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Changes in sex-specific incidence of lymphoid neoplasms across the lifespan

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Data sharing statement

Deidentified data are available at https://seer.cancer.gov/.

Disclosure of conflicts of interest

No conflicts of interest to declare.

Authorship contributions

BV, SJS, SSJ, GMD, MSL, and LMM conceptualized and designed the study; BV performed the analysis; BV, SJS, and LMM drafted the manuscript; SJS and LMM contributed to data acquisition and acquired funding; LMM supervised and administered the study; SJS, SSJ, GMD, MSL, and LMM provided valuable edits to the manuscript and approved the final version of the manuscript.

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LETTER TO THE EDITOR

While male predominance for most subtypes of lymphoid neoplasms (LNs) has been described,[1] the underlying reasons for this observation are not well understood. Certain established LN risk factors (e.g., autoimmune diseases, infections, or occupational exposures) differ by sex but generally are rare and thus unlikely to explain the observed sex differences in LN incidence, and previous studies assessing hormonal factors have been inconclusive.[2] Notably, however, there is substantial age variation in the prevalence of some lymphoma risk factors (e.g., viral infections), with certain risk factors and immune function known to vary substantially by age and sex.[3] To date, the understanding of male predominance across age groups remains limited.[3-5] To contribute novel epidemiologic insights, we explore sex-specific incidence rates and male-to-female incidence rate ratios (IRRs) according to finely categorized age groups across the lifespan for common and rare LN subtypes by leveraging United States population-based cancer registry data.

We identified all first primary incident LNs diagnosed during 2001-2017 in 16 Surveillance, Epidemiology, and End Results (SEER-16) registry areas. Cases with unknown age (n=21), unknown race and ethnicity (n=4,385), or those diagnosed through autopsy/death certificate only (n=4,775) were excluded. We also excluded human immunodeficiency virus-(HIV)positive cases (n=7,562) because of the known age- and sex-specific incidence patterns of HIV infection, which would potentially obscure other incidence patterns. Analysis was limited to cases diagnosed after the 2001 World Health Organization classification introduction (**Supplementary Table 1**) through 2017, the last available HIV status date. Three registries (Iowa, Hawaii, and Connecticut) lacking HIV data were included, assuming low HIV prevalence as previously described.[6, 7]

We estimated age-adjusted incidence rates by sex and fitted multivariable Poisson regression models to estimate male-to-female IRRs and 95% confidence intervals (CIs) in each of the eighteen 5-year age groups (0-4, 5-9, …, and ≥85 years). Age groups with <16 cases for males or females were combined with the next oldest group. Models were adjusted for race and ethnicity, and population size was used as an offset. Using joinpoint models, we estimated the average percent change (APC) in the sex-specific incidence rates and the male-to-female IRRs to evaluate the significance of trends across age groups. Additionally, we performed a sensitivity analysis by comparing the IRRs from the main analysis (restricted to cases without known HIV) with those based on all cases regardless of HIV status at diagnosis using a Z-score.[8] Analyses were performed using SEER*Stat (v8.4.1.2), Joinpoint (v4.9.0), and R (v4.1.1). This study is

not considered human subjects research and thus did not require review by an Institutional Review Board.

We analyzed 492,948 incident LNs (273,620 males and 219,328 females) (**Table 1**). For all ages combined, males had a significantly higher incidence than females for most subtypes, with >2-fold IRRs for hairy cell leukemia, mantle cell lymphoma (MCL), T-cell precursor leukemia/lymphoma (T-ALL), Burkitt leukemia/lymphoma (BL), and nodular lymphocyte predominant Hodgkin lymphoma (NLPHL). In contrast, no male predominance was observed for nodular sclerosis Hodgkin lymphoma (NSCHL); primary mediastinal large B-cell lymphoma (PMBCL); marginal zone lymphoma (MZL), including nodal, extranodal, and splenic MZL; and adult T-cell leukemia/lymphoma.

Male-to-female IRRs increased considerably with age for lymphoplasmacytic lymphoma/Waldenström macroglobulinemia (LPL/WM; IRR [age group], from 0.81 [0-39y] to 2.47 [≥85y]), T-cell large granular lymphocytic leukemia (LGLL, from 0.76 [0-49y] to 2.83 [≥85y]), and primary cutaneous anaplastic large cell lymphoma (PCALCL, from 0.86 [<30y] to 3.91 [≥85y]) (**Figure 1** and **Supplementary Table 1**). Sex-specific APC analyses illustrate that the increasing male predominance with age for these lymphomas resulted from a steeper incidence increase among males than females (**Supplementary Figure 1** and **Supplementary Table 2**). Modest IRR increases with age were noted for multiple myeloma (MM), chronic lymphocytic leukemia/small lymphocytic lymphoma, cutaneous T-cell lymphoma, NOS (CTCL), splenic MZL, and mycosis fungoides/Sézary syndrome (MF/SS). Conversely, steeper increases in the incidence by age in females vs. males resulted in a decrease in the IRR with advancing age for NLPHL (from 3.94 [15-19y] to 1.89 [≥80y]), BL (from peak of 3.75 [10-14y] to 1.70 [≥85y]), and lymphocyte-rich Hodgkin lymphoma (LRHL, from 2.81 [<25y] to 0.81 [75-79y]).

Notably, female predominance was observed for selected LNs in specific age groups. Incidence was significantly higher among females (i.e., IRR<1) for NSCHL (IRRs 0.78-0.84 [15-34y]), extranodal MZL (IRRs 0.76-0.82 [45-59y]), and PMBCL (IRRs 0.47-0.67 [25-49y]).

Male predominance was substantially pronounced in the youngest and oldest age groups for T-ALL, NSCHL, mixed cellularity Hodgkin lymphoma, extranodal and nodal MZL, follicular lymphoma (FL), and diffuse large B-cell lymphoma, not otherwise specified (DLBCL, NOS). Joinpoint analyses suggested a constant male predominance across age groups for MCL, NK/T-cell lymphoma, and B-cell precursor leukemia/lymphoma. The sensitivity analyses indicated that the male predominance was higher when all cases (regardless of HIV status) were included for DLBCL in ages 30-54 ($IRRs_{All\text{-}cases}$ 1.57-1.89 vs. $IRRs_{HIV\text{-}excluded}$ 1.34-1.54; p-values<0.05) and for BL in

ages 40-49 ($IRRs_{All\text{-}cases}$ 3.56-4.64 vs. $IRRs_{HIV\text{-}excluded}$ 2.38-2.81; p-values<0.05). No difference in IRRs was found for other subtypes.

This population-based study revealed age-related variations in the male-to-female IRR for several LN subtypes across the lifespan. Although previous studies have described a male predominance across age groups, these reports primarily focused on broad LN (e.g., non-Hodgkin lymphoma or acute leukemias) and age categories, masking sex-based variations within recognized subtypes.[3] Our study uncovers nuanced patterns of sex-specific incidence rates and male-to-female IRRs with advancing age across LNs. While IRRs remained stable across age groups for certain LNs, others exhibited notable fluctuations, such as increasing and decreasing IRRs or a combination of both patterns. These findings support the heterogeneous nature of lymphoid neoplasms and may reflect the possible contributions of multiple etiologic factors within subtypes, as well as support subtype-specific differences in risk factors.[9]

The female predominance during ages 15-34 for NSCHL contrasts with previous reports of an IRR of 1 for all ages combined.[1] Findings for PMBCL expand previous data[10] and suggest female predominance between ages 25-49. Similar incidence rate peaks in both sexes for NSCHL and PMBCL during early adulthood suggest a possible epidemiological link between these two morphologically distinct entities, supporting molecular evidence that these subtypes arise from a common precursor cell.[11] The female predominance in extranodal MZL at ages 45-59 aligns with the peak incidence of autoimmune diseases and differs from incidence patterns for nodal and splenic MZL.[12] This observation provides epidemiologic evidence lending support for the role of autoimmune conditions, particularly those affecting extranodal sites (e.g., thyroid gland), in the etiology of MZL.

