The Incidence of Soft Tissue Sarcoma over The Next Two Decades (2018-2040)

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Abstract

OBJECTIVE: Soft tissue sarcomas (STS) are rare malignant tumors. The literature evidence suggests an increase in the incidence of STS over the years. The objective is to forecast the incidence of STS over next two decades across the globe as per the recent incidence rates (IR).

METHODS: A literature review was performed (January 2008 - December 2018) using biomedical databases (MEDLINE©, EMBASE©, Google Scholar) and other sources (conference proceedings, registries). The best country specific data source was identified by quality assessment. The trend estimate was based on age and gender-specific rates from historical data for individual geographies. The open source UN annual population estimates were used as base population for the forecast period. The age and gender-specific incidence estimates were projected for the forecast period (2018-2040).

RESULTS: Top geographies with high incidence of STS were the US, UK, France, Germany and Japan. In these geographies, the age standardised IR is expected to increase from 3.51 to 4.30 (US), 5.39 to 6.35 (UK), 4.11 to 4.66 (France), 5.73 to 6.71 (Germany) and 4.48 to 5.32 (Japan) per 100,000 from 2018-2040. The STS IR is higher in males and older age groups. The annual growth for incidence of STS is 1.80 %, 1.32 %, 0.94 %, 0.69 % and 0.34 % in the US, UK, France, Germany and Japan respectively. By 2040, annual incidence cases of STS in the US are estimated to be ~16k, followed by Japan with ~6k and Germany with ~5k. Localized stages account for 60 % of the incident STS cases in the US followed by regional stages (19 %). In Japan, stage III & IV account for majority (43 %) of STS incident cases followed by stage IA & IB (35 %).

CONCLUSION: The IR and incident cases of STS are growing over the forecast period. The incidence data variation is also attributable to demographic factors.

Introduction

STS is a rare heterogeneous group of malignant tumour derived from mesodermal cells, which are widely distributed in the body.[1] There are more than 50 subtypes of STS, based on cell origin, histology, and molecular features.[2] The rarity of this neoplasm and its varied subtypes make STS a complex cancer that is difficult to evaluate. STS comprises ~1 % of all malignancies.[2]
The exact aetiology of STS is unknown. The risk factors such as genetic mutations and radiations can be attributed as contributing factors for STS.[2,4]
Many population based studies reported increasing incidence of STS from 2003–2012, consistently and substantially.[1,3] There are not enough studies to describe the epidemiology of overall STS globally.

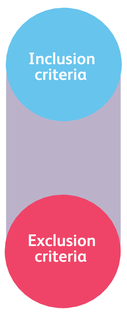
Objective

To forecast the incidence of STS over next two decades across the globe, based on the recent incidence rates (IR) To illustrate the IR by age and gender over the forecast period and across different subgroups

Methodology

Literature review: We performed a systematic literature search in December 2018, using the MEDLINE® and EMBASE® electronic databases for published evidence on the epidemiology of STS. The search results were limited to studies published in English language between January 2006 and December 2018. Searches on Google Scholar and manual searches of grey literature to identify additional literature of interest were also conducted.
Screening and full text review: The retrieved records were screened for relevance, based on predefined inclusion / exclusion criteria (Figure 1). Following an abstract screening, we reviewed full-text of articles for relevance.

Figure 1: Inclusion / exclusion criteria



- Studies discussing epidemiology (incidence, mortality, and survival) of STS
- Systematic literature review, meta-analysis, real world and observational studies

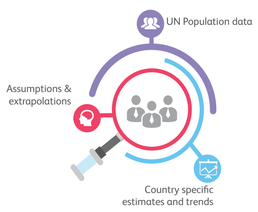
- Studies published before January 1, 2006 Studies with patient population of less than 50
- Studies reporting epidemiology of STS subtypes only, recurrent cases of STS Survival and mortality due to treatment / intervention effect, STS as a comorbidity of another disease, and STS in patient populations exposed to chemical carcinogenic agents
- Clinical trials, conference abstracts / posters, case reports, and general reviews

Quality assessment: In our research, quality assessment of relevant studies was conducted on the basis of:
- Generalizability
- Case ascertainment criteria
- Sample size
- Year of data estimate
- Coverage of data source (national /regional)

Study selection for the forecast: Prioritization of the most reliable data source(s) for each country based on the quality assessment criteria was done. Additional high quality studies were also shortlisted for each country for gender, age, disease classification specific epidemiology data. For countries with limited data, evidence from high quality studies of analogous countries was considered. The preference was given to the most recent and high quality studies.

