



sarcoma  
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**HIGHLIGHTS BY**

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# DISCLOSURES

**Please note:** Views expressed within this presentation are the personal opinions of the author. They do not necessarily represent the views of the author's academic institution or the rest of SARCOMA CONNECT group.

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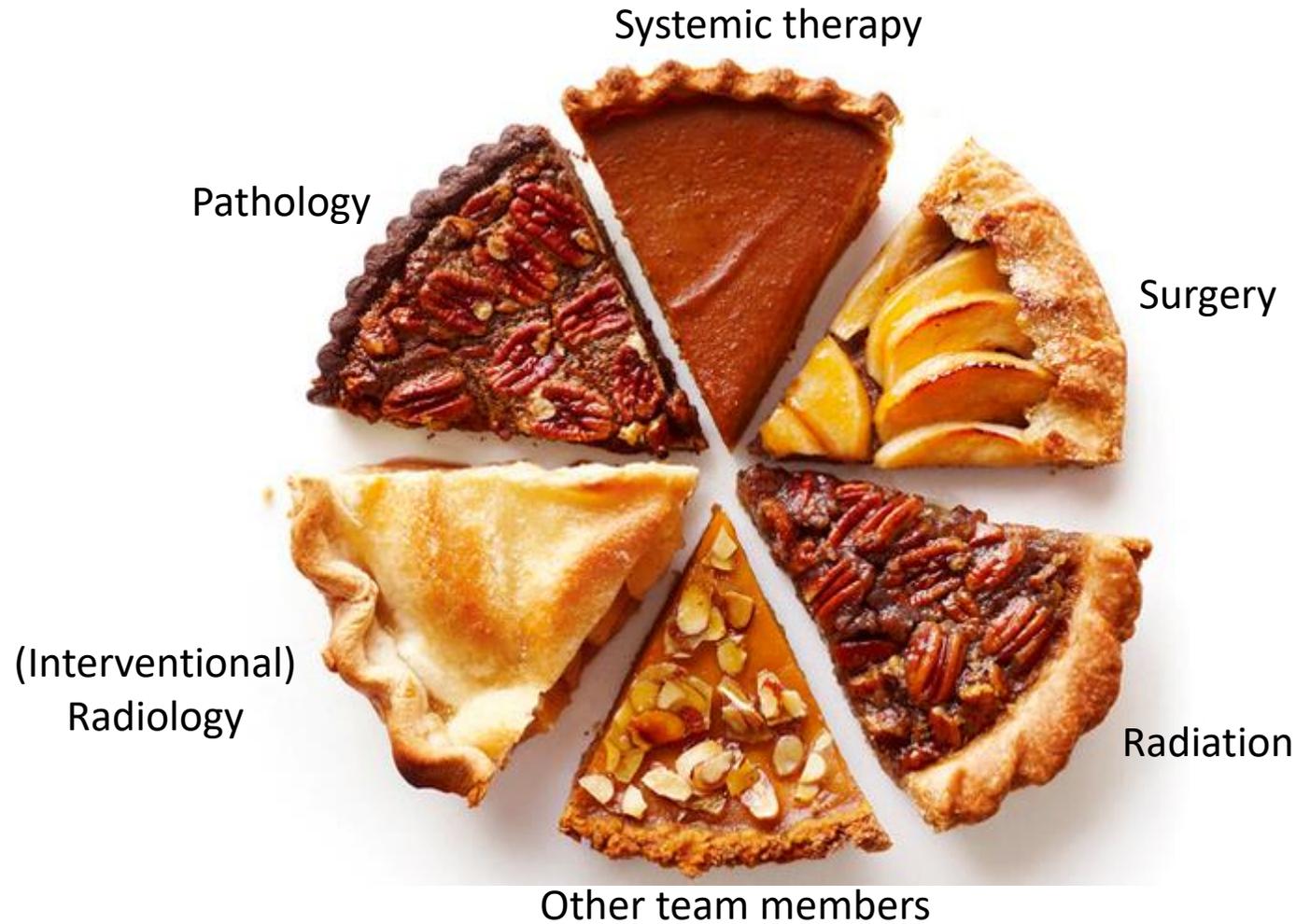
**Disclosures:** **Prof. Robert maki** has received honoraria from the following:

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# BACKGROUND

Multidisciplinary Tumour Board  
Treatment options in Sarcoma

# MULTIDISCIPLINARY MANAGEMENT OF SARCOMAS: POTLUCK – EVERYONE BRINGS SOMETHING



# CHEMOTHERAPY FOR SARCOMA: TWO INTENTIONS

- **Curative intent**

- Adjuvant chemotherapy
- Neoadjuvant chemotherapy

- **Palliative intent**

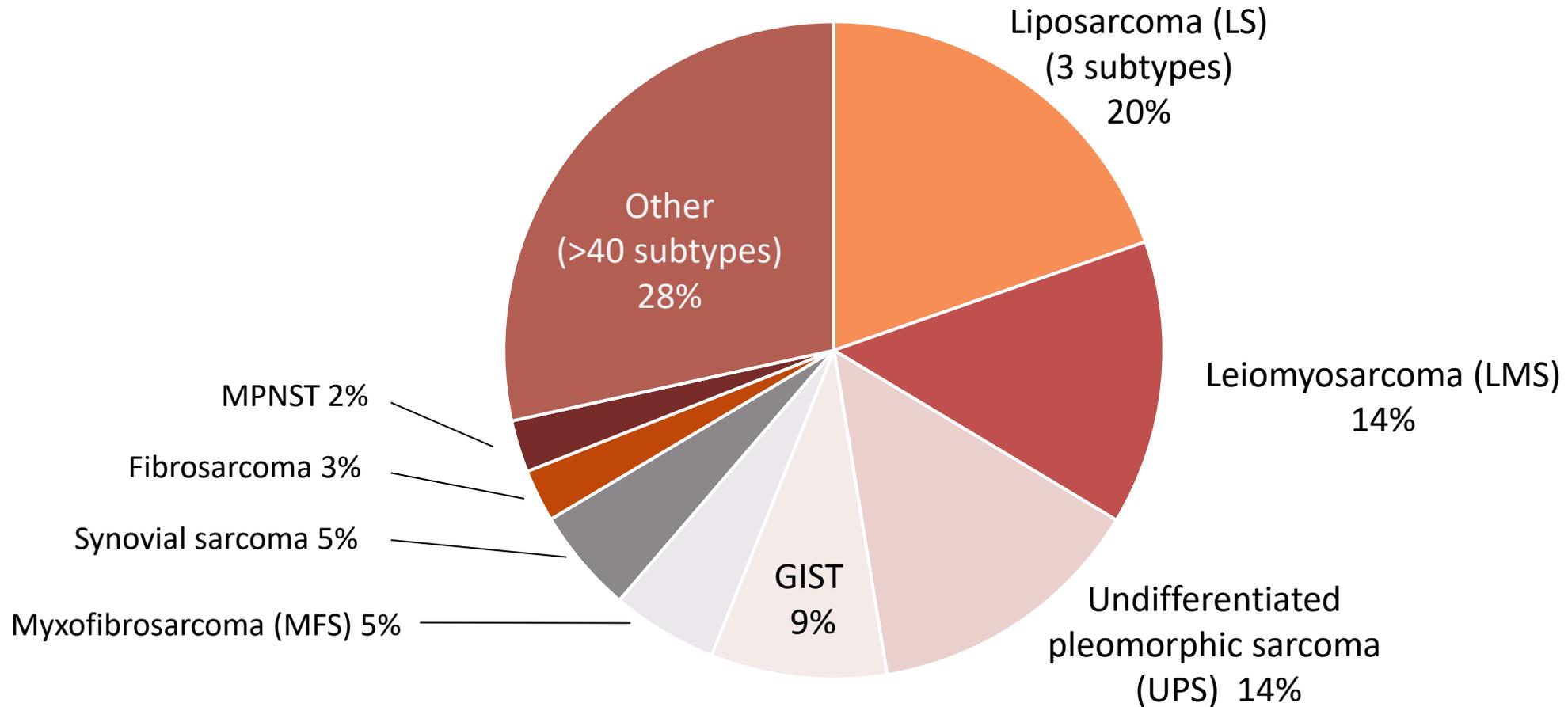
- Treatment of metastatic disease
    - Standard agents
    - Clinical trials
-

# EXTREMITY SOFT TISSUE SARCOMAS

Adjuvant  
neoadjuvant therapy

# COMMON SOFT TISSUE SARCOMAS

13,460 CASES PER YEAR (US 2021), ~50 SUBTYPES < 1 % OF ADULT CANCER



GIST, gastrointestinal stromal tumour; LS, liposarcoma; LMS, leiomyosarcoma; MFS, myxofibrosarcoma; MPNST, malignant peripheral nerve sheath tumour; UPS, undifferentiated pleomorphic sarcoma

Brennan MF, et al. (2013). Management of Soft Tissue Sarcoma. Springer-Verlag, NY, USA