The disproportionate age-related decline in male immune function, compared to females,[13] may have contributed to the observed increase in LN incidence rates and male predominance at older ages for specific subtypes, including cutaneous lymphomas (i.e., CTCL, PCALCL, MF/SS), LGLL, LPL/WM, and MM. For instance, epigenetic dysregulation significantly influences the pathogenesis of cutaneous T-cell lymphomas,[14] and thus, factors associated with epigenetic modulation may be related to the observed sex difference for only some subtypes. In contrast, the attenuation of male predominance with advancing age in BL, NLPHL, and LRHL appeared to be driven by a steeper increase in the incidence rates of females. The reasons behind this pattern require further investigation.

Although incidence rates increased with age in both sexes for most LNs, the IRRs were relatively constant across the lifespan for several subtypes (e.g., B-ALL; chronic lymphocytic leukemia/small lymphocytic lymphoma; MCL; DLBCL, NOS; plasmacytoma;

peripheral T-cell lymphoma, NOS; anaplastic large cell lymphoma; angioimmunoblastic T-cell lymphoma; NK/T cell lymphoma; and adult T-cell leukemia/lymphoma). This suggests that age-related variations in immune function (e.g., increased senescence of T and B cells among males), steroid hormone production,[2, 13] or other sex-specific risk factors between males and females are unlikely to drive the observed sex differences.

A strength of this study was the large number of incident cases diagnosed in the SEER data, particularly relevant for rare subtypes for which previous international studies have had a limited sample size. The large population size allowed the examination of sex differences across age groups, even for rarer subtypes, although the sample size was generally too small to evaluate differences by race and ethnicity. Limitations of our study include the lack of a central expert hematopathology review. Although misclassification of LNs may have occurred, we do not expect misclassification to differ by sex. The absence of dedicated ICD-O-3 codes for recognized subtypes such as EBV-positive DLBCL) precluded their distinction in our study. The lack of individual LN risk factors (e.g., autoimmune disease) and their timing in SEER precludes the analysis of their contribution to the observed estimates and the impact of latencies of exposures on LN risks during aging.

In conclusion, examining sex-specific incidence rates and male-to-female IRRs across ages revealed previously undocumented incidence patterns for some LNs that were not evident when age groups or subtypes were combined in previous studies. This observed variability reflects the heterogeneity of LNs and emphasizes the need for stratifying by sex and age in future etiologic studies. Identifying sex- and age-related risk factors associated with subtype-specific differences in LN development between males and females could improve our understanding of LN etiology. Future research may evaluate the role of sex-dependent changes in immune function during aging, genetic susceptibility, the potential impact of latencies of LN risk factors exposure, and the interaction between these factors on LN development.

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Table 1. Incidence rates by sex and male-to-female incidence rate ratios of lymphoid neoplasms subtypes among all ages, cases diagnosed between 2001 and 2017 from 16 registries of the Surveillance, Epidemiology, and End Results Program.

Lymphoid neoplasm subtypes	Males (n = 273,620)		Females (n = 219,328)		Male-to-female IRR (95% CI)[a]
	No.	IR per 100,000	No.	IR per 100,000	
Precursor lymphoid neoplasms					
B-ALL	4,200	0.62	3,619	0.54	1.17 (1.12-1.23)
T-ALL	2,339	0.34	1,007	0.15	2.38 (2.22-2.57)
Precursor, NOS	7,881	1.17	6,391	0.92	1.25 (1.21-1.29)
Hodgkin lymphomas					
cHL	17,632	2.6	15,602	2.21	1.16 (1.13-1.18)
NSCHL	9,642	1.40	9,833	1.41	1.00 (0.98-1.03)
MCCHL	2,387	0.36	1,447	0.2	1.69 (1.58-1.80)
LRHL	649	0.10	435	0.06	1.53 (1.36-1.73)
LDHL/cHL, NOS[b]	4,954	0.75	3,887	0.54	1.31 (1.25-1.36)
NLPHL	1,417	0.21	659	0.09	2.22 (2.03-2.44)
Mature B-cell lymphomas					
CLL/SLL	49,381	7.95	33,129	4.22	1.53 (1.51-1.55)
MCL	7,787	1.24	3,287	0.42	2.43 (2.33-2.53)
LPL/WM	5,505	0.91	3,873	0.5	1.46 (1.40-1.52)
DLBCL, NOS/Others[c]	50,443	8.08	42,967	5.59	1.20 (1.19-1.22)
PMBCL	322	0.05	503	0.07	0.66 (0.57-0.76)
BL	3,089	0.46	1,365	0.19	2.32 (2.17-2.47)
MZL	12,594	2.00	14,501	1.88	0.89 (0.87-0.91)
Extranodal MZL	7,438	1.18	8,986	1.17	0.85 (0.83-0.88)
Nodal MZL	3,966	0.63	4,252	0.55	0.96 (0.92-1.00)
Splenic MZL	1,190	0.19	1,263	0.16	0.97 (0.89-1.05)
FL	25,075	3.86	25,019	3.26	1.03 (1.01-1.04)
HCL	3,282	0.5	880	0.12	3.82 (3.55-4.12)
PCN	49,531	7.91	39,381	5.08	1.30 (1.28-1.32)
MM	46,199	7.40	37,338	4.81	1.28 (1.26-1.29)
Plasmacytoma	3,332	0.52	2,043	0.27	1.68 (1.59-1.77)
Mature T-cell lymphomas					
MF/SS	4,133	0.63	2,994	0.4	1.42 (1.36-1.49)
PTCL	9,103	1.41	6,469	0.86	1.45 (1.40-1.50)
PTCL, NOS/Others[d]	3,594	0.56	2,517	0.33	1.47 (1.40-1.55)
ALCL	1,842	0.28	1,175	0.16	1.61 (1.50-1.73)
AITL	1,107	0.17	899	0.12	1.27 (1.16-1.38)
CTCL	1,796	0.28	1,323	0.18	1.40 (1.30-1.50)
PCALCL	764	0.12	555	0.07	1.42 (1.27-1.58)
ATL	252	0.04	235	0.03	1.11 (0.93-1.32)
NK/T cell	696	0.11	393	0.05	1.81 (1.60-2.05)
LGLL	931	0.15	861	0.11	1.11 (1.01-1.22)
Others/Lymphoid, NOS[e]	18,027	2.98	16,193	2.07	1.14 (1.12-1.17)

* Denotes statistically significant APC changes at p-value < 0.05

[a] Incidence rate ratios (IRRs) adjusted for race and ethnicity (Hispanic, non-Hispanic American Indian/Alaska Native, non-Hispanic Asian/Pacific Islander, non-Hispanic Black, and non-Hispanic White).

[b] LDHL cases were combined with cHL, NOS because of limited case counts across age groups.

[c] Others include intravascular large B-cell lymphoma (n=145), primary effusion lymphoma (n=72), and plasmablastic lymphoma (n=314, since 2010).

[d] Others include subcutaneous panniculitis-like T-cell lymphoma (n=200); enteropathy-type T-cell lymphoma (n=188); hepatosplenic T-cell lymphoma (n=135).

[e] Others include prolymphocytic B- or T-cell leukemia (n=792), heavy chain disease (n=53), and composite Hodgkin lymphoma and non-Hodgkin lymphoma (n=712). Lymphoid, NOS (n=32,663)

