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Regional Differences in Stage III Nonseminoma Germ Cell Tumor Patients Across SEER Registries

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Abstract

Our study analyzed regional variations in patient demographics, tumor prognostics, and treatment outcomes among stage III nonseminoma germ cell tumor patients using the SEER database. It found significant differences in systemic therapy and retroperitoneal lymph dissection rates, as well as cancer-specific mortality across regions, suggesting potential disparities in care quality or expertise.

Purpose: We investigated regional differences in patients with stage III nonseminoma germ cell tumor (NSGCT). Specifically, we investigated differences in baseline patient, tumor characteristics and treatment characteristics, as well as cancer-specific mortality (CSM) across different regions of the United States. **Methods:** Using the Surveillance, Epidemiology, and End Results (SEER) database (2004-2018), patient (age, race/ethnicity), tumor (International Germ Cell Cancer Collaborative Group [IGCCCG] prognostic groups) and treatment (systemic therapy and retroperitoneal lymph dissection [RPLND] status) characteristics were tabulated for stage III NSGCT patients, according to 12 SEER registries representing different geographic regions. Multinomial regression models and multivariable Cox regression models testing for cancer-specific mortality (CSM) were used. **Results:** In 3,174 stage III NSGCT patients, registry-specific patient counts ranged from 51 (1.5%) to 1630 (51.3%). Differences across registries existed for age (12%-31% for age 40+), race/ethnicity (5%-73% for others than non-Hispanic whites), IGCCCG prognostic groups (24%-43% vs. 14-24% vs. 3%-20%, in respectively poor vs. intermediate vs. good prognosis), systemic therapy (87%-96%) and RPLND status (12%-35%). After adjustment, clinically meaningful inter-registry differences remained for systemic therapy (84%-97%) and RPLND (11%-32%). Unadjusted 5-year CSM rates ranged from 7.1% to 23.3%. Finally in multivariable analyses addressing CSM, 2 registries exhibited more favorable outcomes than SEER registry of reference (SEER Registry 12): SEER Registry 4 (Hazard Ratio (HR): 0.36) and SEER Registry 9 (HR: 0.64; both $P = .004$). **Conclusion:** We identified important regional differences in patient, tumor and treatment characteristics, as well as CSM which may be indicative of regional differences in quality of care or expertise in stage III NGSCT management.

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Introduction

In urologic oncology, testicular cancer has one of the highest cure rates, largely due to the effectiveness of multi-agent chemotherapy regimens. Seminoma germ cell tumors (SGCT) generally have more favorable outcomes compared to nonseminoma germ cell tumor (NSGCT). Additionally, the stage of disease is a crucial determinant of prognosis in testicular cancer.[1,2] While patients with earlier-stage disease (Stages I and II) patients often have excellent prognoses and high cure rates, those with distant metastases and/or high postorchiectomy tumor markers (Stage III) face significantly higher mortality and more complex treatment challenges. A previous analysis of the SEER database covering the period from 2004 to 2015 revealed 10-year cancer-specific mortality (CSM) rates for NSGCT as follows: Stage I 98.2% versus Stage II 97.0% versus Stage III 75.8%.[3] Moreover, this SEER analysis revealed poorer survival rates in stage III NSGCT compared to high-volume centers, like Indiana University Cancer Center and members of the Swedish-Norwegian Testicular Cancer Group.[3–5] However, it is unknown whether in stage III NSGCT patients regional differences regarding patient, tumor and treatment characteristics exist and potentially even contribute to cancer-specific mortality (CSM) differences across the United States.

To address this gap, we investigated regional differences in stage III NSGCT patients using data from the Surveillance, Epidemiology, and End Results (SEER) Program. Specifically, we investigated differences in baseline patient, tumor and treatment characteristics, as well as CSM across different SEER registries. We hypothesized that specific SEER registries might show higher-than-expected CSM rates, even after adjusting for patient, tumor, and treatment characteristics.