- Diagnosis-dependent
- **GIST:** 3 years imatinib is standard of care (SOC) for higher-risk disease
- Paediatric sarcomas: also SOC
  - **Ewing sarcoma:** VAdrC-IE
  - **Rhabdomyosarcoma:** VDactinoC
  - **Osteosarcoma:** doxorubicin/cisplatin ± MTX
- **Extremity sarcomas** – benefit of chemoRx less clear
  - Most studies showed no benefit
  - Meta-analysis data supports its use (with ifosfamide)
  - Neoadjuvant chemoRx may be better than adjuvant chemoRx
- **Retroperitoneal sarcoma:** mostly a surgical disease

# LARGEST INDIVIDUAL ADJUVANT STUDY IN ADULTS: NO SURVIVAL ADVANTAGE FOR DOXORUBICIN + IFOSFAMIDE

- High-risk soft tissue sarcoma patients: doxorubicin/ifosfamide / lenograstim vs observation alone
  - 351 patients recruited, 1995-2003
  - 5 cycles of doxorubicin 75 mg/m<sup>2</sup> + ifosfamide 5 g/m<sup>2</sup> q3w
- Interim analysis for futility led to early study closure

	Estimated 5-yr RFS	Estimated 5-yr OS
<b>Treatment</b>	55%	67%
<b>Observation</b>	53%	68%

The hypothesis that adjuvant chemotherapy improves recurrence-free survival and overall survival was *rejected*

# HOWEVER...2008 META-ANALYSIS SHOWED IMPROVED SURVIVAL FOR IFOSFAMIDE-BASED THERAPY

- Largest adjuvant study compiled to date
- Update to a 1997 meta-analysis
  - Greater use of ifosfamide
  - 18 trials
  - 1,953 patients
- New data are **still needed...**

Hazard ratios	Overall survival
<b>Any chemo</b>	0.77 (p=0.01)
<b>Dox only</b>	0.84 (p=0.09)
<b>Dox + Ifos</b>	0.56 (p=0.01)

# NEW NEOADJUVANT DATA: TAILORED VS STANDARD RX

- Primary STS Dx:

- UPS
- Leiomyosarcoma
- MPNST
- Myxoid Liposarcoma
- Synovial
- Sarcoma NOS

- Outcomes

- **Primary: DFS** (specifically if tailored > standard Rx)
- Secondary included: OS



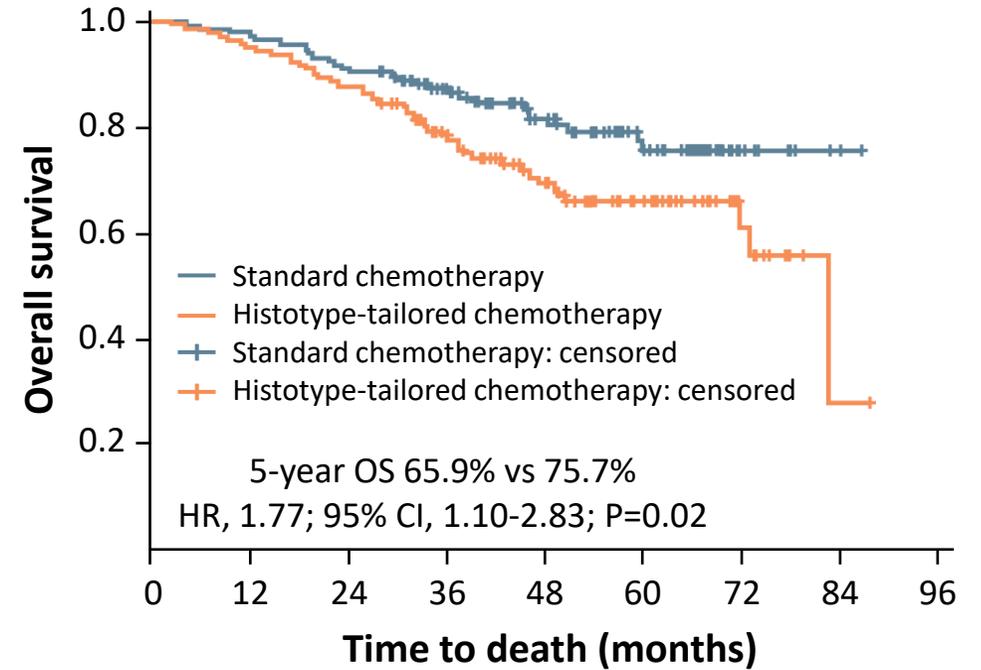
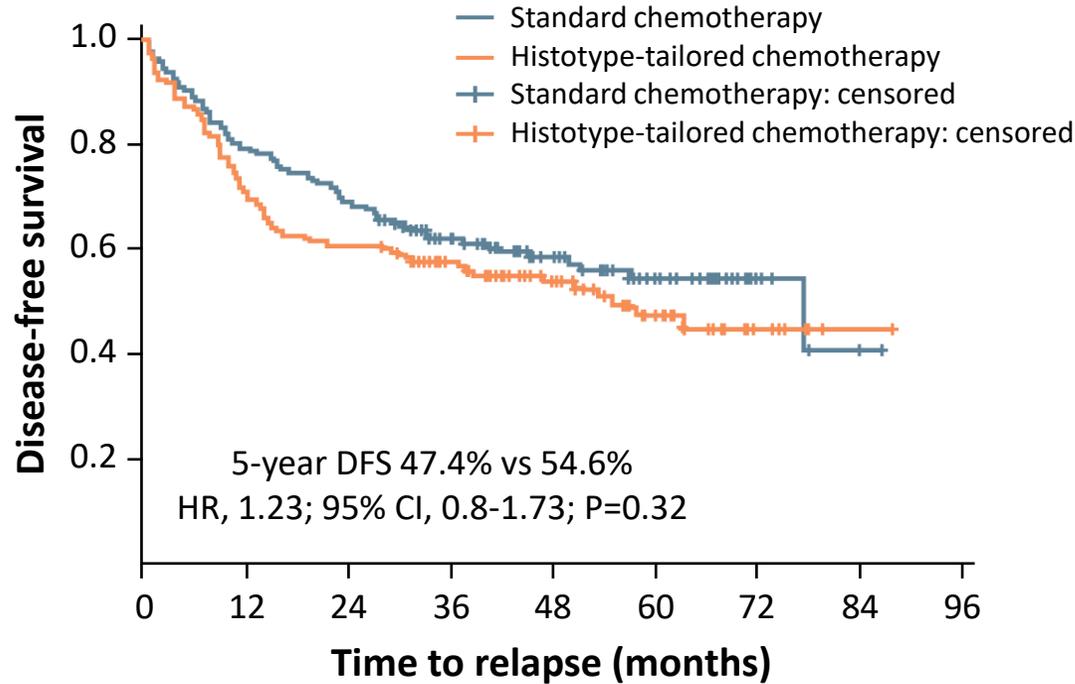
# DEMOGRAPHICS

Characteristic	Standard Rx (n=145)	Tailored Rx (n=142)
<b>Age, years, mean</b>	48	49
<b>Female gender</b>	37%	40%
<b>Tumour size, mm, mean</b>	112	105
<b>Histology (n, %)</b>		
Myxoid liposarcoma	37 (26%)	28 (20%)
Synovial	36 (25%)	34 (24%)
MPNST	15 (10%)	12 (9%)
Leiomyosarcoma	12 (8%)	16 (11%)
UPS	43 (30%)	50 (35%)
Other	2 (1%)	2 (1%)
<b>RT preop</b>	12%	13%
<b>RT postop</b>	66%	67%
<b>% R0 margin</b>	78%	81%

MPNST, malignant peripheral nerve sheath tumour; R, resection; RT, radiation therapy; Rx, chemotherapy; UPS, undifferentiated pleomorphic sarcoma

Gronchi A, et al. Lancet Oncol. 2017;18:812-22; Gronchi A, et al. J Clin Oncol. 2020;38:2178-86

# DFS AND OS: STANDARD VS TAILORED THERAPY



No. at risk:

Standard CT	145	115	100	77	55	36	8	2	0
HT CT	142	101	86	65	44	23	8	1	0

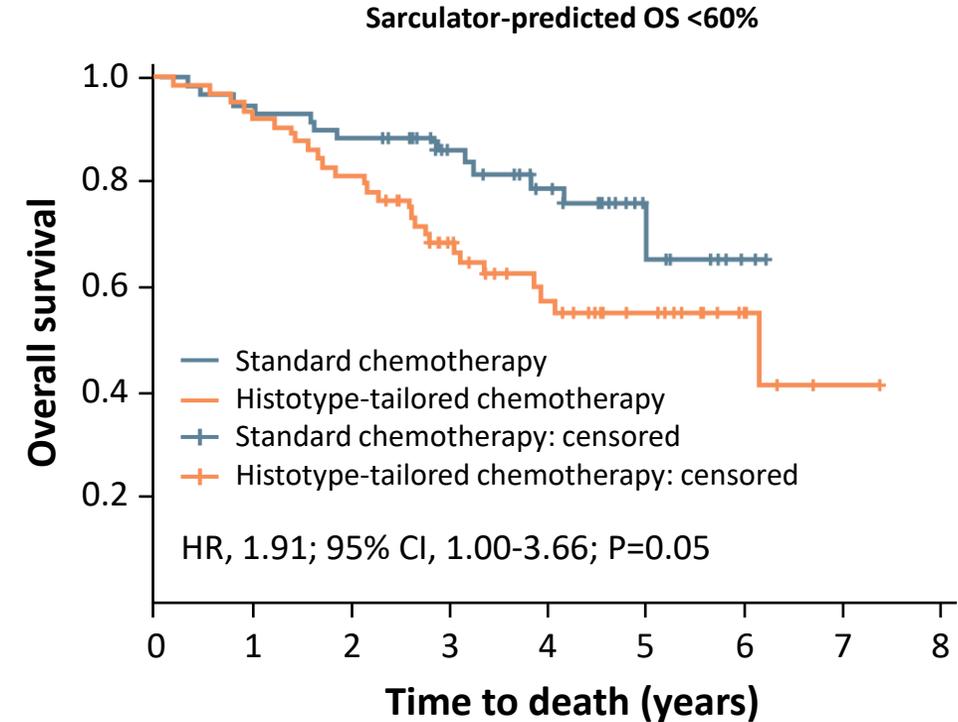
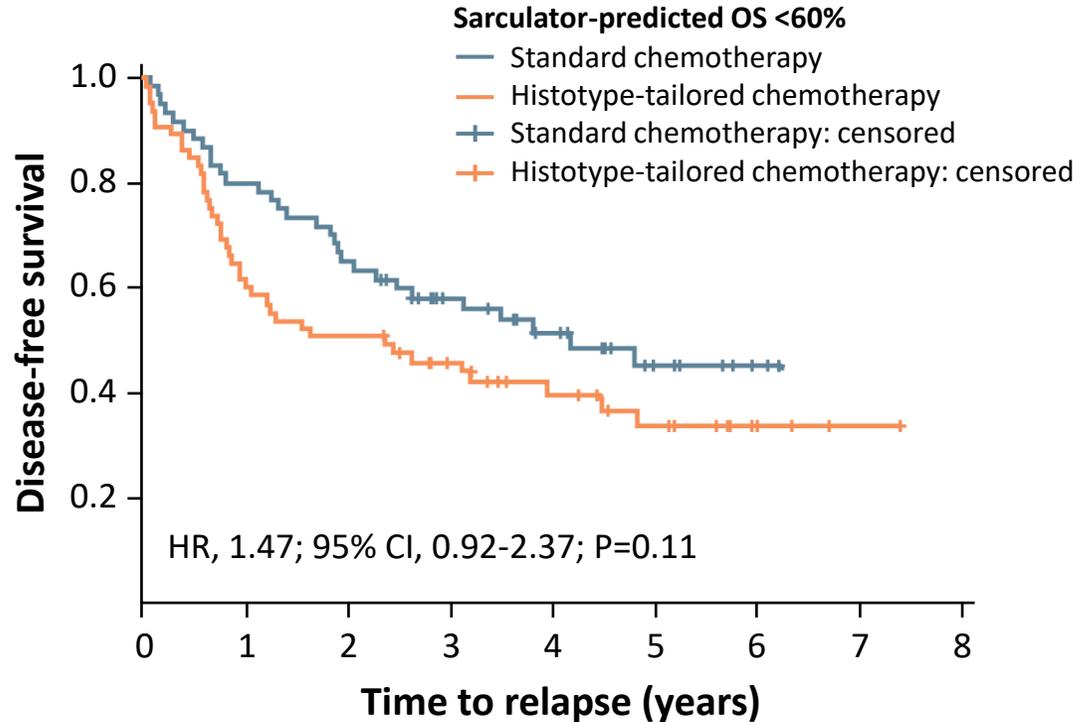
DFS

No. at risk:

Standard CT	145	142	131	104	72	45	13	2	0
HT CT	142	135	125	92	61	35	13	1	0

OS

# WHO DID BETTER? ONLY WHEN PREDICTED SURVIVAL <60%



**No. at risk:**

<b>Standard CT</b>	60	48	39	28	20	11	3	0	0
<b>HT CT</b>	65	40	33	25	17	10	3	1	0

**DFS**

**No. at risk:**

<b>Standard CT</b>	60	57	53	38	28	13	3	0	0
<b>HT CT</b>	65	60	53	38	24	15	4	1	0

**OS**

# TAKE-HOME MESSAGES

- No placebo control – everyone got something
- RT typically given after surgery in this trial
- No study of adjuvant vs neoadjuvant therapy
  - Increasingly we give everything preoperatively
- Limitations
  - Epirubicin was the anthracycline – does that matter?
  - Hard to give ifosfamide >60 years of age
- Rule of 60s: consider therapy in patients <60 years, <60% expected survival

# RETROPERITONEAL SARCOMAS

Well-differentiated / dedifferentiated liposarcoma

# RETROPERITONEAL SARCOMAS

- **Two major subtypes**
    - Both usually present with large tumours >10 cm
  - **Well-differentiated / dedifferentiated liposarcoma**
    - Local-regional recurrence common (70%)
    - Uncommon metastatic disease (20%)
  - **Leiomyosarcoma**
    - Local-regional recurrence uncommon (20%)
    - Metastatic disease common (>50%)
  - **Principal therapy**
    - Surgery
    - Chemotherapy for unresectable disease
    - Radiation for unresectable leiomyosarcoma, usually not liposarcoma
-

# RETROPERITONEAL SARCOMAS



**WDDDLs**

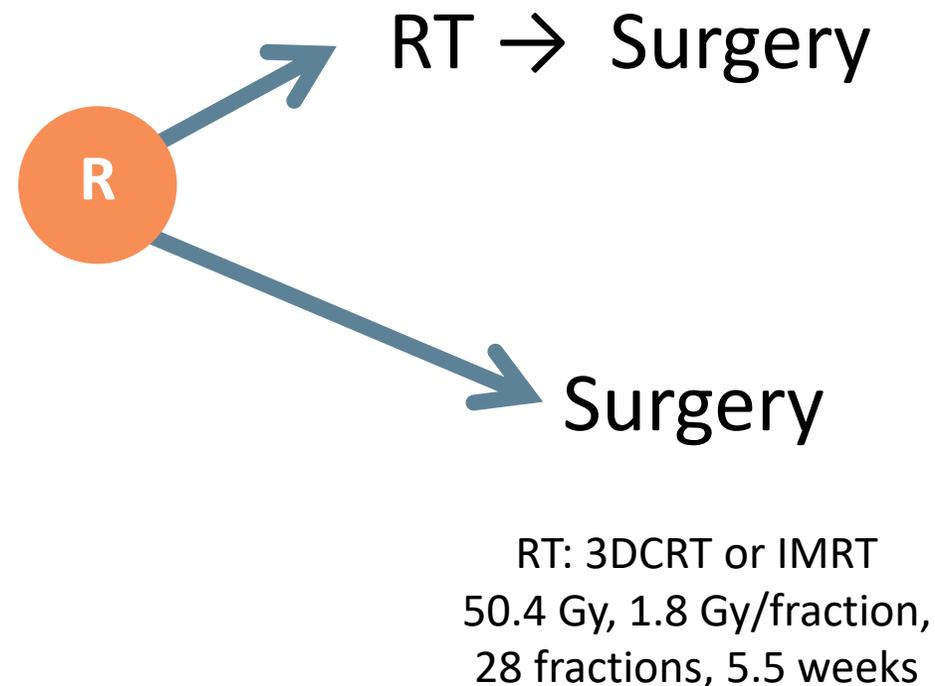


**Leiomyosarcoma**



# STRASS TRIAL (EORTC-62092): IS RADIATION USEFUL BEFORE SURGERY FOR RETROPERITONEAL SARCOMAS?

- Primary STS Dx:
  - WDDDLs
  - Leiomyosarcoma
  - Other
- Outcomes
  - Primary: **Abdominal RFS**
  - Secondary included: RFS, OS