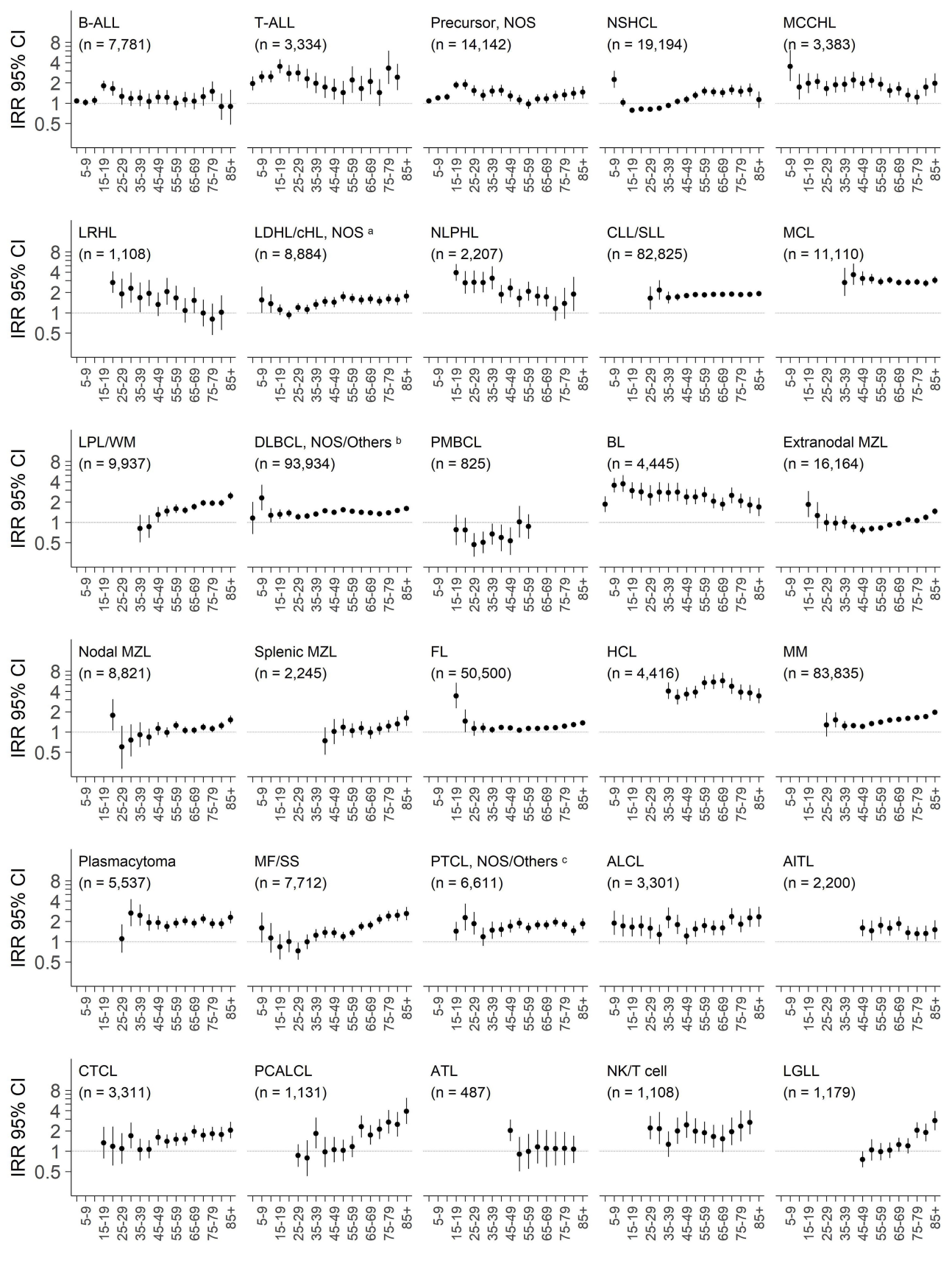
Abbreviations: AITL, angioimmunoblastic T-cell lymphoma; ALCL, anaplastic large cell lymphoma; APC, Average percent change; ATL, adult T-cell leukemia/lymphoma; B-ALL, B-cell lymphoblastic leukemia/lymphoma; BL, Burkitt leukemia/lymphoma; cHL, classical Hodgkin lymphoma; CLL/SLL, chronic lymphocytic leukemia/small lymphocytic lymphoma; CI, Confidence interval; CTCL, cutaneous T-cell lymphoma, NOS; DLBCL, diffuse large B-cell lymphoma; FL, follicular lymphoma; HCL, hairy cell leukemia; IR, incidence rate; LDHL, lymphocyte-depleted Hodgkin lymphoma; LGLL, T-cell large granular lymphocytic leukemia; LPL/WM, lymphoplasmacytic lymphoma/Waldenström macroglobulinemia; LRHL, lymphocyte-rich Hodgkin lymphoma; MCCHL, mixed cellularity Hodgkin lymphoma; MCL, mantle cell lymphoma; MF/SS, mycosis fungoides/Sézary syndrome; MM, multiple myeloma; MZL, marginal zone lymphoma; NK/T cell, NK/T cell lymphoma; NLPHL, nodular lymphocyte predominant Hodgkin lymphoma; NOS, not otherwise specified; NSCHL, nodular sclerosis Hodgkin lymphoma; PCALCL, primary cutaneous anaplastic large cell lymphoma; PCN, plasma cell neoplasms; PMBCL, primary mediastinal large B-cell lymphoma; PTCL, peripheral T-cell lymphoma; SEER-16, 16 cancer registry areas of the Surveillance, Epidemiology, and End Results Program, which include Connecticut, Atlanta (Metropolitan), Greater Georgia, Rural Georgia, Los Angeles, San Francisco–Oakland SMSA, San Jose–Monterey, Hawaii, Iowa, Kentucky, Louisiana, New Mexico, New Jersey, Seattle (Puget Sound), and Utah; T-ALL, T-cell lymphoblastic leukemia/lymphoma.

FIGURE LEGENDS

Figure 1. Male-to-female incidence rate ratios across the lifespan for lymphoid neoplasms. Incidence rate ratios (95% confidence intervals) were adjusted for race and ethnicity (Hispanic, non-Hispanic American Indian/Alaska Native, non-Hispanic Asian/Pacific Islander, non-Hispanic Black, and non-Hispanic White) and stratified by 5-year age groups (unless otherwise specified). Cases diagnosed between 2001 and 2017 from 16 registries of the Surveillance, Epidemiology, and End Results.

[a] LDHL cases were combined with cHL, NOS because of limited case counts across age groups.
[b] Others include intravascular large B-cell lymphoma, primary effusion lymphoma, and plasmablastic lymphoma. Cases were combined because of low counts across age groups.
[c] Others include subcutaneous panniculitis-like T-cell lymphoma, enteropathy-type T-cell lymphoma, and hepatosplenic T-cell lymphoma. Cases were combined because of low counts across age groups.

Abbreviations: AITL, angioimmunoblastic T-cell lymphoma; ALCL, anaplastic large cell lymphoma; ATL, adult T-cell leukemia/lymphoma; B-ALL, B-cell lymphoblastic leukemia/lymphoma; BL, Burkitt leukemia/lymphoma; cHL, classical Hodgkin lymphoma; CLL/SLL, chronic lymphocytic leukemia/small lymphocytic lymphoma; CTCL, cutaneous T-cell lymphoma, NOS; DLBCL, diffuse large B-cell lymphoma; FL, follicular lymphoma; HCL, hairy cell leukemia; LDHL, Lymphocyte-depleted Hodgkin lymphoma; LGLL, T-cell large granular lymphocytic leukemia; LPL/WM, lymphoplasmacytic lymphoma/Waldenström macroglobulinemia; LRHL, lymphocyte-rich Hodgkin lymphoma; MCCHL, mixed cellularity Hodgkin lymphoma; MCL, mantle cell lymphoma; MF/SS, mycosis fungoides/Sézary syndrome; MM, multiple myeloma; MZL, marginal zone lymphoma; NK/T cell, NK/T cell lymphoma; NLPHL, nodular lymphocyte predominant Hodgkin lymphoma; NOS, not otherwise specified; NSCHL, nodular sclerosis Hodgkin lymphoma; PCALCL, primary cutaneous anaplastic large cell lymphoma; PCN, plasma cell neoplasms; PMBCL, primary mediastinal large B-cell lymphoma; PTCL, peripheral T-cell lymphoma; T-ALL, T-cell lymphoblastic leukemia/lymphoma.


B-ALL
(n = 7,781)
T-ALL
(n = 3,334)
Precursor, NOS
(n = 14,142)
NSHCL
(n = 19,194)
MCCHL
(n = 3,383)
LRHL
(n = 1,108)
LDHL/cHL, NOS a
(n = 8,884)
NLPHL
(n = 2,207)
CLL/SLL
(n = 82,825)
MCL
(n = 11,110)
LPL/WM
(n = 9,937)
DLBCL, NOS/Others b
(n = 93,934)
PMBCL
(n = 825)
BL
(n = 4,445)
Extranodal MZL
(n = 16,164)
Nodal MZL
(n = 8,821)
Splenic MZL
(n = 2,245)
FL
(n = 50,500)
HCL
(n = 4,416)
MM
(n = 83,835)
Plasmacytoma
(n = 5,537)
MF/SS
(n = 7,712)
PTCL, NOS/Others c
(n = 6,611)
ALCL
(n = 3,301)
AITL
(n = 2,200)
CTCL
(n = 3,311)
PCALCL
(n = 1,131)
ATL
(n = 487)
NK/T cell
(n = 1,108)
LGLL
(n = 1,179)
IRR 95% CI
8
4
2
1
0.5
5-9
15-19
25-29
35-39
45-49
55-59
65-69
75-79
85+

Supplementary Table 1. Male-to-female incidence rate ratios across age groups for lymphoid neoplasms, cases diagnosed between 2001 and 2017 from 16 registries of the Surveillance, Epidemiology, and End Results Program.