Material and Methods

Study Population

The SEER database, supported by the Surveillance Research Program in Division of Cancer Control and Population Sciences of the National Cancer Institute, is a key source of U.S. cancer statistics. It provides data on cancer incidence, prevalence, and survival from population-based cancer registries, for 2018 covering about 28% of the U.S. population. The objectives include collecting accurate cancer data, reporting periodically on cancer incidence, mortality, and survival, identifying unusual cancer patterns, and describing temporal changes in cancer statistics to evaluate cancer prevention and control efforts and reduce the cancer burden among the US population.[6]

Within the SEER database (2004-2018), we identified patients aged ≥18 years, who underwent orchiectomy, with histologically confirmed NSGCT (International Classification of Disease for Oncology (ICD-O) site codes C62.1, C62.9; ICD-O-3 histology code 9070/3, 9071/3, 9080/3, 9085/3, 9081/3, 9100/3, 9101/3). Only patients with American Joint Committee on Cancer (AJCC) clinical staging III were included. Cases identified only at autopsy were excluded. The available SEER included 13 registries: Alaska Natives, California, Connecticut, Detroit (Metropolitan), Georgia, Hawaii, Iowa, Kentucky, Louisiana, New Jersey, New Mexico, Seattle (Puget Sound) and Utah. Due to limited sample size (n = 2) 1 registry was excluded. Finally, following the SEER data agreements and limitations,[6] names of individual registries were censored. These selection criteria resulted in an overall cohort of 3174 patients within 12 SEER registries, namely from SEER Registry 1 to SEER Registry 12 in ascending order of patient count. Death was defined according to the SEER mortality codes.[7] For this study, CSM (defined as death from NSGCT) was considered.

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Statistical Analyses

Statistical analyses relied on 3 steps. First, baseline patient (age at initial diagnosis: ≥40 vs. <40 years according to previously defined cutoff,[8] race/ethnicity: others vs. non-Hispanic white), tumor (International Germ Cell Cancer Collaborative Group [IGCCCG] prognostic groups) and treatment (systemic therapy and retroperitoneal lymph node dissection [RPLND] status) characteristics were tabulated and graphically displayed, according to the above defined SEER registries. Second, we repeated the analyses for types and rates of treatment after multivariable adjustment for age, IGCCCG prognostic groups, race/ethnicity and year of diagnosis using multinomial regression models. Here, a predicted treatment probability was calculated for each patient. Additionally, treatment rates were displayed focusing on the 3 largest registries (SEER Registry 10 to 12) and 9 smaller registries (SEER Registry 1 to 9) separately, according to previously described methodology.[9,10] Finally, follow-up, 5-year CSM, CS deaths per 1000 person-years (number of CS deaths/total person-years in follow-up), as well as unadjusted and adjusted CSM Hazard Ratios (HR) were computed for each SEER registry. Adjustment variables consisted of baseline patient (age at diagnosis, race/ethnicity), tumor (IGCCCG prognostic group) and treatment (systemic therapy and RPLND status) characteristics. Uni- and multivariable Cox regression models that account for these patient, tumor and treatment characteristics addressing CSM are displayed in Supplemental Table 1. Supplemental Table 2 summarizes patient, tumor, treatment and survival data for each registry. All tests were 2 sided with a level of significance set at $P < .05$ and R software environment for statistical computing and graphics (version 4.1.2) was used for all analyses.[11] Owing to the anonymously coded design of the SEER database, study-specific ethics approval was waived by the institutional review board.

Results

Descriptive Characteristics

Overall, 3174 stage III NSGCT patients were identified. Descriptive characteristics are presented in Table 1.

Differences in Patient and Tumor Characteristics, Across SEER Registries

Registry-specific patient counts ranged from 49 (1.5%) in SEER Registry 1 to 1630 (51.4%) in SEER Registry 12 (Figure 1). Age ≥40 at initial diagnosis ranged from 12% (SEER Registry 2) to 31% (SEER Registry 5; $P = .002$; Figure 2A). Rates of race/ethnicity other than non-Hispanic white ranged from 5% (SEER 8) to 73% (SEER Registry 2; $P < .001$; Figure 2B). IGCCCG prognostic group proportions ranged from 24% (SEER Registry 4) to 43%

Figure 1 Pie chart depicting the distribution of 3174 stage III nonseminoma germ cell tumor (NSGCT) patients according to Surveillance, Epidemiology, and End Results (SEER) 2004-2018 geographic registries across the United States.