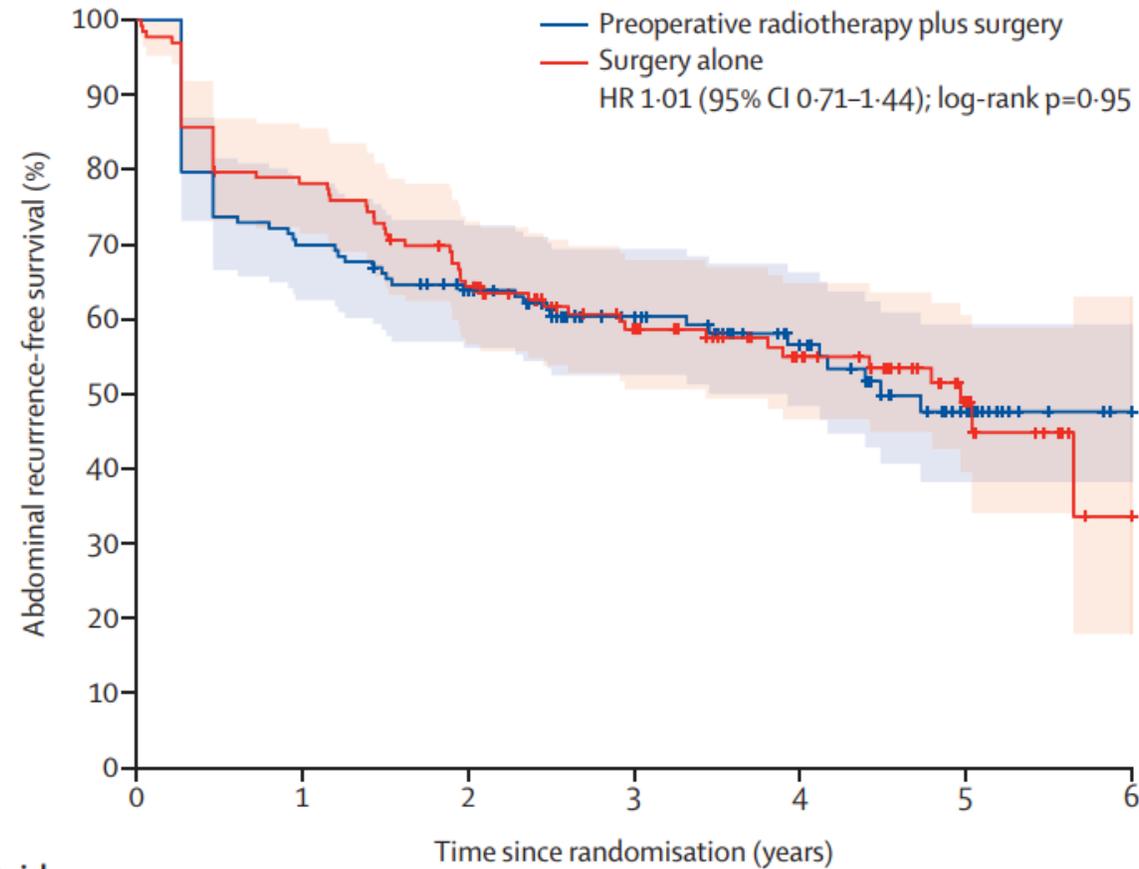


# DEMOGRAPHICS (N=266)

Characteristic	Surgery (n=133)	Surgery + RT (n=133)
<b>Age, years, median</b>	61	61
<b>Female gender</b>	50%	47%
<b>Tumour size, mm, median</b>	167	160
<b>Histology (n, %)</b>		
WDDDLS	96 (72%)	97 (73%)
Leiomyosarcoma	22 (17%)	16 (12%)
Other/data missing	11 (8%)	19 (14%)
<b>WHO PS 0</b>	75%	83%
<b>Tumour Grade at Bx (1: low / 2: intermediate / 3: high)</b>	32%/29%/14%	33%/35%/9%

Table simplified for readability

# ABDOMINAL RFS

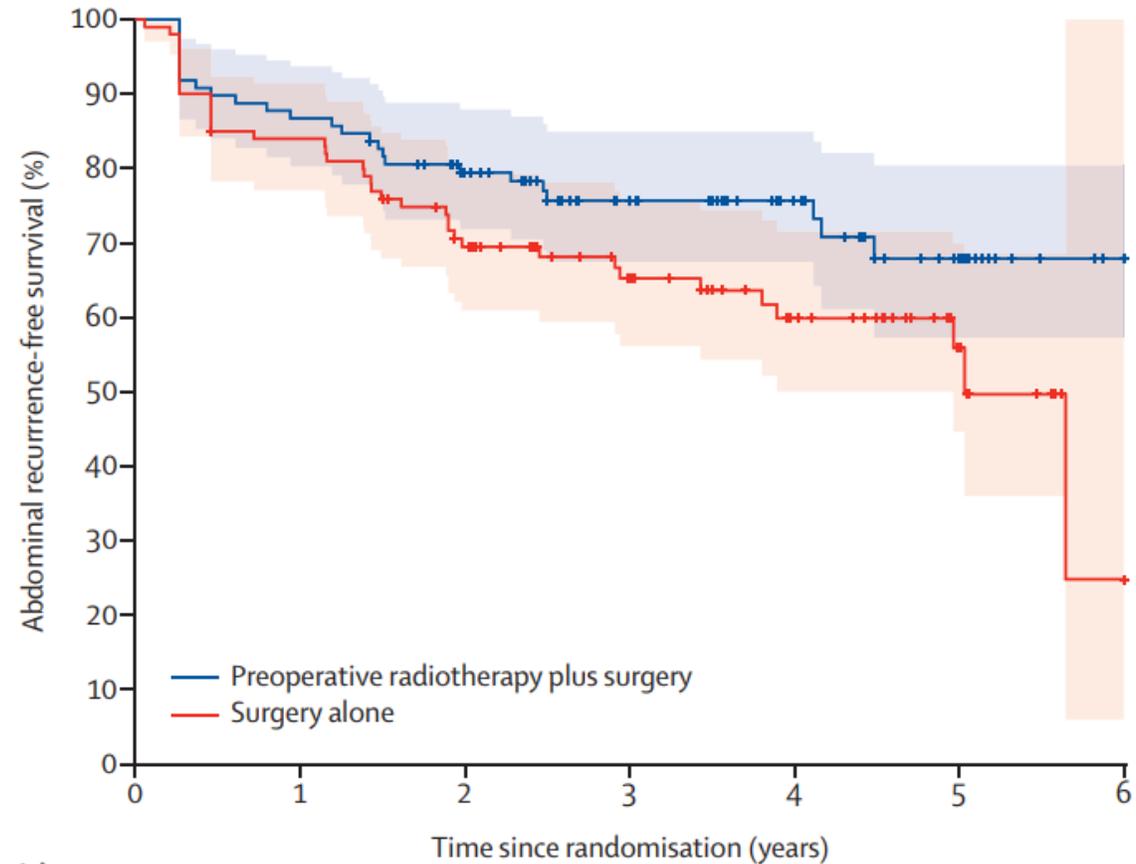


	Number at risk (number censored)						
	0	1	2	3	4	5	6
Preoperative radiotherapy plus surgery	133 (0)	93 (0)	78 (7)	57 (24)	38 (40)	17 (56)	3 (70)
Surgery alone	133 (0)	103 (1)	82 (4)	57 (23)	40 (37)	17 (57)	2 (70)

CI, confidence interval; HR, hazard ratio; RFS, recurrence-free survival

Bonvalot S, et al. Lancet Oncol. 2020;21:1366-77

# ABDOMINAL RFS: LIPOSARCOMA ONLY



	Number at risk (number censored)						
	0	1	2	3	4	5	6
Preoperative radiotherapy plus surgery	98 (0)	85 (0)	69 (9)	50 (25)	34 (41)	18 (54)	4 (68)
Surgery alone	100 (0)	83 (1)	64 (6)	44 (23)	30 (34)	13 (50)	1 (60)

# TAKE-HOME MESSAGES

- No difference in overall survival with use of RT, but follow up is short as of 2021
- Liposarcoma patients are the only subgroup that may benefit from radiation since local control is the most problematic issue. Study needs longer follow up
- Leads to next study: Neoadjuvant chemotherapy before surgery – AIM for WDDDLs, doxorubicin/dacarbazine for leiomyosarcoma (NCT04031677)
- Both this and prior study are great examples of expert centres cooperating to study rare cancers

# IMMUNOTHERAPY AND KINASE-TARGETED THERAPIES

# TREATMENT FOR METASTATIC SARCOMA

- Are there symptoms from advanced disease?
  - If **yes**, combination regimens have a better chance of alleviating symptoms
  - If **no** symptoms, single agents are reasonable
- Consider disease sensitivity based on histopathology
- Agents
  - doxorubicin
  - ifosfamide (synovial sarcoma, myxoid liposarcoma)
  - pazopanib (synovial sarcoma, leiomyosarcoma)
  - gemcitabine / docetaxel (UPS, leiomyosarcoma)
  - trabectedin, eribulin, dacarbazine
  - some subtype specific drugs
    - Angiosarcoma: taxanes
    - Epithelioid sarcoma: tazemetostat

# BUT WHO CARES ABOUT ANYTHING EXCEPT IMMUNOTHERAPY?

- Today: focus on **immune checkpoint inhibitors – ICI** – no special handling needed
- **Cellular therapies** against NY-ESO-1 **are** active against **synovial sarcoma** and **myxoid liposarcoma**