Lymphoid neoplasms	ICD-O-3 codes	Sex	0-4		5-9		10-14		15-19	
			No.	IRR (95% CI)	No.	IRR (95% CI)	No.	IRR (95% CI)	No.	IRR (95% CI)
Precursor lymphoid neoplasms										
B-ALL	9728, 9812, 9813, 9814, 9815, 9816, 9817, 9818, 9836	Female	1210	Ref	579	Ref	321	Ref	196	Ref
		Male	1368	1.08 (1.00-1.17)	618	1.02 (0.91-1.14)	367	1.09 (0.94-1.27)	372	1.80 (1.52-2.15)
T-ALL	9729, 9837	Female	104	Ref	136	Ref	138	Ref	86	Ref
		Male	213	1.96 (1.55-2.48)	349	2.45 (2.02-3.00)	360	2.47 (2.04-3.02)	321	3.51 (2.78-4.47)
Precursor, NOS	9727[a], 9811, 9820, 9835	Female	1606	Ref	819	Ref	545	Ref	345	Ref
		Male	1807	1.08 (1.01-1.15)	1020	1.19 (1.09-1.31)	703	1.23 (1.10-1.38)	680	1.86 (1.63-2.11)
Hodgkin lymphomas										
cHL	9650, 9651, 9652, 9653, 9654, 9655, 9661, 9663, 9664, 9665, 9666, 9667	Female			119	Ref	457	Ref	1418	Ref
		Male			295	2.39 (1.94-2.98)	551	1.14 (1.01-1.29)	1341	0.89 (0.83-0.96)
NSCHL	9663, 9664, 9665, 9666, 9667	Female			66	Ref	352	Ref	1146	Ref
		Male			154	2.24 (1.68-3)	381	1.03 (0.89-1.19)	944	0.78 (0.72-0.85)
MCCHL	9652	Female			18	Ref	32	Ref	50	Ref
		Male			74	3.51 (2.13-6.09)	59	1.73 (1.13-2.7)	113	1.96 (1.41-2.77)
LRHL	9651	Female								
		Male								
LDHL/cHL, NOS[b]	9650, 9653, 9654, 9655, 9661, 9662	Female			32	Ref	64	Ref	210	Ref
		Male			50	1.54 (0.99-2.44)	92	1.36 (0.99-1.88)	245	1.11 (0.92-1.33)
NLPHL	9659	Female							60	Ref
		Male							249	3.94 (2.99-5.27)
Mature B-cell lymphomas										
CLL/SLL	9670, 9823	Female								
		Male								
MCL	9673	Female								
		Male								
LPL/WM	9671, 9761	Female								
		Male								
DLBCL, NOS/Others[c]	9678, 9684, 9712, 9735, 9680, 9688, 9737, 9738	Female	24	Ref	28	Ref	111	Ref	234	Ref
		Male	29	1.16 (0.67-2)	69	2.36 (1.54-3.72)	151	1.3 (1.02-1.66)	342	1.38 (1.17-1.63)
PMBCL	9679	Female							32	Ref
		Male							26	0.78 (0.46-1.3)
BL	9687, 9826	Female	81	Ref	80	Ref	60	Ref	65	Ref
		Male	157	1.85 (1.42-2.43)	297	3.53 (2.77-4.55)	237	3.75 (2.84-5.02)	203	2.95 (2.24-3.93)
MZL	9689, 9760, 9764, 9699	Female							44	Ref
		Male							88	1.95 (1.37-2.84)
Extranodal MZL	9760, 9764, 9699 (sites: C000-C769, C780-C809)	Female							30	Ref
		Male							58	1.84 (1.2-2.9)
Nodal MZL	9699 (sites: C770-C779)	Female								
		Male								
Splenic MZL	9689	Female								
		Male								
FL	9675, 9690, 9691, 9695, 9698	Female							26	Ref
		Male							104	3.41 (2.25-5.38)
HCL	9940	Female								
		Male								
PCN	9731, 9732, 9733, 9734	Female								
		Male								
MM	9732, 9733	Female								
		Male								
Plasmacytoma	9731, 9734	Female								
		Male								
Mature T-cell lymphomas										
MF/SS	9700, 9701	Female			24	Ref	29	Ref	44	Ref
		Male			40	1.60 (0.97-2.68)	33	1.13 (0.68-1.88)	39	0.84 (0.54-1.29)
PTCL	9702, 9705, 9708, 9714, 9716, 9717, 9709, 9726, 9718	Female	25	Ref	45	Ref	75	Ref	107	Ref
		Male	30	1.15 (0.68-1.96)	80	1.74 (1.21-2.53)	127	1.62 (1.22-2.16)	167	1.48 (1.16-1.89)
PTCL, NOS/Others[d]	9702, 9708, 9716, 9717	Female							63	Ref
		Male							95	1.42 (1.04-1.97)
ALCL	9714	Female			36	Ref	44	Ref	59	Ref
		Male			69	1.88 (1.26-2.86)	79	1.71 (1.19-2.5)	102	1.64 (1.19-2.27)
AITL	9705	Female								
		Male								
CTCL	9709, 9726	Female							23	Ref
		Male							32	1.33 (0.78-2.29)
PCALCL	9718	Female								
		Male								
ATL	9827	Female								
		Male								
NK/T cell	9719, 9948	Female								
		Male								
LGLL	9831	Female								
		Male								
Others[e]/Lymphoid, NOS	9596, 9762, 9833, 9591, 9597, 9832, 9590, 9594, 9724, 9725, 9970, 9971	Female	27	Ref	34	Ref	43	Ref	60	Ref
		Male	41	1.45 (0.90-2.39)	48	1.32 (0.85-2.07)	59	1.27 (0.85-1.89)	124	1.96 (1.44-2.68)