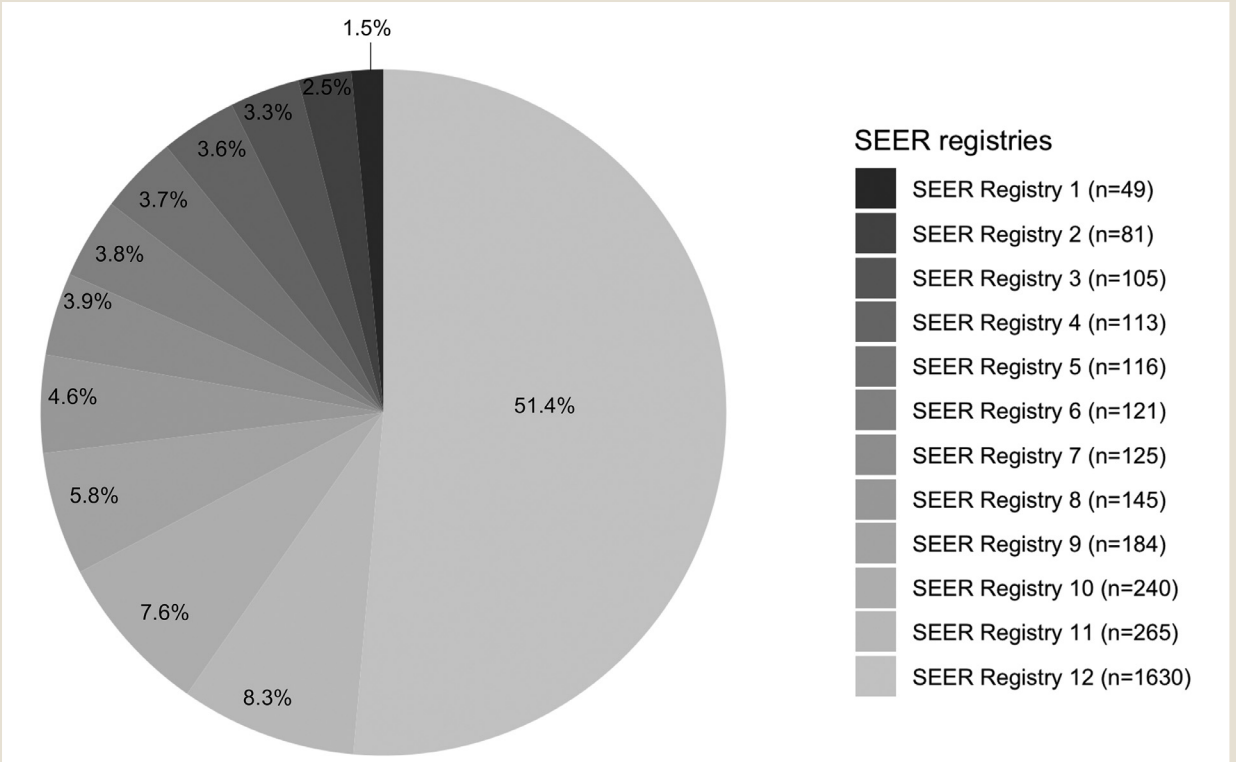


Table 1 Descriptive Characteristics of 3174 Stage III Nonseminoma Germ Cell Tumor (NSGCT) Patients Within The Surveillance, Epidemiology, and End Results (SEER) Database (2004-2018)

Characteristic	Overall Stage III NSGCT Population[a] n = 3174
Age at diagnosis (years)	28 (23, 38)
Age group	
<40 years	2460 (78%)
≥40 years	714 (22%)
IGCCCG Risk Group	
Good prognosis	409 (13%)
Intermediate prognosis	613 (19%)
Poor prognosis	1257 (40%)
Unknown	895 (28%)
Systemic therapy	2924 (92%)
RPLND performed	663 (21%)

Abbreviation: IGCCCG = International Germ Cell Cancer Collaborative Group, RPLND = retroperitoneal lymph node dissection.
[a] Median (IQR); n (%).

(SEER Registries 11 and 12) for poor prognosis group, from 14% (SEER Registry 11) to 24% (SEER Registry 3) for intermediate prognosis group, from 4% (SEER Registry 2) to 20% (SEER Registry 4) for good prognosis group and from 22% (SEER Registry 1) and 41% for unknown prognosis group (SEER Registry 2; $P < .001$; Figure 2C).