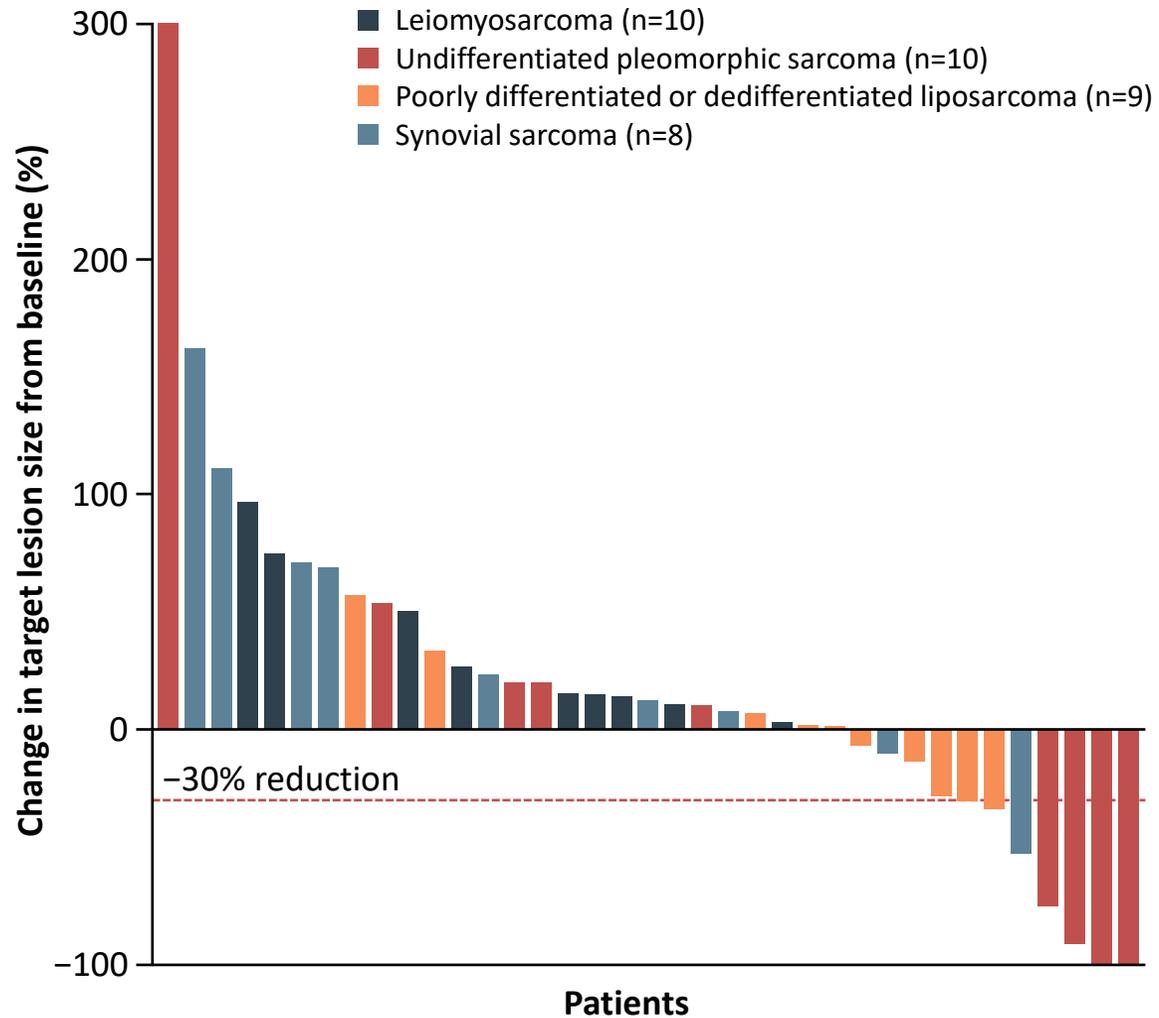
# FIRST ICI TRIALS IN ADVANCED SARCOMAS

Year (published)	Drug(s)	N	Diagnosis	RR (%)
2013 <sup>1</sup>	ipilimumab	6	synovial sarcoma	0
2017 <sup>2</sup>	pembrolizumab	86	bone sarcoma STS	5 18
2017 <sup>3</sup>	nivolumab	12	uterine LMS	0
2018 <sup>4</sup>	nivolumab	43	bone & STS	5
	nivolumab + ipilimumab	42		16
2018 <sup>5</sup>	pembrolizumab + metronomic cyclophosphamide	57	STS (incl GIST)	2
2019	nivolumab	21	STS	0
2019 <sup>6</sup>	axitinib + pembrolizumab	33	bone & STS	25

GIST, gastrointestinal stromal tumour; ICI, immune checkpoint inhibitors; LMS, leiomyosarcoma; RR, response rate; STS, soft tissue sarcoma

1. Maki RG, et al. Sarcoma. 2013;2013:168145; 2. Tawbi HA, et al. Lancet Oncol. 2017;18:1493-1501; 3. Ben-Ami E, et al. Cancer. 2017;123:3285-90; 4. D'Angelo SP, et al. Lancet Oncol. 2018;19:416-26; 5. Toulmonde M, et al. JAMA Oncol. 2018;4:93-7; 6. Wilky BA, et al. Lancet Oncol. 2019;20:837-48

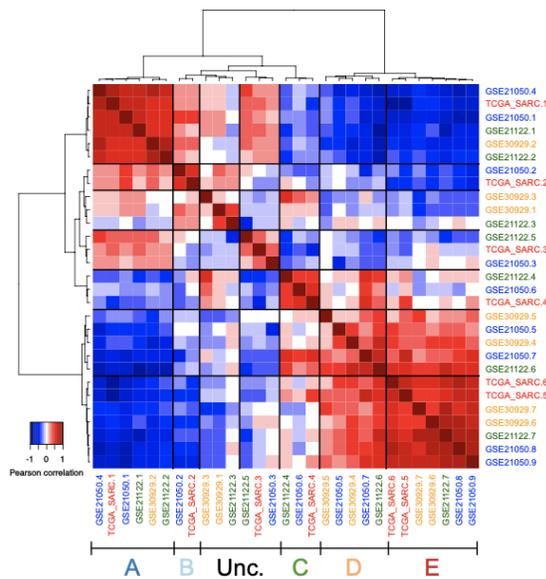
# SARC028: PEMBROLIZUMAB



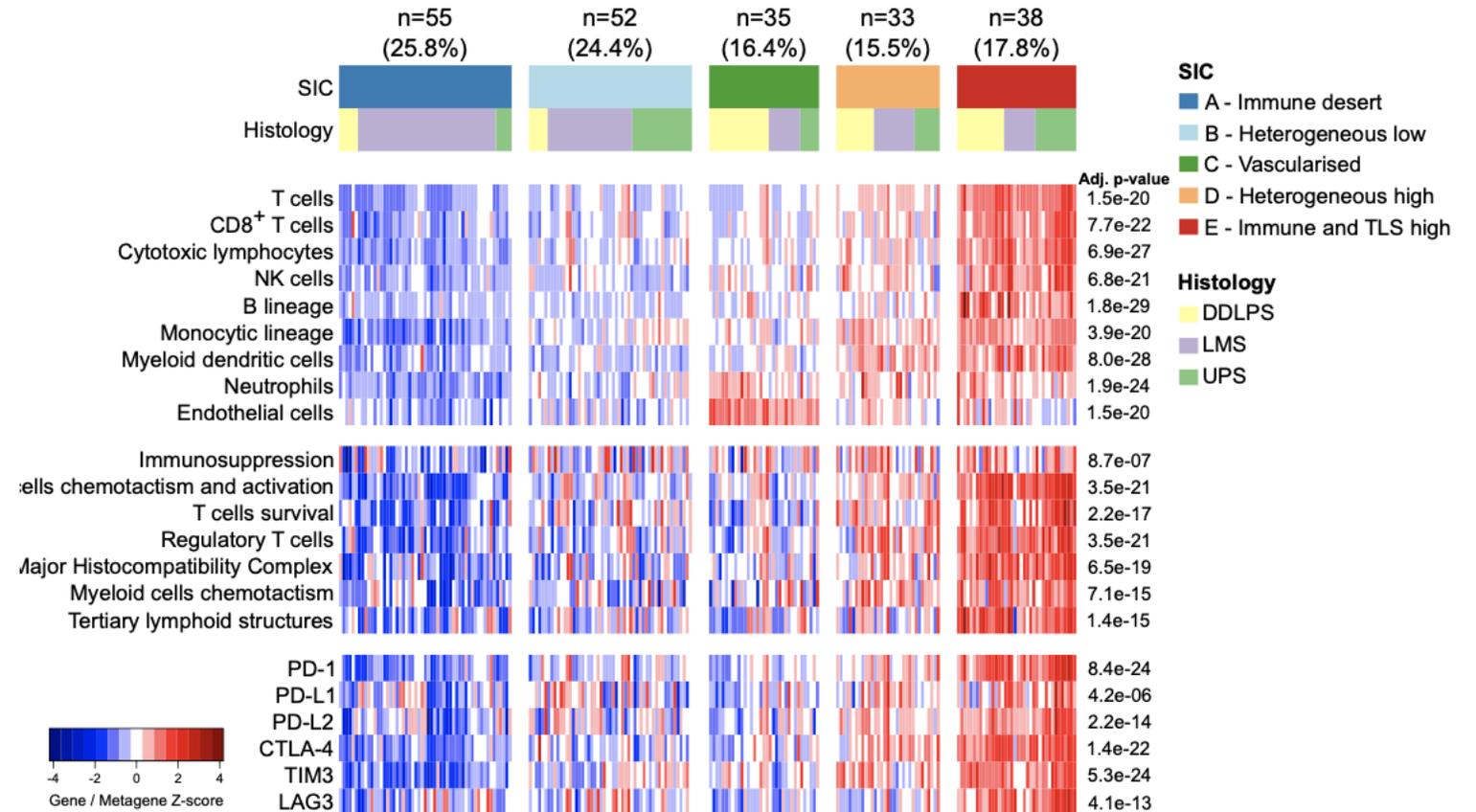
## Histology subtype-specific responses (n=40)