Age groups													
20-24		25-29		30-34		35-39		40-44		45-49		50-54	
No.	IRR (95% CI)	No.	IRR (95% CI)	No.	IRR (95% CI)	No.	IRR (95% CI)	No.	IRR (95% CI)	No.	IRR (95% CI)	No.	IRR (95% CI)
99	Ref	84	Ref	108	Ref	90	Ref	107	Ref	126	Ref	117	Ref
176	1.65 (1.29-2.12)	114	1.25 (0.95-1.67)	131	1.17 (0.91-1.51)	109	1.19 (0.90-1.58)	114	1.06 (0.82-1.39)	153	1.23 (0.97-1.56)	138	1.22 (0.95-1.56)
67	Ref	62	Ref	51	Ref	48	Ref	45	Ref	49	Ref	42	Ref
195	2.75 (2.09-3.65)	177	2.81 (2.11-3.78)	120	2.30 (1.67-3.22)	94	1.98 (1.40-2.82)	78	1.72 (1.20-2.51)	78	1.60 (1.12-2.31)	57	1.43 (0.96-2.14)
194	Ref	183	Ref	173	Ref	177	Ref	175	Ref	207	Ref	259	Ref
398	1.89 (1.59-2.24)	303	1.53 (1.28-1.85)	235	1.31 (1.07-1.59)	273	1.51 (1.25-1.83)	268	1.54 (1.27-1.87)	258	1.28 (1.06-1.54)	281	1.12 (0.94-1.32)
2037	Ref	1873	Ref	1596	Ref	1203	Ref	1025	Ref	863	Ref	738	Ref
1946	0.90 (0.85-0.96)	1806	0.93 (0.87-0.99)	1573	0.96 (0.90-1.03)	1314	1.08 (1.00-1.17)	1287	1.26 (1.16-1.36)	1119	1.31 (1.20-1.43)	1114	1.55 (1.42-1.71)
1581	Ref	1438	Ref	1198	Ref	864	Ref	698	Ref	508	Ref	405	Ref
1369	0.82 (0.76-0.88)	1208	0.81 (0.75-0.88)	1028	0.84 (0.77-0.91)	804	0.92 (0.84-1.02)	736	1.06 (0.95-1.17)	573	1.14 (1.01-1.28)	512	1.3 (1.14-1.48)
80	Ref	95	Ref	81	Ref	83	Ref	75	Ref	95	Ref	86	Ref
178	2.09 (1.61-2.74)	163	1.65 (1.28-2.13)	153	1.87 (1.43-2.46)	161	1.9 (1.46-2.49)	166	2.2 (1.68-2.9)	185	1.95 (1.53-2.51)	179	2.17 (1.68-2.82)
39	Ref	23	Ref	21	Ref	24	Ref	30	Ref	43	Ref	29	Ref
115	2.81 (1.97-4.08)	45	1.9 (1.16-3.19)	53	2.31 (1.41-3.93)	40	1.67 (1.01-2.81)	61	1.94 (1.26-3.06)	55	1.33 (0.89-1.99)	56	2.06 (1.32-3.28)
361	Ref	317	Ref	296	Ref	232	Ref	222	Ref	217	Ref	218	Ref
359	0.93 (0.81-1.08)	390	1.19 (1.03-1.38)	339	1.12 (0.96-1.31)	309	1.32 (1.12-1.57)	324	1.46 (1.24-1.74)	306	1.43 (1.2-1.7)	367	1.74 (1.47-2.06)
35	Ref	35	Ref	43	Ref	35	Ref	62	Ref	55	Ref	67	Ref
103	2.79 (1.92-4.14)	103	2.83 (1.95-4.21)	124	2.82 (2.01-4.03)	106	3.25 (2.22-4.87)	113	1.87 (1.38-2.57)	125	2.32 (1.70-3.21)	106	1.65 (1.22-2.25)
		40	Ref	51	Ref	153	Ref	404	Ref	968	Ref	1779	Ref
		69	1.65 (1.12-2.45)	112	2.16 (1.56-3.03)	261	1.68 (1.38-2.05)	693	1.71 (1.52-1.94)	1711	1.79 (1.65-1.93)	3231	1.86 (1.76-1.97)
						23	Ref	38	Ref	91	Ref	179	Ref
						67	2.81 (1.78-4.61)	139	3.68 (2.60-5.34)	291	3.21 (2.55-4.08)	553	3.17 (2.68-3.76)
						38	Ref	57	Ref	100	Ref	206	Ref
						32	0.81 (0.50-1.30)	50	0.87 (0.59-1.27)	128	1.30 (1.00-1.69)	292	1.47 (1.23-1.76)
352	Ref	504	Ref	653	Ref	899	Ref	1146	Ref	1778	Ref	2510	Ref
543	1.46 (1.27-1.67)	688	1.32 (1.18-1.48)	888	1.34 (1.21-1.48)	1245	1.38 (1.27-1.5)	1731	1.52 (1.41-1.64)	2526	1.44 (1.36-1.53)	3743	1.54 (1.46-1.62)
50	Ref	74	Ref	86	Ref	76	Ref	52	Ref	53	Ref	28	Ref
41	0.77 (0.51-1.16)	37	0.47 (0.31-0.69)	44	0.51 (0.35-0.72)	51	0.67 (0.47-0.95)	30	0.59 (0.37-0.93)	27	0.53 (0.33-0.84)	27	1.02 (0.6-1.74)
56	Ref	45	Ref	47	Ref	54	Ref	55	Ref	78	Ref	89	Ref
166	2.83 (2.10-3.87)	119	2.48 (1.77-3.53)	135	2.80 (2.02-3.94)	151	2.76 (2.03-3.80)	152	2.81 (2.07-3.87)	184	2.38 (1.83-3.11)	204	2.38 (1.86-3.08)
42	Ref	110	Ref	160	Ref	235	Ref	410	Ref	714	Ref	1116	Ref
55	1.23 (0.82-1.85)	107	0.94 (0.72-1.23)	147	0.90 (0.72-1.13)	229	0.98 (0.81-1.17)	345	0.85 (0.74-0.98)	599	0.85 (0.77-0.95)	953	0.88 (0.81-0.96)
34	Ref	87	Ref	123	Ref	178	Ref	287	Ref	520	Ref	738	Ref
46	1.27 (0.82-1.99)	89	0.99 (0.74-1.34)	122	0.98 (0.76-1.25)	178	1 (0.81-1.24)	242	0.85 (0.72-1.01)	389	0.76 (0.67-0.87)	576	0.81 (0.72-0.9)
22	Ref	20	Ref	30	Ref	46	Ref	102	Ref	151	Ref	292	Ref
39	1.77 (1.05-3.06)	16	0.6 (0.28-1.23)	23	0.76 (0.44-1.3)	42	0.91 (0.6-1.39)	84	0.84 (0.63-1.12)	167	1.13 (0.9-1.41)	279	0.99 (0.84-1.16)
								42	Ref	43	Ref	86	Ref
								32	0.74 (0.46-1.16)	43	1.01 (0.66-1.55)	98	1.17 (0.88-1.57)
42	Ref	115	Ref	263	Ref	589	Ref	972	Ref	1575	Ref	2407	Ref
65	1.45 (0.99-2.16)	136	1.13 (0.88-1.45)	311	1.15 (0.98-1.36)	644	1.08 (0.96-1.21)	1136	1.16 (1.07-1.27)	1797	1.15 (1.07-1.23)	2499	1.06 (1.00-1.12)
						63	Ref	75	Ref	93	Ref	108	Ref
						262	4.05 (3.10-5.39)	249	3.29 (2.56-4.29)	333	3.64 (2.90-4.61)	415	3.91 (3.18-4.86)
		72	Ref	122	Ref	328	Ref	854	Ref	1675	Ref	2752	Ref
		93	1.20 (0.88-1.64)	215	1.74 (1.40-2.18)	451	1.39 (1.21-1.60)	1094	1.31 (1.19-1.43)	2044	1.26 (1.18-1.34)	3563	1.35 (1.29-1.42)
		41	Ref	97	Ref	287	Ref	777	Ref	1564	Ref	2558	Ref
		55	1.28 (0.85-1.92)	147	1.51 (1.17-1.96)	350	1.23 (1.06-1.44)	948	1.24 (1.13-1.37)	1834	1.21 (1.13-1.29)	3249	1.33 (1.26-1.4)
		31	Ref	25	Ref	41	Ref	77	Ref	111	Ref	194	Ref
		38	1.10 (0.68-1.79)	68	2.65 (1.7-4.27)	101	2.45 (1.72-3.56)	146	1.91 (1.46-2.53)	210	1.91 (1.52-2.41)	314	1.68 (1.41-2.01)
57	Ref	106	Ref	126	Ref	161	Ref	180	Ref	233	Ref	319	Ref
61	1.00 (0.70-1.44)	79	0.72 (0.54-0.97)	125	0.99 (0.78-1.28)	197	1.24 (1.01-1.53)	242	1.36 (1.13-1.66)	306	1.35 (1.14-1.61)	365	1.19 (1.03-1.39)
105	Ref	140	Ref	201	Ref	206	Ref	298	Ref	377	Ref	510	Ref
188	1.67 (1.32-2.13)	203	1.41 (1.14-1.75)	250	1.23 (1.02-1.48)	319	1.56 (1.31-1.86)	396	1.35 (1.16-1.57)	557	1.52 (1.34-1.74)	764	1.56 (1.39-1.74)
26	Ref	40	Ref	73	Ref	76	Ref	106	Ref	130	Ref	180	Ref
63	2.28 (1.46-3.66)	77	1.85 (1.27-2.74)	86	1.18 (0.86-1.61)	109	1.47 (1.1-1.98)	156	1.51 (1.18-1.93)	214	1.7 (1.37-2.12)	324	1.87 (1.56-2.25)
49	Ref	47	Ref	63	Ref	44	Ref	57	Ref	91	Ref	92	Ref
90	1.7 (1.21-2.43)	75	1.58 (1.1-2.29)	83	1.28 (0.92-1.78)	99	2.23 (1.57-3.21)	99	1.79 (1.29-2.49)	107	1.21 (0.91-1.6)	138	1.54 (1.18-2.01)
										76	Ref	58	Ref
										124	1.59 (1.2-2.12)	80	1.45 (1.04-2.05)
16	Ref	27	Ref	32	Ref	55	Ref	80	Ref	85	Ref	122	Ref
20	1.19 (0.62-2.32)	30	1.09 (0.65-1.85)	55	1.7 (1.1-2.65)	58	1.05 (0.73-1.53)	84	1.07 (0.78-1.45)	130	1.61 (1.22-2.12)	165	1.4 (1.11-1.77)
		60	Ref	24	Ref	22	Ref	33	Ref	42	Ref	58	Ref
		50	0.86 (0.59-1.27)	19	0.79 (0.43-1.46)	40	1.84 (1.1-3.14)	29	0.97 (0.58-1.63)	43	1.05 (0.69-1.62)	57	1.02 (0.71-1.48)
										43	Ref	25	Ref
										89	2.03 (1.42-2.94)	21	0.91 (0.50-1.62)
		35	Ref	20	Ref	36	Ref	29	Ref	28	Ref	34	Ref
		88	2.21 (1.50-3.32)	43	2.16 (1.28-3.80)	52	1.26 (0.82-1.97)	58	1.99 (1.29-3.15)	65	2.45 (1.58-3.89)	62	1.99 (1.31-3.06)
										119	Ref	61	Ref
										92	0.76 (0.57-0.99)	60	1.05 (0.73-1.50)
103	Ref	139	Ref	170	Ref	227	Ref	306	Ref	475	Ref	790	Ref
140	1.28 (0.99-1.65)	173	1.21 (0.97-1.52)	216	1.25 (1.02-1.53)	314	1.39 (1.17-1.65)	476	1.57 (1.36-1.81)	704	1.51 (1.34-1.69)	1076	1.41 (1.28-1.54)