Unadjusted and Adjusted Differences in Treatment Rates, Across SEER Registries

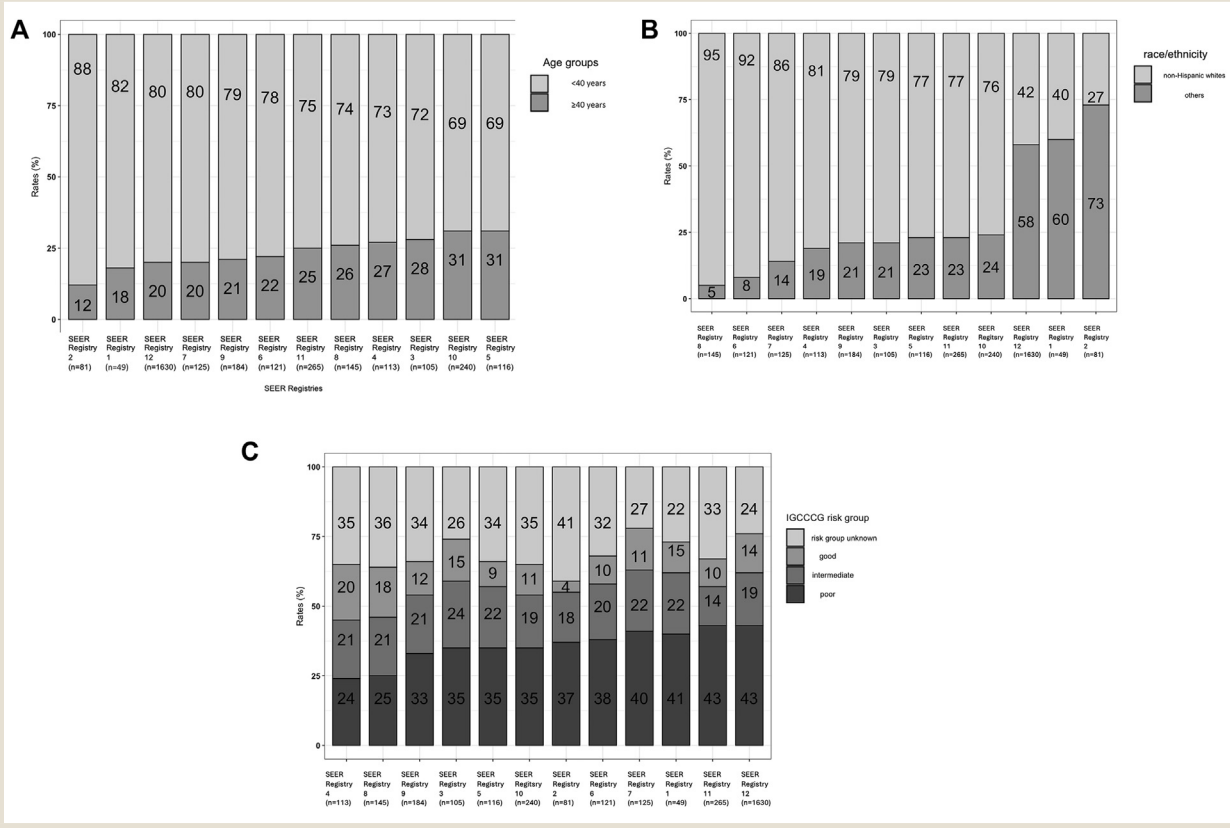
Rates of systemic therapy ranged from 87% (SEER Registry 5) to 96% (SEER Registry 10, $P = .1$). After adjustment, differences in systemic therapy persisted (84%-97%). When focusing on the 3 largest registries (SEER Registry 10 to 12), rates ranged from 92% to 96% ($\Delta = 4\%$). In the 9 remaining smaller registries (SEER Registry 1 to 9), rates ranged from 84% to 97% ($\Delta = 13\%$, Figure 3A).

Rates of RPLND ranged from 12% (SEER Registry 11) to 35% (SEER Registry 9, $P < .001$). After adjustment, differences in RPLND persisted (11%-32%). When focusing on the 3 largest registries, rates ranged from 11% to 28% ($\Delta = 17\%$). In the 9 remaining smaller registries, rates ranged from 15% to 32% ($\Delta = 17\%$; Figure 3B).

Unadjusted and Adjusted Differences in Cancer-Specific Mortality Rates, Across SEER Registries

Five-year registry-specific CSM rates ranged from 7% to 23%. Focusing on the 3 largest registries, 5-year CSM rates ranged from 19% to 23.0% ($\Delta = 4\%$). In the 9 remaining smaller registries, 5-CSM rates ranged from 7% to 23% ($\Delta = 16\%$). Registry-specific

Figure 2 (A) Stacked bar plots depicting age groups (≥40 vs. <40 years) distribution in 3174 stage III nonseminoma germ cell tumor (NSGCT) patients according to Surveillance, Epidemiology, and End Results (SEER) geographic registries (2004-2018). (B) Stacked bar plots depicting race/ethnicity (non-Hispanic whites vs. others) distribution in 3174 stage III nonseminoma germ cell tumor (NSGCT) patients according to to Surveillance, Epidemiology, and End Results (SEER) geographic registries (2004-2018). (C) Stacked bar plots depicting IGCCCG (International Germ Cell Cancer Collaborative Group) risk group distribution in 3174 stage III nonseminoma germ cell tumor (NSGCT) patients according to Surveillance, Epidemiology, and End Results (SEER) geographic registries (2004-2018).