- UPS: 4/10
- Dedifferentiated LPS: 2/10
- Synovial sarcoma: 1/10
- Leiomyosarcoma: 0/10
- Median PFS for all patients: 18 weeks

# SARCOMA GENE EXPRESSION SIGNATURES FROM PUBLIC DATABASES

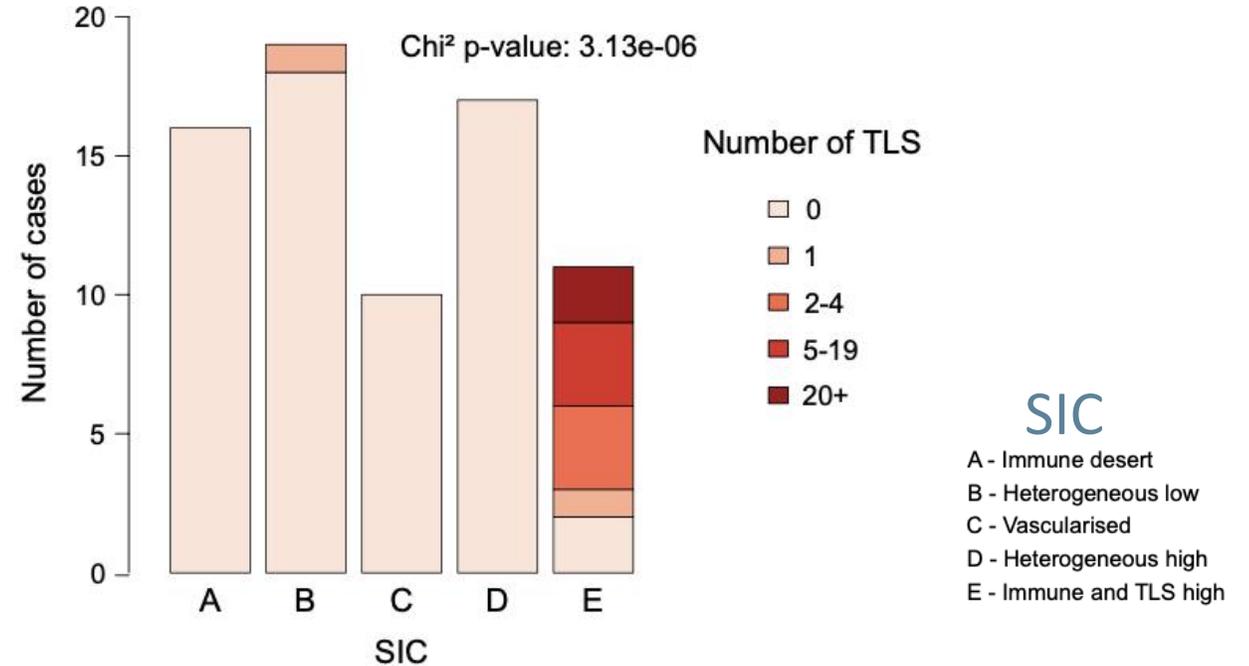
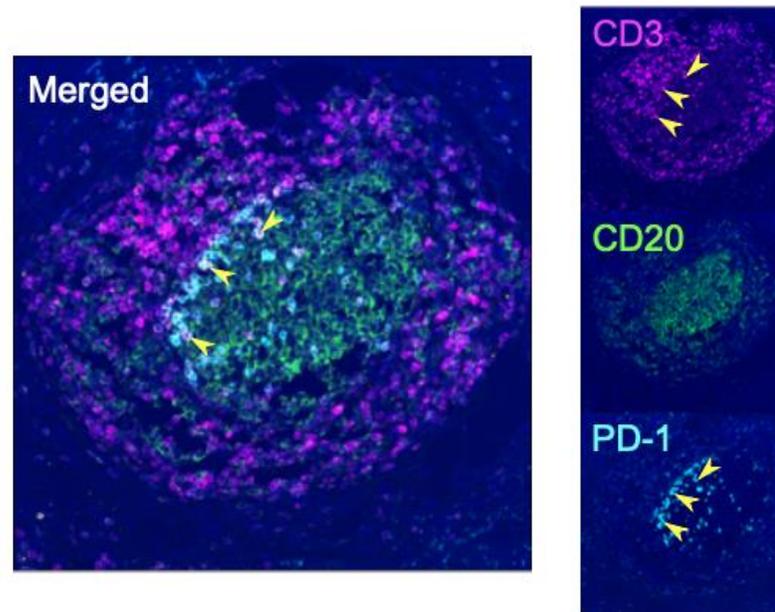


Heat map of the Pearson correlation of centroids from each SIC class of discovery cohorts (TCGA SARC, GSE21050, GSE21122 and GSE30929, n=608), with five immune classes and two groups of unclassified samples.



The Sarcoma Immune Class (SIC) exhibit strongly different TMEs

# PEMBROLIZUMAB RESPONDERS HAD SIGNS OF TERTIARY LYMPHOID STRUCTURES (TLS)



Representative immunofluorescence staining of a TLS for CD3 (magenta), CD20 (green) and PD1 (cyan)

DAPI staining is shown in blue

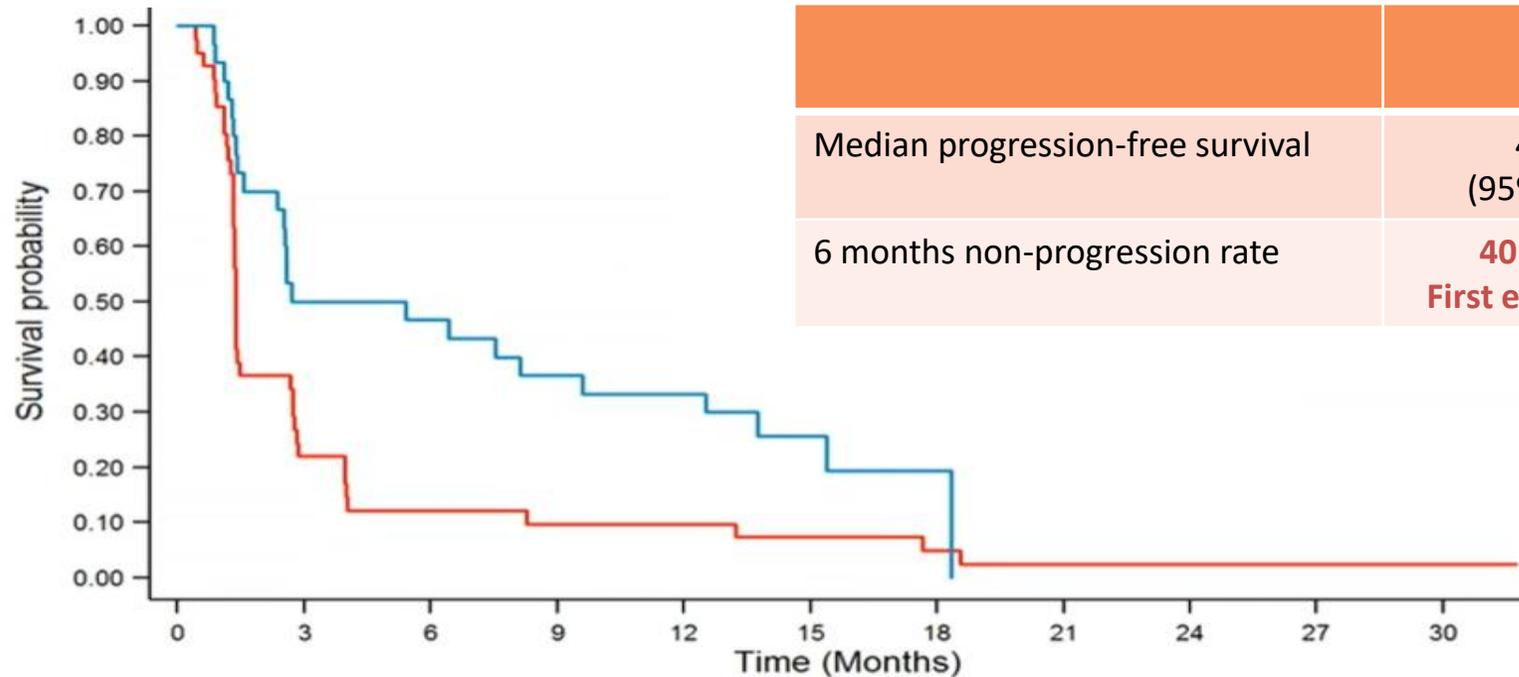
The merged image shows CD3+PD1+ double-positive cells (yellow arrows)