Data extraction: A Data Extraction table template to capture required information from the relevant studies was developed. We extracted data from the full text of the relevant results to capture the following details:
- Study details such as study centre, inclusion/exclusion criteria, study period and follow-up duration
- Patient characteristics
- Epidemiology related information such as incidence, prevalence, mortality, survival
- Evidence for any sub-groups (age, gender, disease classification)

Forecast Model Development:
Country specific forecast model was created in MS Excel. We used the UN database to identify the base population. Historical data from shortlisted high-quality studies were leveraged to depict incidence rate trends.



- Country-specific evidences from literature were utilized.
- Base population from the UN database (2017) i.e., age and sex specific annual population were used.
- The stable and logarithmic trend were applied based on the historical data.
- Assumptions / Extrapolations: In case of limited data availability, then data from another reliable source either within the same country or another country were used.

Forecast Model Flow
Estimated incidence/ incident cases by age and gender, further categorized into subgroups

Results

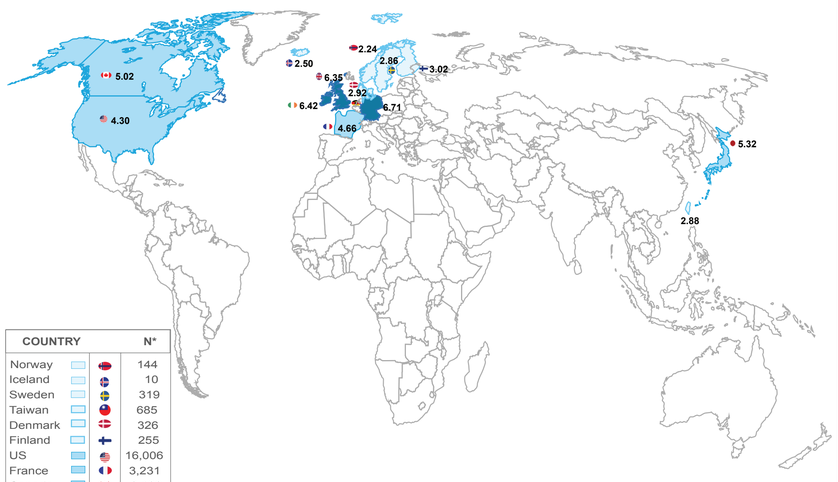
Fifty one studies reporting the epidemiological data for overall STS were identified. The studies included patients covering age groups from 0 to 80+ years, and were conducted across the globe (US, Canada, Europe, Asia-Pacific, and Middle East). The studies were shortlisted based on quality assessment and suitability for the forecast model. Low quality studies were excluded. A total of nine sources were shortlisted, that provided reliable data for preparing the forecast model for 13 geographies. No reliable studies were identified in Africa and Oceania.

High quality studies reporting incidence of STS in all age groups are presented in Table 1.

TABLE 1: SOURCES FOR INCIDENCE OF STS[5-13]

Study Name	Country	Study Period	Age group	IR (Per100,000)
Statistics Canada[5]	Canada	2016	All ages	3.70
SEER Cancer Statistics Review[6]	UK	2012-2016	All ages	3.50
NCIN[7]	UK	1996-2010	All ages	4.51
Trautmann, F. et al. (2015)[8]	Germany	2005-2012	All ages	4.50
Ducimetiere, F. et al. (2011)[9]	France	2005-2007	All ages	3.70
Nomura, E. et al. (2013)[10]	Japan	1978-2007	All ages	2.53
Bray, F. et al. (2010)[11]	Denmark, Norway, Sweden, Finland and Iceland	1964-2003	All ages	2.25
Bhatt, N. et al. (2016)[12]	Ireland	1984-2012	All ages	4.48
Hung, Y. et al. (2015)[13]	Taiwan	2003-2011	All ages	1.86

FIGURE 1: INCIDENCE RATE OF STS PER 100,000[5-13] IN 2040



COUNTRY	N*
Norway	144
Iceland	10
Sweden	319
Taiwan	685
Denmark	326
Finland	255
US	16,006
France	3,231
Canada	2,160
Japan	6,127
UK	4,625
Ireland	355
Germany	5,409

N* - Forecasted incident cases of STS in 2040

The map below (Figure 1) provides the forecasted incidence rates for the year 2040 for the 13 geographies where the reliable data were available in literature.