55-59		60-64		65-69		70-74		75-79		80-84		85+	
No.	IRR (95% CI)	No.	IRR (95% CI)	No.	IRR (95% CI)	No.	IRR (95% CI)	No.	IRR (95% CI)	No.	IRR (95% CI)	No.	IRR (95% CI)
135	Ref	110	Ref	105	Ref	77	Ref	67	Ref	52	Ref	36	Ref
128	1.00 (0.79-1.28)	114	1.13 (0.87-1.47)	98	1.06 (0.81-1.40)	80	1.25 (0.91-1.71)	73	1.49 (1.07-2.09)	31	0.89 (0.57-1.38)	16	0.89 (0.48-1.57)
28	Ref	36	Ref	30	Ref	35	Ref	17	Ref	33	Ref		
59	2.21 (1.42-3.51)	53	1.64 (1.08-2.52)	55	2.09 (1.35-3.29)	42	1.43 (0.91-2.25)	42	3.31 (1.92-5.97)	46	2.42 (1.55-3.82)		
312	Ref	305	Ref	273	Ref	233	Ref	202	Ref	176	Ref	207	Ref
286	0.97 (0.83-1.14)	322	1.15 (0.99-1.35)	283	1.17 (0.99-1.38)	247	1.27 (1.06-1.52)	204	1.33 (1.09-1.61)	163	1.40 (1.13-1.73)	150	1.45 (1.18-1.79)
690	Ref	712	Ref	690	Ref	666	Ref	637	Ref	469	Ref	409	Ref
1069	1.63 (1.48-1.79)	966	1.47 (1.34-1.62)	943	1.54 (1.39-1.70)	809	1.45 (1.31-1.61)	694	1.43 (1.29-1.60)	486	1.56 (1.37-1.77)	319	1.56 (1.35-1.81)
304	Ref	283	Ref	263	Ref	225	Ref	201	Ref	165	Ref	136	Ref
441	1.5 (1.3-1.74)	383	1.46 (1.26-1.71)	334	1.43 (1.21-1.68)	298	1.57 (1.32-1.87)	228	1.49 (1.23-1.8)	172	1.57 (1.27-1.95)	77	1.12 (0.85-1.48)
103	Ref	114	Ref	124	Ref	132	Ref	127	Ref	81	Ref	71	Ref
187	1.91 (1.51-2.44)	161	1.53 (1.21-1.95)	181	1.64 (1.3-2.06)	144	1.32 (1.04-1.67)	120	1.23 (0.95-1.57)	93	1.73 (1.28-2.33)	70	1.98 (1.42-2.75)
37	Ref	45	Ref	34	Ref	41	Ref	38	Ref	31	Ref		
59	1.65 (1.1-2.52)	45	1.08 (0.71-1.64)	46	1.52 (0.98-2.38)	34	0.99 (0.63-1.56)	22	0.81 (0.47-1.36)	18	1.02 (0.56-1.81)		
246	Ref	270	Ref	269	Ref	268	Ref	271	Ref	204	Ref	190	Ref
382	1.64 (1.39-1.92)	377	1.55 (1.33-1.82)	382	1.6 (1.37-1.87)	333	1.49 (1.27-1.75)	324	1.6 (1.36-1.88)	212	1.56 (1.29-1.89)	163	1.76 (1.43-2.17)
56	Ref	57	Ref	59	Ref	46	Ref	27	Ref	22	Ref		
110	2.08 (1.51-2.89)	92	1.76 (1.27-2.46)	88	1.72 (1.24-2.40)	46	1.16 (0.76-1.75)	28	1.38 (0.81-2.35)	24	1.89 (1.06-3.40)		
2868	Ref	3756	Ref	4485	Ref	4579	Ref	4891	Ref	4348	Ref	4807	Ref
5070	1.85 (1.76-1.93)	6537	1.87 (1.79-1.94)	7498	1.87 (1.80-1.94)	7281	1.89 (1.82-1.96)	6952	1.86 (1.79-1.93)	5437	1.88 (1.81-1.95)	4529	1.92 (1.84-1.99)
314	Ref	384	Ref	482	Ref	489	Ref	478	Ref	417	Ref	392	Ref
869	2.89 (2.54-3.29)	1090	3.05 (2.72-3.43)	1212	2.81 (2.53-3.12)	1166	2.83 (2.55-3.15)	1048	2.86 (2.57-3.19)	761	2.73 (2.43-3.08)	591	3.04 (2.68-3.46)
297	Ref	451	Ref	525	Ref	553	Ref	626	Ref	567	Ref	453	Ref
449	1.59 (1.37-1.84)	632	1.50 (1.33-1.70)	803	1.70 (1.53-1.90)	909	1.94 (1.74-2.15)	926	1.93 (1.74-2.14)	729	1.94 (1.74-2.16)	555	2.47 (2.19-2.80)
3395	Ref	4291	Ref	4989	Ref	5550	Ref	5954	Ref	5324	Ref	5225	Ref
4695	1.46 (1.4-1.52)	5593	1.41 (1.36-1.47)	6137	1.39 (1.33-1.44)	6236	1.34 (1.3-1.39)	6277	1.38 (1.34-1.43)	5321	1.5 (1.44-1.55)	4229	1.61 (1.55-1.68)
52	Ref												
39	0.87 (0.57-1.32)												
83	Ref	94	Ref	115	Ref	80	Ref	103	Ref	90	Ref	90	Ref
202	2.57 (2.00-3.33)	179	2.06 (1.61-2.66)	189	1.86 (1.48-2.35)	168	2.51 (1.93-3.29)	163	2.08 (1.63-2.67)	108	1.80 (1.37-2.39)	75	1.70 (1.24-2.31)
1438	Ref	1694	Ref	1989	Ref	1835	Ref	1869	Ref	1491	Ref	1354	Ref
1298	0.95 (0.88-1.03)	1527	0.98 (0.91-1.05)	1757	0.99 (0.93-1.06)	1715	1.12 (1.05-1.19)	1561	1.10 (1.02-1.17)	1210	1.22 (1.13-1.31)	1003	1.49 (1.37-1.61)
942	Ref	1046	Ref	1205	Ref	1076	Ref	1086	Ref	852	Ref	782	Ref
733	0.82 (0.75-0.91)	884	0.92 (0.84-1)	1028	0.96 (0.89-1.05)	974	1.09 (1-1.18)	880	1.06 (0.97-1.16)	672	1.18 (1.07-1.31)	567	1.45 (1.3-1.62)
369	Ref	501	Ref	595	Ref	572	Ref	607	Ref	493	Ref	452	Ref
438	1.25 (1.09-1.43)	486	1.05 (0.93-1.19)	561	1.06 (0.94-1.19)	565	1.18 (1.05-1.32)	516	1.11 (0.99-1.25)	410	1.24 (1.09-1.41)	340	1.52 (1.32-1.74)
127	Ref	147	Ref	189	Ref	187	Ref	176	Ref	146	Ref	120	Ref
127	1.05 (0.82-1.34)	157	1.14 (0.91-1.43)	168	0.98 (0.79-1.21)	176	1.12 (0.91-1.37)	165	1.22 (0.98-1.5)	128	1.32 (1.04-1.67)	96	1.61 (1.23-2.1)
2881	Ref	3153	Ref	3318	Ref	3090	Ref	2717	Ref	2156	Ref	1715	Ref
3108	1.13 (1.07-1.19)	3312	1.13 (1.07-1.18)	3398	1.14 (1.09-1.20)	2999	1.15 (1.10-1.21)	2538	1.22 (1.16-1.29)	1860	1.29 (1.21-1.37)	1168	1.37 (1.27-1.47)
88	Ref	73	Ref	66	Ref	67	Ref	77	Ref	75	Ref	95	Ref
453	5.36 (4.29-6.78)	377	5.50 (4.31-7.12)	342	5.76 (4.46-7.57)	271	4.77 (3.68-6.29)	230	3.89 (3.02-5.07)	190	3.79 (2.91-4.98)	160	3.44 (2.67-4.44)
3850	Ref	4656	Ref	5541	Ref	5564	Ref	5453	Ref	4636	Ref	3878	Ref
5132	1.42 (1.37-1.49)	6470	1.53 (1.48-1.59)	7480	1.55 (1.50-1.60)	7384	1.62 (1.56-1.68)	6709	1.65 (1.59-1.71)	5141	1.70 (1.63-1.76)	3755	1.98 (1.89-2.07)
3636	Ref	4415	Ref	5271	Ref	5337	Ref	5220	Ref	4423	Ref	3712	Ref
4754	1.4 (1.34-1.46)	6020	1.5 (1.45-1.56)	7035	1.53 (1.48-1.59)	6975	1.6 (1.54-1.65)	6384	1.64 (1.58-1.7)	4881	1.69 (1.62-1.76)	3567	1.96 (1.88-2.06)
214	Ref	241	Ref	270	Ref	227	Ref	233	Ref	213	Ref	166	Ref
378	1.89 (1.6-2.23)	450	2.03 (1.74-2.38)	445	1.88 (1.61-2.18)	409	2.18 (1.86-2.57)	325	1.85 (1.56-2.19)	260	1.85 (1.54-2.22)	188	2.29 (1.86-2.83)
350	Ref	307	Ref	333	Ref	238	Ref	197	Ref	157	Ref	133	Ref
445	1.35 (1.17-1.55)	474	1.68 (1.46-1.94)	519	1.75 (1.53-2.01)	427	2.14 (1.83-2.52)	355	2.38 (2.00-2.84)	255	2.45 (2.01-3.00)	171	2.60 (2.08-3.27)
587	Ref	654	Ref	669	Ref	658	Ref	681	Ref	615	Ref	516	Ref
871	1.58 (1.42-1.75)	1016	1.69 (1.53-1.86)	1058	1.79 (1.62-1.97)	1006	1.84 (1.67-2.04)	896	1.74 (1.58-1.92)	663	1.63 (1.46-1.82)	512	1.99 (1.76-2.25)
223	Ref	262	Ref	267	Ref	276	Ref	277	Ref	284	Ref	234	Ref
331	1.59 (1.35-1.89)	424	1.77 (1.52-2.06)	414	1.77 (1.52-2.07)	441	1.94 (1.67-2.26)	375	1.8 (1.54-2.11)	271	1.45 (1.23-1.72)	214	1.84 (1.53-2.21)
99	Ref	106	Ref	101	Ref	75	Ref	84	Ref	66	Ref	62	Ref
164	1.73 (1.35-2.22)	157	1.59 (1.24-2.04)	144	1.6 (1.24-2.07)	149	2.35 (1.79-3.12)	117	1.82 (1.38-2.42)	98	2.25 (1.65-3.09)	72	2.34 (1.66-3.29)
78	Ref	93	Ref	109	Ref	129	Ref	151	Ref	118	Ref	87	Ref
128	1.73 (1.31-2.3)	135	1.59 (1.22-2.07)	177	1.84 (1.46-2.35)	145	1.35 (1.06-1.71)	149	1.3 (1.04-1.63)	104	1.32 (1.01-1.72)	65	1.5 (1.08-2.06)
130	Ref	152	Ref	134	Ref	125	Ref	132	Ref	112	Ref	98	Ref
184	1.5 (1.2-1.88)	213	1.52 (1.23-1.87)	233	1.96 (1.59-2.43)	179	1.73 (1.38-2.18)	181	1.82 (1.46-2.28)	132	1.78 (1.38-2.29)	100	2.05 (1.55-2.71)
57	Ref	41	Ref	58	Ref	53	Ref	37	Ref	35	Ref	35	Ref
64	1.17 (0.82-1.67)	87	2.31 (1.6-3.37)	90	1.74 (1.26-2.44)	92	2.12 (1.52-3)	74	2.7 (1.83-4.06)	58	2.49 (1.64-3.82)	61	3.91 (2.54-6.15)
23	Ref	23	Ref	20	Ref	25	Ref	29	Ref	47	Ref		
21	0.99 (0.55-1.80)	24	1.16 (0.65-2.07)	23	1.10 (0.58-2.06)	22	1.09 (0.61-1.94)	22	1.10 (0.62-1.94)	30	1.08 (0.67-1.70)		
44	Ref	43	Ref	35	Ref	29	Ref	23	Ref	37	Ref		
76	1.88 (1.30-2.74)	65	1.66 (1.13-2.45)	41	1.53 (0.96-2.46)	46	1.95 (1.23-3.14)	40	2.35 (1.40-4.02)	60	2.67 (1.78-4.06)		
95	Ref	114	Ref	130	Ref	116	Ref	88	Ref	76	Ref	62	Ref
89	0.99 (0.74-1.32)	109	1.03 (0.79-1.34)	144	1.25 (0.98-1.58)	116	1.20 (0.93-1.55)	136	2.05 (1.57-2.68)	100	1.89 (1.40-2.56)	85	2.83 (2.04-3.95)
1114	Ref	1351	Ref	1783	Ref	1974	Ref	2233	Ref	2406	Ref	2958	Ref
1347	1.27 (1.18-1.38)	1858	1.49 (1.39-1.60)	2138	1.35 (1.27-1.44)	2282	1.38 (1.30-1.46)	2496	1.46 (1.38-1.55)	2170	1.35 (1.27-1.43)	2365	1.61 (1.52-1.70)