➔ Overall SIC E tumours were associated with the highest response rate to pembrolizumab vs tumours from other SICs (P=0.026)

# ASCO 2021: TLS IHC SCREENING FOR I/O THERAPY

- Unselected patients Rx PD-1 antagonist – median PFS
  - 4.1 months – SARC028 – 4 cohorts of 10 patients each<sup>1</sup>
  - 1.4 months – PEMBROSARC trial, unselected n=57<sup>2</sup>
- PEMBROSARC trial, response by TLS status<sup>3</sup>
  - Screened 240 patients for TLS(+)
  - 48 were (+) by central review (20%), 35 included on trial: WDDDLs, UPS, leiomyosarcoma
  - Therapy: pembrolizumab IV q3w and oral cyclophosphamide

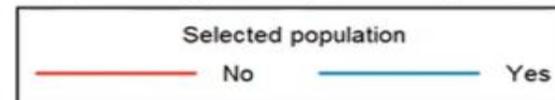
# COMPARISON OF SELECTED PATIENTS VS UNSELECTED PATIENTS OF PRIOR STUDY



	TLS cohort N=35	Previous cohorts N=41
Median progression-free survival	4.1 months (95% CI: 2.4-12.5)	1.4 months* (95% CI: 1.3-2.7)
6 months non-progression rate	<b>40.0 (22.7-59.4)</b> <b>First endpoint reached</b>	4.9% (0.6-16.5)

At risk (Events)

No	41	(32)	9	(4)	5	(1)	4	(0)	4	(1)	3	(1)	2	(1)	1	(0)	1	(0)	1	(0)	1
Yes	30	(15)	15	(1)	14	(3)	11	(1)	10	(2)	4	(2)	1	(0)	0	(0)	0	(0)	0	(0)	0



CI, confidence interval; TLS, tertiary lymphoid structures

\*Toulmonde et al. Jama Oncol. 2017

Italiano A, et al. J Clin Oncol. 2021;39(15\_suppl):11507 (ASCO 2021 abstract #11507)

# ASCO 2021: TLS IHC SCREENING FOR I/O THERAPY

- Primary endpoint: 6 month non-progression rate
- 8/30 (27%) had RECIST PR
- 13/30 (43%) had tumour shrinking of any sort
- Median PFS 4.1 months, median OS 14.5 months
- Compare to prior response rate in French trial of 2%
- Raises the question of how we can best screen patients

# IMMUNOTHERAPY: TAKE-HOME MESSAGES

- Cellular therapeutics (NY-ESO-1, MAGE-A4) are active in myxoid liposarcoma, synovial sarcoma
- PD-1, (PD-L1) inhibitors are active in specific diagnoses amongst the 70 or so sarcoma subtypes
  - UPS, angiosarcoma, dedifferentiated liposarcoma and others (e.g. ASPS) have supportive trials data
- Biomarker screening increases the odds of success
- As with other cancers, combination immunotherapy trials are underway

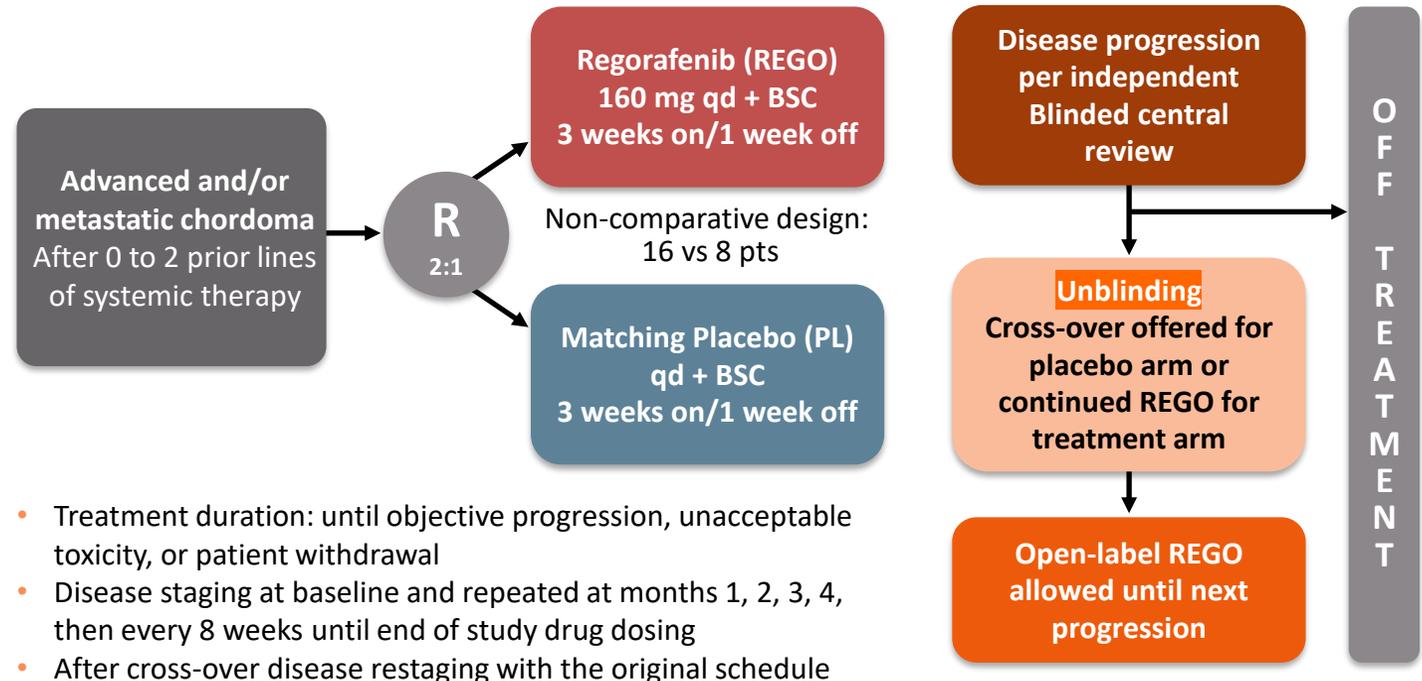
# LATE-BREAKING ABSTRACTS FROM ESMO 2021

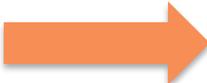
# CHORDOMA IN REGOBONE: STUDY DESIGN

## Background:

**REGOBONE (NCT02389244)** = investigator-initiated study to explore the activity of regorafenib in patients with relapsed advanced and/or metastatic chordoma as well as cohorts of other primary bone sarcomas in separate parallel cohorts

**REGOBONE** has shown prior signals of regorafenib activity in **osteosarcoma, chondrosarcoma and Ewing sarcoma cohorts**

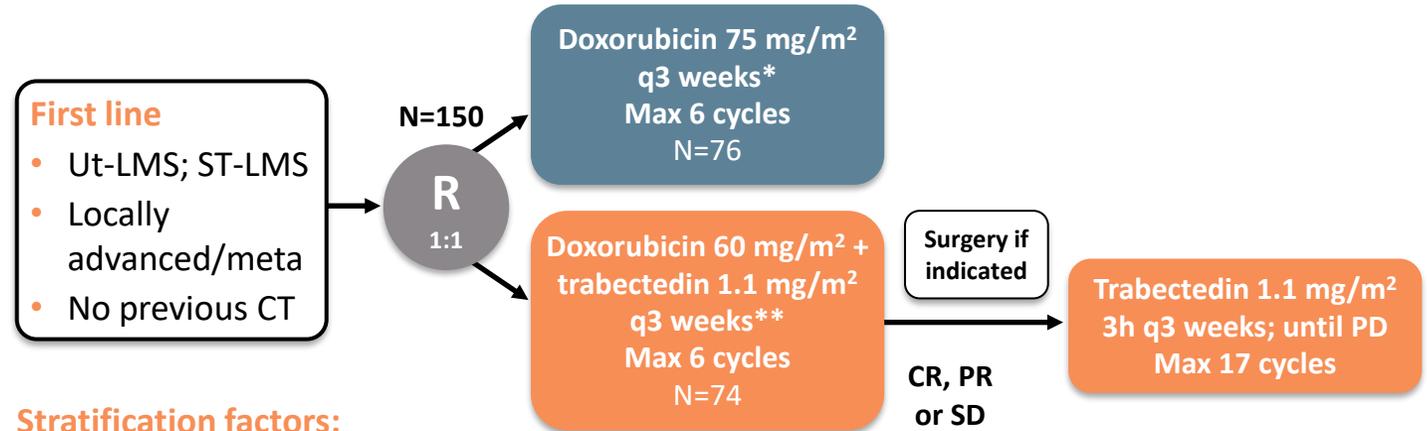


 **Primary endpoint (PFS rate at 6 months) not achieved**

## Background:

**LMS-04 (NCT02997358)** = Randomised Phase III multicentric study comparing efficacy of doxorubicin with trabectedin followed by trabectedin in non-progressive patients versus doxorubicin alone as first-line therapy in patients with metastatic or unresectable leiomyosarcoma (uterine or soft tissue)