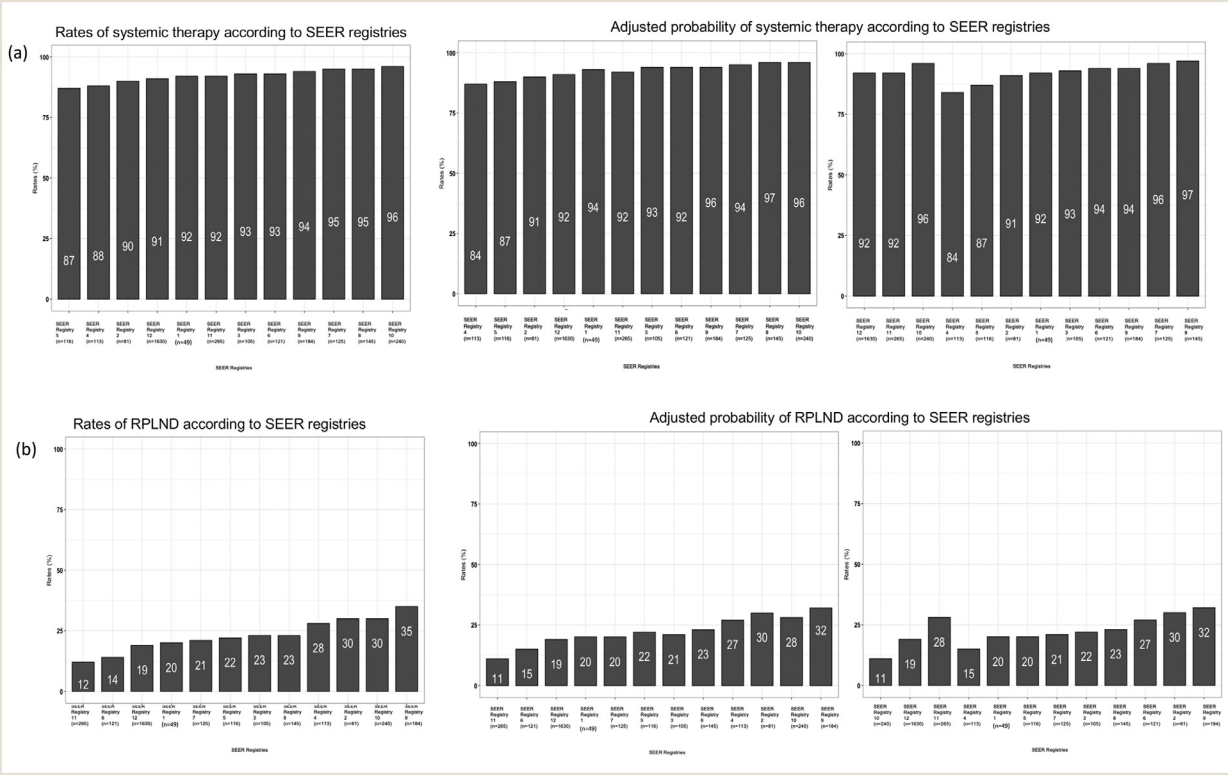
CS deaths per 1000 person-years ranged from 12.9 to 49.5. Focusing on the 3 largest registries, CS deaths per 1000 person-years ranged from 32.6 to 48.6 ($\Delta = 16.0$). In the 9 remaining smaller registries, CS deaths per 1000 person-years ranged from 12.9 to 49.5 ($\Delta = 36.6$). Unadjusted HR predicting CSM ranged from 0.29 to 1.02. Finally, adjusted HR predicting CSM ranged from 0.36 to 1.21. Two registries differed from SEER registry of reference (SEER Registry 12) regarding HR predicting CSM. Specifically, HR in SEER Registry 12 was 1.0. Conversely, HR in SEER Registry 4 was 0.36 ($P = .004$) and in SEER Registry 9 0.64 ($P = .004$, Table 2).

Discussion

Analysis of the SEER database from 2004 to 2015 revealed poorer survival rates in stage III nonseminomatous NSGCT compared to high-volume centers, like Indiana University Cancer Center and members of the Swedish-Norwegian Testicular Cancer Group.[3–5] It is unknown whether in stage III NSGCT patients regional differences regarding patient, tumor and treatment characteristics exist and potentially even contribute to CSM differences across the United States. We hypothesized that higher than expected CSM rates may be identified in select SEER registries, even after adjustment for patient, tumor and treatment characteristics. We tested this hypothesis within the SEER 2004-2018 database and made serval important observations.