a Cases reported with the 9727 code were included from 2001 to 2009 in the precursor, NOS category.
b LDHL cases were combined with cHL, NOS because of limited case counts across age groups.
d Others include subcutaneous panniculitis-like T-cell lymphoma; enteropathy-type T-cell lymphoma; hepatosplenic T-cell lymphoma.

e Others include prolymphocytic B- or T-cell leukemia, heavy chain disease, and composite Hodgkin lymphoma and non-Hodgkin lymphoma.

Incidence rate ratios adjusted for race and ethnicity. Because of low counts, we combined age groups as follows: ages 0-9 years for ALCL, LDHL/NOS, MCCHL, MFS/SS, NSCHL, T-ALL; ages 0-19 years for NLPHL, DLBCL, NOS, PMBCL, extranodal MZL, FL, PTCL, NOS/Others, CTCL; ages 0-24 years for LRHL, nodal MZL; ages 0-29 years for CLL/SLL, MM, NK/T cell, Plasmacytoma, PCALCL; ages 0-39 years for MCL, LPL/WM, HCL; ages 0-44 years for splenic MZL; ages 0-49 years for AITL, ATL, LGLL; ages 55-85+ for PMBCL; ages ≥80 years for T-ALL, LRHL, NLPHL, ATL, NK/T cell.