The historical data from identified literature were used to trend the incidence rates from 2018-2040. Both stable and logarithmic trends were applied for each country and estimates on incidence rate and incident cases of STS were obtained. The comparative assessment of both trends was made and the logarithmic trend was prioritized over the stable trend keeping in view the increasing STS incidence with time and the impact of demographic factors.

FIGURE 2. ANNUAL INCIDENCE RATE, 2018-2040 (STABLE TREND)

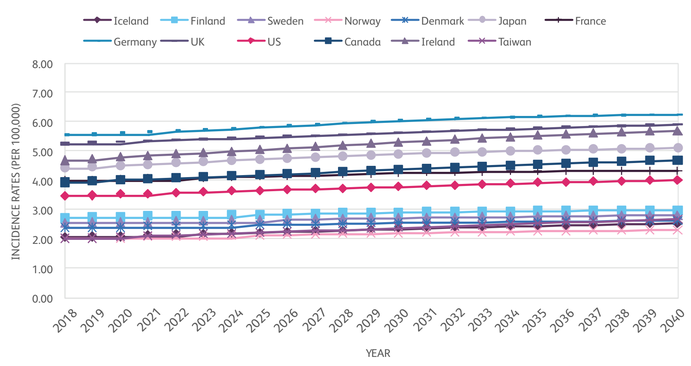


Figure 2 depicts the incidence rates projected when stable IR were applied across the forecast period.
The IR of STS is increasing over the years for all countries, where the stable rates were applied over the forecast period.

FIGURE 3. ANNUAL INCIDENCE RATE, 2018-2040 (LOGARITHMIC TREND)

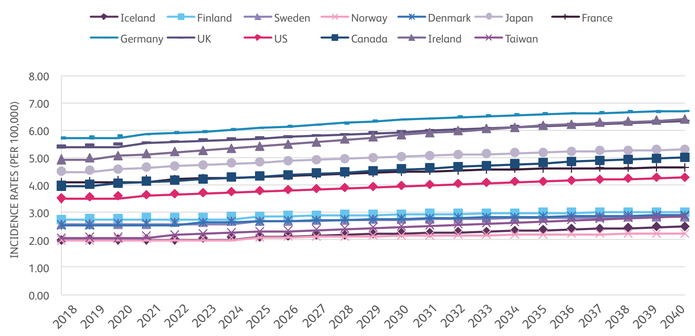


Figure 3 provides the IR of STS with a logarithmic trend over the forecast period. The IR of STS is increasing over the years for all countries, when the rates were applied a logarithmic trend over the forecast period.

FIGURE 4. ANNUAL INCIDENT CASES, 2018-2040 (LOGARITHMIC TREND)

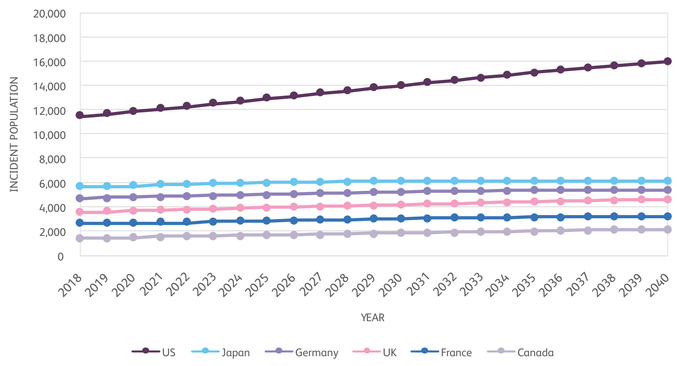


Figure 4 provides the annual incidence cases of STS with a logarithmic trend over the forecast period.
The incidence cases of STS are increasing over the years for all countries, however the rise is more steep for the US.
It may be attributable to the increasing proportion of elderly population over the forecast period in addition to increase in the detection of STS cases due to increased diagnostic capability and awareness.