First, we identified 3174 contemporary (2004-2018) stage III NSGCT patients within the SEER database. Although GCTs represent the most common solid tumor in men between 20 and 30 years with an increased incidence over the last decades, they only account for around 1% of all cancers in men.[12,13] Moreover, stage III NSGCT represents a less common stage and data focusing on stage III NSGCT patients are limited. For example, a previous work by Ko at al. including metastatic testicular germ cell tumor patients from 5 tertiary cancer centers between 1990 and 2012 accounted for only 464 stage III patients.[14] Therefore, the use of large-scale population-based databases such as the SEER database or National Cancer Database (NCDB) is essential to describe the distribution

Figure 3 Bar plots depicting rates of (A) systemic therapy and (B) retroperitoneal lymph node dissection (RPLND) before and after multinomial adjustment in 3174 stage III nonseminoma germ cell tumor (NSGCT) patients according to Surveillance, Epidemiology, and End Results (SEER) geographic registries (the first plot shows SEER registries in ascending order according to rates of treatment before adjustment, the second plot shows SEER registries in the same order after adjustment and the third plot the largest SEER registries (10,11,12) and then the smallest in ascendant order after adjustment).



of patient baseline characteristics and treatment patterns of less common stages.

Second, we noted significant variations in patient, tumor and treatment characteristics approaches across SEER registries. Older age group (≥40 years) varied between 12% and 31%, and racial/ethnic makeup outside of non-Hispanic whites ranged from 5% to 73%. Differences in IGCCCG prognostic groups were also significant, with poor prognosis cases accounting for 24%-43%, and the use of systemic therapy ranged from 87% to 96%, with slight variations observed in larger registries. Although differences in systemic therapy rates were not statistically significant, these differences are clinically meaningful since systemic therapy represents the key element in multimodal treatment of stage III NSGCT.[1,2] The presence and persistence of such differences in systemic therapy may attest to the variability in patient care that should ideally not exist. Moreover, older age, race/ethnicity other than non-Hispanic white and IGCCCG poor prognosis group have been identified as independent predictors of higher CSM in the current study (Supplemental Table 1), as well as in previous studies.[8,15] The current study also showed variability in the rates of retroperitoneal lymph node dissection (RPLND), ranging from 12% to 35%, even after adjusting for various factors. The variability in RPLND rates, which may depend on patient and clinician preferences, aligns with findings from an NCDB-based report by Woldu et al.[16] Given that registry-specific differences can influence CSM outcomes, it is essential to incorporate these patient, tumor, and treatment characteristics into multivariable analyses when evaluating CSM.

Third, significant disparities were noted in 5-year CSM rates and CS deaths per 1000 person-years across SEER registries. Smaller registries exhibited a wider range of CS deaths (7 to 23%) and CSM per 1000 person-years (12.9 to 49.5), compared to larger registries which showed narrower variations (CSM: 19% to 23%, CS deaths per 1000 person-years: 32.6 to 48.6). We also identified important variability in unadjusted registry-specific HR predicting CSM relative to SEER registry of reference (SEER Registry 12) as largest registry (ranged from 0.29 to 1.02). Despite adjusting for patient, tumor, and treatment characteristics, HR for CSM still showed significant differences. Specifically, the risk of CSM was significantly lower in SEER Registry 4 (HR 0.36) and SEER Registry 9 (HR 0.64) compared to SEER Registry 12, highlighting important regional differences in cancer outcomes. These observations suggest that improvements in cancer control may be achiev-

Table 2 Cancer-Specific Mortality (CSM) in Stage III Nonseminoma Germ Cell Tumor (NSGCT) Patients According to Surveillance, Epidemiology, and End Results (SEER) 2004-2018 Geographic Registries Across the United States

