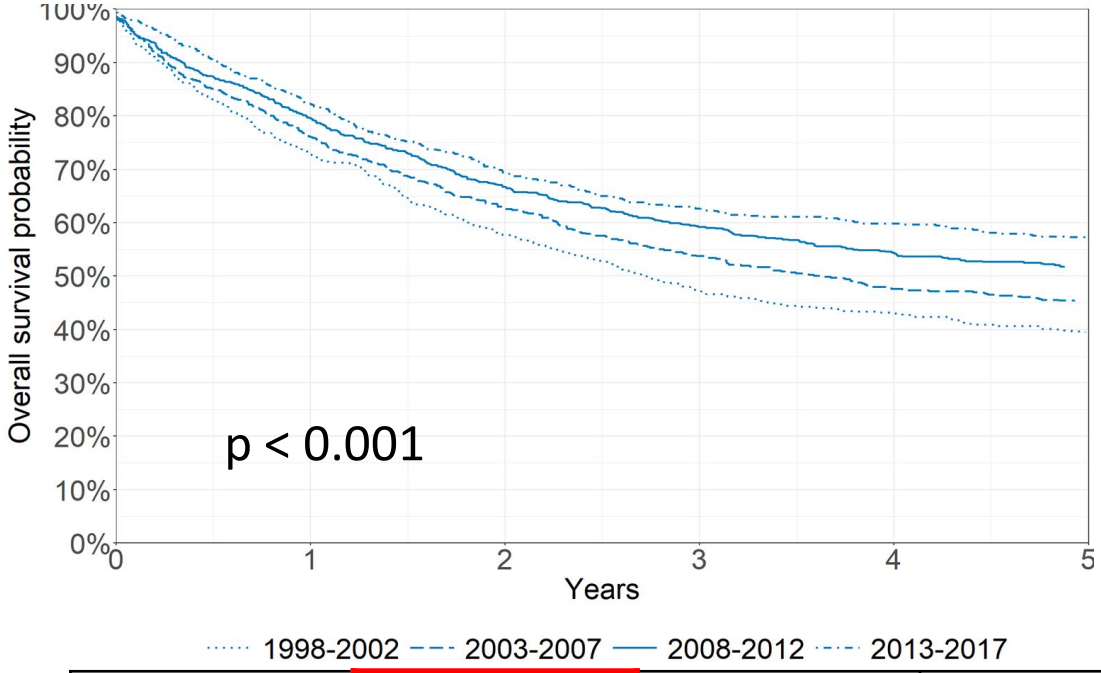
Significant improvement in 16-24-yr-olds



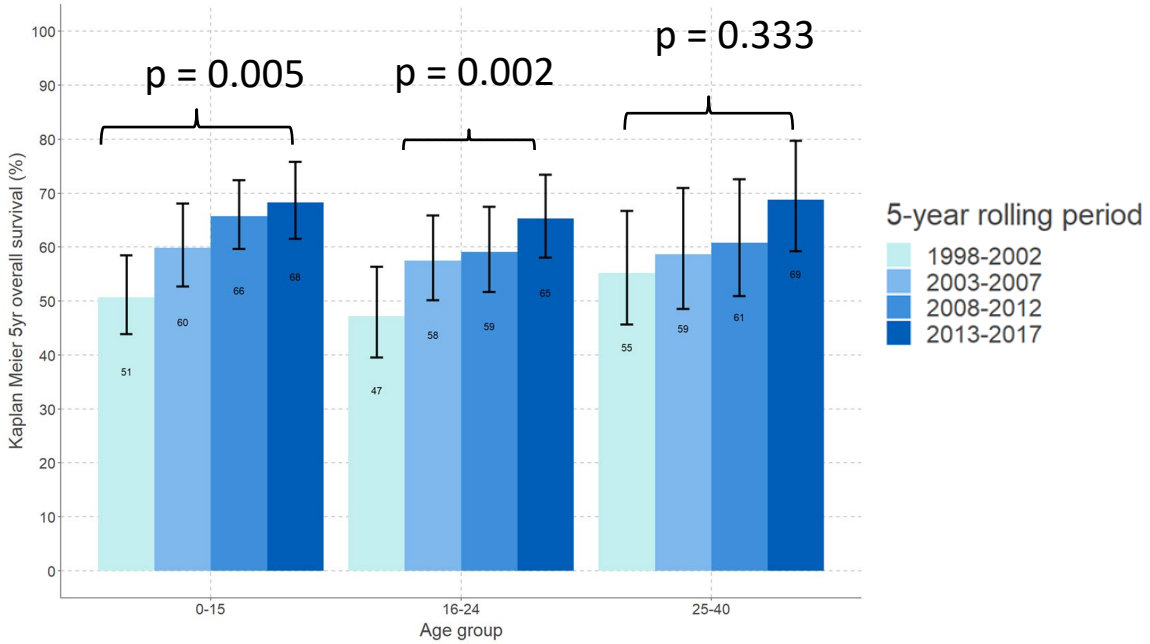
Significant improvement in patients with pelvic primary site but not extremity



Change in survival, 1998-2017 (Osteosarcoma)



Years	**5yr OS %**	LCL	UCL
1998-2002	**40**	36	44
2003-2007	**45**	42	49
2008-2012	**52**	48	56
2013-2017	**57**	53	61



Significant improvement in 0-15 and 16-24-yr-olds. Not in 25-40.

Discussion and conclusions

- Pattern of improvement across PBS aligns with introduction of national specialist centre guidance
- Improvement in osteosarcoma also aligns with introduction of three-drug MAP as standard of care and global phase III clinical trial that standardised systemic treatment
- Ewing sarcoma – less improvement

More detailed analysis is ongoing evaluating impact of treatment and specialist services on outcome

- **Challenges: access to proton beam radiotherapy- working with RTDS and protons outcome centre to access, poor staging, ~ 50% and tumour grade**

Conclusion

- Partnership project has provided a unique opportunity to
- Understand incidence and outcome of groups of patients and provision of sarcoma services across England
  - → Dissemination – stakeholders including charities for wider access to stats
  - → SAG/ BSG - Use to reduce inequalities and drive improvements
  - → engagement with commissioners

Ongoing work….

- → demonstrated value – developed methodology to analyse many other groups
- → January 2024: Extended funding from BCRT and Sarcoma UK for partnership 18 months aims:

  1. detailed analysis of Ewing sarcoma
  2. peform detailed studies of sarcoma diagnosis, treatment and outcomes for specific sarcoma patient groups (as prioritised by Steering group and Sarcoma Advisor Group chairs)
  3. Develop methodology to analyse patient referral pathways and impact of specialist MDT discussion and timing thereof on treatment and outcomes.
  4. Development of a future NDRS sarcoma partnership programme and longer- term infrastructure support with stakeholder engagement to ensure fit for purpose

Acknowledgements

NDRS
Shane Collins
Reuben Hastings

Andrew Bacon
Lizz Paley
Kwok Wong
Hanhua Liu
Sean McPhail
John Broggio

Zoe Davison Sorrel Bickley

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Sarcoma UK
The bone & soft tissue cancer charity

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Lee Bayliss
Mahbubl Ahmed
Jo Franks
Mike Parry

This work uses data that has been provided by patients and collected by the NHS as part of their care and support. The data is collated, maintained and quality assured by the National Cancer Registration and Analysis Service, which is part of Public Health England (PHE).