## LMS 04: Ph-III first-line therapy for locally advanced/metastatic LMS



### Stratification factors:

- Uterus vs soft tissue
- Locally advanced vs metastatic

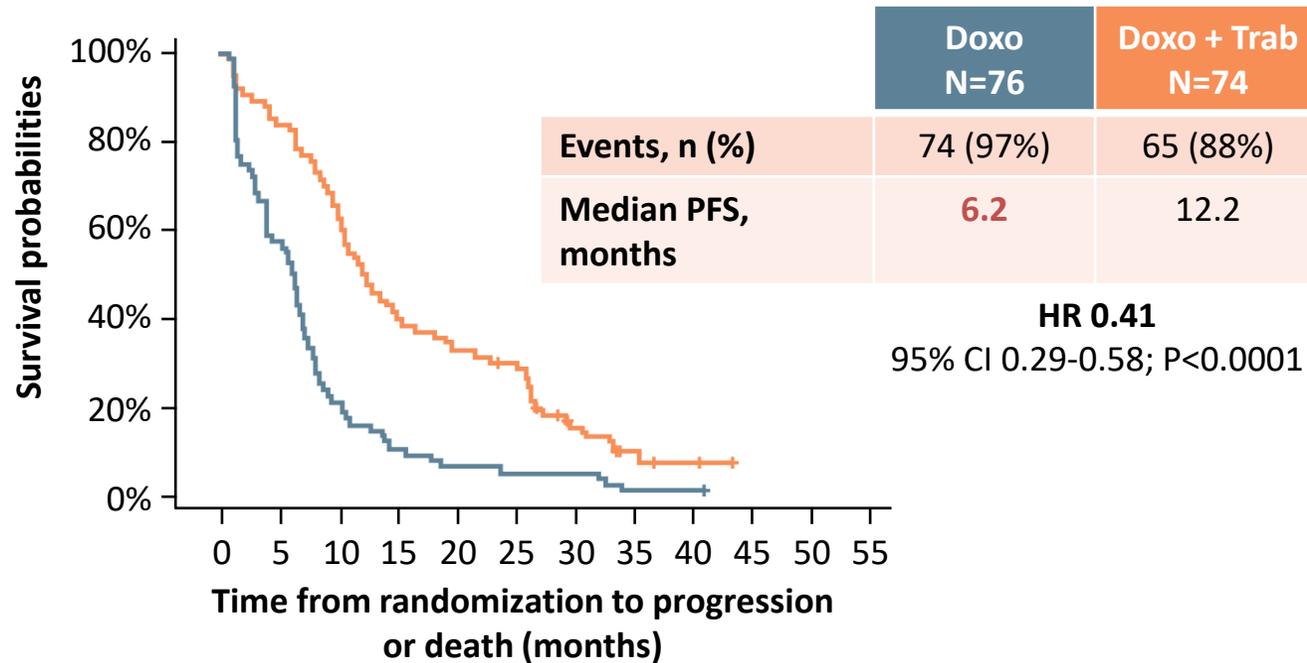
\* + Lenograstim 150 µg/m<sup>2</sup>/day s.c. d3-9; \*\* + Pegfilgrastim 6 mg s.c. day 2

CT, chemotherapy; PFS, progression-free survival; RX, radiological; CBR, clinical beneficence rate; LMS, leiomyosarcoma; PFS inv, investigator-assessed PFS; ST-LMS, soft tissue leiomyosarcoma; Ut-LMS, Uterine leiomyosarcoma

Source: Pautier P, et al. ESMO 2021 LBA59

# LMS-04: PFS BY BICR, ITT POPULATION

## Progression-free survival



1: Arm A: doxorubicin	75	43	16	8	5	4	4	1	1	0
2: Arm B: doxorubicin + trabectedin	74	61	46	29	24	21	9	4	2	0

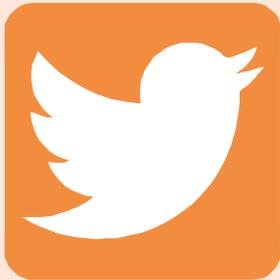
## Conclusion:

- Safety profile of doxorubicin + trabectedin = consistent and manageable toxicity
- Doxorubicin + Trabectedin should be a new standard of care for 1L treatment of metastatic LMS

# SARCOMA TREATMENT: SUMMARY

- First, get the diagnosis right – expert pathology
- Primary therapy – increasingly **neoadjuvant** Rx, just like other cancers
  - Osteosarcoma is a prime example (since the 1970s!)
- Metastatic disease
  - Increasingly Rx is a function of primary diagnosis
    - **The LMS-04 study indicates a possible new standard of care for 1<sup>st</sup> line therapy for metastatic leiomyosarcoma patients**
  - Clinical trials for later stage disease now often focussed on specific histologies or groups of them
  - Rare, so need multicentre trials
- Act locally (patient level), think globally (collaborative, diagnosis-specific trials)

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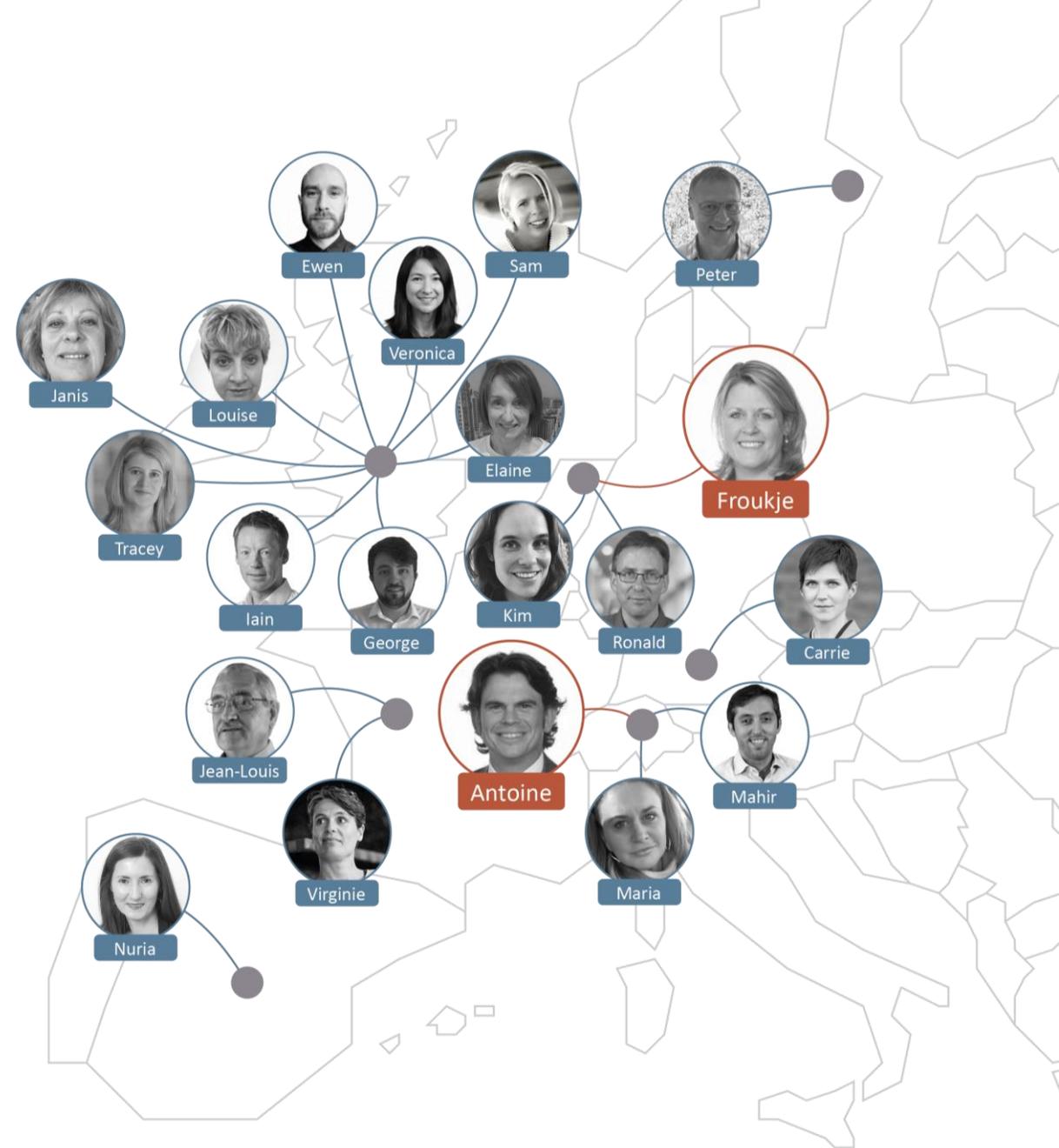
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