SEER Registries	12 (n = 1630)	11 (n = 265)	10 (n = 240)	9 (n = 184)	8 (n = 145)	7 (n = 125)	6 (n = 121)	5 (n = 116)	4 (n = 113)	3 (n = 105)	2 (n = 81)	1 (n = 49)
Median Follow-up (months)	47	48	54	67	58	44	63	55	55	57	39	45
Five-year CSM (%)	23	22	19	13	21	22	15	23	7	17	21	18
CS deaths per 1000 person-years	45.2	48.6	32.6	23.3	36.0	40.5	23.7	49.5	12.9	30.0	40.2	32.3
Total person-years in follow-up	8295	1194	1381	1032	832	667	760	546	620	600	423	296
Number of CS deaths	375	58	45	24	30	27	18	27	8	18	17	9
Unadjusted CSM HR	Ref.	1.00	0.77	**0.53**[b]	0.87	0.89	**0.60**[b]	1.02	**0.29**[b]	0.71	0.85	0.74
Adjusted CSM HR[a]	Ref.	0.93	0.91	**0.64**[b]	1.21	1.02	0.65	1.00	**0.36**[b]	0.86	0.91	0.77

[a] Adjusted for age at diagnosis, IGCCCG (International Germ Cell Cancer Collaborative Group) prognosis group, systemic therapy, RPLND (retroperitoneal lymph node dissection) status, race/ethnicity.
[b] *P*-value <.05.

able. These findings highlight the critical need for uniformity in patient care and support infrastructure across all registries.

Taken together, the observed heterogeneity in patient, tumor and treatment characteristics approaches across SEER registries underscores the necessity to adjust cancer control analyses accordingly. Even after comprehensive adjustments, 2 registries demonstrated a statistically significantly lower CSM risk compared to the largest registry. These pronounced disparities might indicate potential inconsistencies in patient care and supportive healthcare infrastructure. It was previously reported that that centers treating a higher volume of advanced testicular cancer patients achieve better outcomes.[17] Collette et al. observed that patients treated at institutions with fewer than 5 patients had lower survival rates in a large European trial.[18] This trend is supported by other studies showing better survival for patients treated at high-volume centers compared to those at low-volume centers.[17] These findings emphasize the need for patients with GCTs to be treated at high-volume centers to ensure optimal outcomes, highlighting the critical role of institutional experience and adherence to established treatment protocols.

Despite the novelty of the current study, our work has limitations and should be interpreted in the context of its retrospective and population-based design, as well as the reliance on data from only 13 SEER registries, which may not fully represent the US population. Its applicability to non-US populations is uncertain without validation in larger, international databases. Second, SEER data is limited in its ability to explain the underlying reasons for these regional differences. Furthermore, SEER data does not provide information on the number of institutions within each SEER registry or, more importantly, the number of patients per institution. Moreover, no information about rural versus urban settings or socioeconomic status was available. Third, the SEER database lacks of detailed systemic therapy data, including specific regimens, cycles, and duration, which restricts treatment analysis. Furthermore, our multivariable adjustments were limited to variables available within SEER, omitting potential influences like hospital volume, disease dissemination, metastasis specifics, comorbidities, and patient preferences, all of which could affect treatment choices and regional variation.[19]

Conclusion

We identified important regional differences that included patient, tumor, and treatment characteristics. Even after adjustment for these characteristics, important CSM differences persisted which may be indicative of regional differences in quality of care or expertise in stage III NGSCT management.

Clinical Practice Points

- Testicular cancer has one of the highest cure rates. Patients with nonseminoma germ cell tumor (NSGCT) and distant metastases and/or high postorchiectomy tumor markers (Stage III) face significantly higher mortality and more complex treatment challenges. Prior studies have established that patient outcomes can vary significantly between registry-based data and high-volume centers. It is unknown if regional differences in patient, tumor and treatment characteristics and therefore in cancer-specific mortality (CSM) exit across the United States. Our study

using the Surveillance, Epidemiology, and End Results (SEER) database (2004-2018) to examine stage III NSGCT patients. The findings reveal significant regional disparities in patient demographics, such as age and race/ethnicity, and tumor prognostic factors, as defined by the International Germ Cell Cancer Collaborative Group. Treatment modalities, specifically systemic therapy and retroperitoneal lymph node dissection also exhibited variability across different registries. These regional differences were further reflected in CSM rates and outcomes. Certain registries reported more favorable outcomes compared to the largest SEER registry, even after adjusting for various patient and tumor characteristics. Looking to the future, this study's insights call for a targeted approach to harmonize the quality of care across regions. Recognizing and addressing these regional disparities could enhance the clinical management of NSGCT patients. Implementing standardized treatment protocols and increasing the expertise available in underperforming regions could potentially balance the survival outcomes and improve overall patient care. This study highlights a pivotal step toward personalizing treatment plans and allocating resources efficiently to optimize patient outcomes in the management of stage III NSGCT.

Role of the Funder

Not applicable.