FIGURE 5. INCIDENCE RATES BY GENDER, 2040 (LOGARITHMIC TREND)

Figure 5 provides the gender wise IR of STS with a logarithmic trend over the forecast period. The IR of STS is higher in males in all countries except Japan and Ireland where the incidence rates are higher in females.

FIGURE 6. INCIDENT RATE COMPARISON 2018-2040 AND ANNUAL AVERAGE CHANGE (%) (LOGARITHMIC TREND)

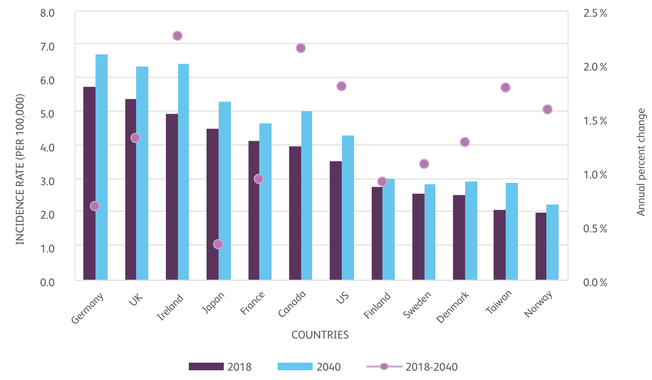


Figure 6 provides the comparison of IR of STS in 2018-2040 and annual average change (%), with a logarithmic trend over the forecast period. The IR of STS has the highest annual increase in Ireland (2.27 %) and the lowest in Japan (0.34 %) over the forecast period.

FIGURE 7. ANNUAL INCIDENT CASES BY STAGE, 2040 (LOGARITHMIC TREND)

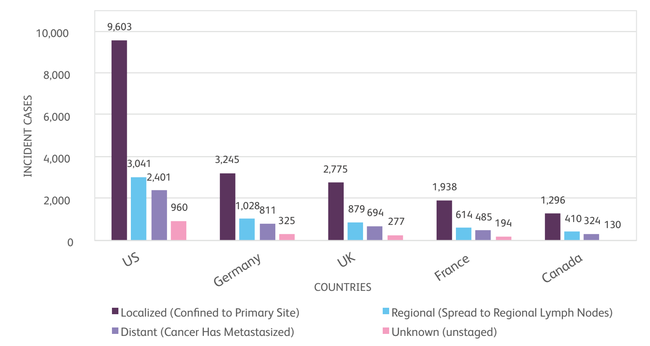
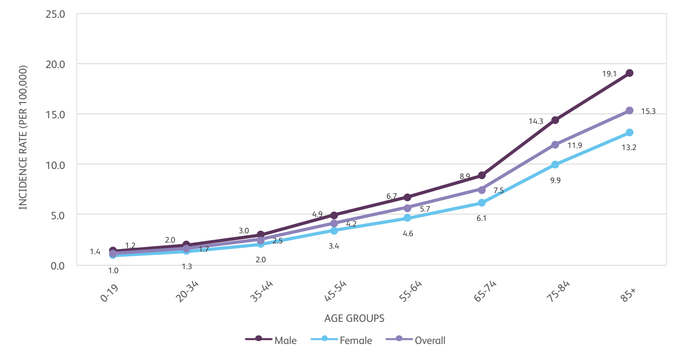


Figure 7 provides the annual incident cases of STS by stage, with a logarithmic trend over the forecast period.
The localized stages have the highest proportion among the STS incident cases over the forecast, followed by regional and distant stages.
Unknown or un-staged cases contribute the least.

FIGURE 8. AGE AND GENDER SPECIFIC RATES, 2040 (LOGARITHMIC TREND)



The IR of STS is increasing with increasing age, the elderly have the highest incidence rates in both sexes, where the males have higher rates in all age groups compared to females. Figure 8 provides the age and gender wise IR of STS with a logarithmic trend over the forecast period.

Conclusion

- Our research demonstrated a male predominance in incidence of STS
- Incidence of STS in adults (≥18 years) was higher compared to younger ages
- There is a steady increase in the incidence of STS over the forecast period
- Average annual percent change in incidence rate was highest in Ireland (2.27 %) and the lowest in Japan (0.34 %)
- The increase in incidence of STS is also due to demographic changes, such as ageing population and low birth rates in some countries projected over the forecast period
- The increase in detection of STS cases will also lead to increase in number of diagnosed incident cases of STS over the next two decades

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