Ethics Statement

All analyses and their reporting followed the SEER reporting guidelines. Due to the anonymously coded design of the SEER database, study-specific Institutional Review Board ethics approval was not required.

Data availability

The data underlying this article are available in The Surveillance, Epidemiology, and End Results (SEER) Program, at https://seer.cancer.gov. The datasets were derived from sources in the public domain: Incidence - SEER Research Data, Nov 2018 Submission available at https://seer.cancer.gov/data/.

Disclosures

The authors declare that they have no conflicts of interest.

CRediT authorship contribution statement

Cristina Cano Garcia: Conceptualization, Data curation, Formal analysis, Methodology, Writing – original draft. **Francesco Barletta:** Data curation, Writing – review & editing. **Stefano Tappero:** Data curation, Writing – review & editing. **Mattia Luca Piccinelli:** Data curation, Writing – review & editing. **Reha-Baris Incesu:** Data curation, Writing – review & editing. **Simone Morra:** Data curation, Writing – review & editing. **Lukas Scheipner:** Data curation, Writing – review & editing. **Zhe Tian:** Methodology. **Fred Saad:** Writing – review & editing. **Shahrokh F. Shariat:** Writing – review & editing. **Sascha Ahyai:** Writing – review & editing. **Nicola Longo:** Writing – review & editing. **Derya Tilki:** Writing – review & editing. **Ottavio De Cobelli:** Writing – review & editing. **Carlo Terrone:** Writing – review & editing. **Alberto Briganti:** Writing – review & editing. **Severine Banek:** Writing – review & editing. **Luis A. Kluth:** Writing – review & editing, Writing – review & editing. **Felix K.H. Chun:** Supervision, Writing – review & editing. **Pierre I. Karakiewicz:** Conceptualization, Methodology, Supervision, Writing – review & editing.

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Supplementary materials

Supplementary Table 1 Uni- and multivariable Cox regression models addressing cancer-specific mortality

		Univariable HR (95% CI)	P-value	Multivariable HR (95% CI)	P-value
Age group	<40 years	*Reference*		*Reference*	
	≥40 years	2.1 (1.8-2.5)	<0.001	12.3 (1.9-2.7)	<0.001
IGCCCG	good	*Reference*		*Reference*	
	intermediate	1.6 (1.1-2.5)	0.02	1.8 (1.2-2.8)	0.005
	poor	4.8 (3.3-7.0)	<0.001	5.0 (3.4-7.4)	<0.001
	unknown	3.1 (2.1-4.6)	<0.001	2.7 (1.8-4.0)	<0.001
Systemic therapie	no	*Reference*		*Reference*	
	yes	0.5 (0.4-0.6)	<0.001	0.5 (0.4-0.6)	<0.001
RPLND	no	*Reference*		*Reference*	
	yes	0.4 (0.3-0.5)	<0.001	0.4 (0.4-0.6)	<0.001
Non-hispanic white race/ethnicity	no	*Reference*		*Reference*	
	yes	0.8 (0.7-0.9)	0.007	0.8 (0.6-0.9)	<0.001

Abbreviation: IGCCCG=International Germ Cell Cancer Collaborative Group, RPLND= retroperitoneal lymph node dissection

Supplementary Table 2 **Summary table of patient, tumor and treatment characteristics according to Surveillance, Epidemiology, and End Results (SEER) 2004-2018 geographic registries across the United States**

SEER Registries	12 (n=1630)	11 (n=265)	10 (n=240)	9 (n=184)	8 (n=145)	7 (n=125)	6 (n=121)	5 (n=116)	4 (n=113)	3 (n=105)	2 (n=81)	1 (n=49)
Age group ≥40 years (%)	20	25	31	21	26	20	22	31	27	28	12	18
race/ethnicity other than non-Hispanic white (%)	58	23	24	21	5	14	8	23	19	21	73	60
IGCCCG												
Good (%)	14	10	11	12	18	11	10	9	20	25	4	15
Intermediate (%)	19	14	19	21	21	22	20	22	21	24	18	22
Poor (%)	43	43	35	33	25	40	38	35	24	35	37	41
Unknown (%)	24	33	35	34	36	27	32	34	35	26	41	22
Systemic therapy (%)	91	92	96	94	95	93	93	87	88	93	90	92
RPLND (%)	19	12	30	35	23	21	14	22	28	23	30	20
Five-year CSM (%)	23	22	19	13	21	22	15	23	7	17	21	18

Abbreviation: IGCCCG=International Germ Cell Cancer Collaborative Group, RPLND= retroperitoneal lymph node dissection, CSM=cancer-specific mortality