Abbreviations: AITL, angioimmunoblastic T-cell lymphoma; ALCL, anaplastic large cell lymphoma; ATL, adult T-cell leukemia/lymphoma; B-ALL, B-cell lymphoblastic leukemia/lymphoma; BL, Burkitt leukemia/lymphoma; cHL, classical Hodgkin lymphoma; CLL/SLL, chronic lymphocytic leukemia/small lymphocytic lymphoma; CTCL, cutaneous T-cell lymphoma, NOS; DLBCL, diffuse large B-cell lymphoma; FL, follicular lymphoma; HCL, hairy cell leukemia; ICD-O-3, International Classification of Diseases for Oncology, third edition; LDHL, lymphocyte-depleted Hodgkin lymphoma; LGLL, T-cell large granular lymphocytic leukemia; LPL/WM, lymphoplasmacytic lymphoma/Waldenström macroglobulinemia; LRHL, lymphocyte-rich Hodgkin lymphoma; MCCHL, mixed cellularity Hodgkin lymphoma; MCL, mantle cell lymphoma; MF/SS, mycosis fungoides/Sézary syndrome; MM, multiple myeloma; MZL, marginal zone lymphoma; NK/T cell, NK/T cell lymphoma; NLPHL, nodular lymphocyte predominant Hodgkin lymphoma; NOS, not otherwise specified; NSCHL, nodular sclerosis Hodgkin lymphoma; PCALCL, primary cutaneous anaplastic large cell lymphoma; PCN, plasma cell neoplasms; PMBCL, primary mediastinal large B-cell lymphoma; PTCL, peripheral T-cell lymphoma; SEER, Surveillance, Epidemiology, and End Results; T-ALL, T-cell lymphoblastic leukemia/lymphoma.

Supplementary Table 2. Joinpoint analysis of the male-to-female incidence rate ratio and the male and female incidence rates by lymphoid neoplasms, cases diagnosed between 2001 and 2017 from 16 registries of the Surveillance, Epidemiology, and End Results Program.

Lymphoid neoplasms	Male-to-female incidence rate ratio		Males		Females	
	Age groups (years)	APC of the incidence rate ratio by age group (95% CI)	Age groups (years)	APC of the incidence rates by age group (95% CI)	Age groups (years)	APC of the incidence rates by age group (95% CI)
Precursor lymphoid neoplasms						
B-ALL	0-4 to 85+	0.5 (-1.9, 2.9)	0-4 to 25-29 25-29 to 85+	-39.3 (-44.6, -33.5)* 7.1 (0.6, 14)*	0-4 to 20-24 20-24 to 85+	-48.1 (-51.4, -44.5)* 5.9 (3, 8.8)*
T-ALL	0-4 to 15-19 15-19 to 45-49 45-49 to 80+	19.9 (2.3, 40.5)* -11.8 (-20.8, -1.8)* 8.3 (-1.3, 18.8)	0-4 to 10-14 10-14 to 45-49 45-49 to 80+	22.9 (-0.9, 52.3) -23.2 (-26.8, -19.4)* 13.7 (6.5, 21.5)*	0-4 to 40-44 40-44 to 80+	-14.9 (-20.3, -9.1)* 4.6 (-4.9, 15.1)
Precursor, NOS	0-4 to 20-24 20-24 to 55-59 55-59 to 85+	15.8 (9.2, 22.7)* -8 (-13.6, -2.1)* 5.8 (-0.9, 12.9)	0-4 to 30-34 30-34 to 85+	-30.1 (-33.8, -26.3)* 15.3 (10.9, 19.9)*	0-4 to 20-24 20-24 to 40-44 40-44 to 60-64 60-64 to 85+	-41.7 (-44.7, -38.4)* -3.3 (-18.2, 14.3) 26.5 (9.9, 45.7)* 9.1 (2.1, 16.6)*
Hodgkin lymphomas						
cHL						
NSCHL	0-9 to 15-19 15-19 to 60-64 60-64 to 85+	-41.9 (-56.6, -22)* 8.8 (6.4, 11.3)* -0.5 (-7.6, 7.1)	0-9 to 20-24 20-24 to 50-54 50-54 to 85+	106.5 (64.7, 158.8)* -16 (-21.2, -10.4)* 8.4 (0.5, 16.9)*	0-9 to 15-19 15-19 to 30-34 30-34 to 50-54 50-54 to 85+	382.2 (178.3, 735.7)* -2.7 (-16.2, 13) -27.3 (-35.1, -18.6)* 6.1 (0.6, 12)*
MCCHL	0-9 to 15-19 15-19 to 50-54 50-54 to 75-79 75-79 to 85+	-25.3 (-55.4, 25) 1.9 (-3.6, 7.6) -9.8 (-19.9, 1.6) 28 (-16.5, 96.4)	0-9 to 20-24 20-24 to 40-44 40-44 to 85+	63.3 (35.6, 96.8)* -1.7 (-14.4, 13) 14.9 (11.6, 18.3)*	0-9 to 20-24 20-24 to 50-54 50-54 to 75-79 75-79 to 85+	83.8 (31.4, 157.2)* 0.1 (-8, 8.9) 33.3 (19.9, 48.2)* -21.7 (-48.3, 18.6)
LRHL	<25 to 80+	-7.6 (-10.4, -4.7)*	<25 to 30-34 30-34 to 80+	48.2 (-8.6, 140.4) 5.3 (-0.1, 10.9)	<25 to 80+	18.5 (12.3, 25)*
LDHL/cHL, NOS	0-9 to 20-24 20-24 to 50-54 50-54 to 70-74 70-74 to 85+	-13.2 (-27, 3.1) 9.2 (4.7, 13.9)* -2.9 (-9.8, 4.6) 4.5 (-3.9, 13.7)	0-9 to 20-24 20-24 to 45-49 45-49 to 75-79 75-79 to 85+	110.3 (81.1, 144.2)* -4.9 (-9.5, 0) 25 (20.6, 29.4)* -3.6 (-22.5, 19.9)	0-9 to 20-24 20-24 to 45-49 45-49 to 75-79 75-79 to 85+	137.6 (109, 170.3)* -13.6 (-17.2, -10)* 25.6 (21.8, 29.5)* -7.7 (-20.8, 7.5)
NLPHL	<20 to 80+	-7.7 (-10, -5.4)*	<20 to 25-29 25-29 to 65-69 65-69 to 80+	28.2 (1.2, 62.5)* 4.3 (0.5, 8.2)* -20.5 (-38.1, 2.2)	<20 to 70-74 70-74 to 80+	15.7 (10.5, 21.1)* -41 (-78.1, 58.9)
Mature B-cell lymphomas						
CLL/SLL	<30 to 85+	0.5 (0.1, 0.9)*	<30 to 45-49 45-49 to 65-69 65-69 to 85+	199.1 (88.6, 374.5)* 68.5 (45.6, 95)* 19.1 (9.7, 29.3)*	<30 to 45-49 45-49 to 65-69 65-69 to 85+	194.9 (77.4, 390.3)* 67.4 (42.7, 96.3)* 18.6 (10.1, 27.7)*
MCL	20-39 to 85+	-1.2 (-2.7, 0.3)	20-39 to 60-64 60-64 to 85+	100.6 (57.9, 154.9)* 18.5 (4.7, 34.2)*	20-39 to 65-69 65-69 to 85+	84.9 (52.2, 124.7)* 9.7 (-7.1, 29.6)
LPL/WM	<40 to 85+	7.7 (5.2, 10.2)*	<40 to 65-69 65-69 to 85+	102.3 (56.3, 162)* 22.3 (-0.9, 50.9)	<40 to 65-69 65-69 to 85+	91.2 (46.7, 149.1)* 13.3 (-10.9, 44.2)
DLBCL, NOS/Others	0-4 to 75-79 75-79 to 85+	-0.8 (-1.9, 0.4) 8.1 (-1.7, 18.9)	0-4 to 15-19 15-19 to 75-79 75-79 to 85+	112.5 (27.4, 254.4)* 43.7 (42, 45.5)* 9.1 (-2.8, 22.4)	0-4 to 75-79 75-79 to 85+	44.9 (42.4, 47.5)* 0.2 (-13.6, 16.2)
PMBCL	<20 to 55+	3.6 (-3.4, 11.1)	<20 to 25-29 25-29 to 55+	147 (-8.6, 567.8) -18 (-29.6, -4.6)*	<20 to 25-29 25-29 to 55+	217.4 (7.2, 839.9)* -24.2 (-34.6, -12)*
BL	0-4 to 85+	-3.3 (-4.8, -1.9)*	0-4 to 30-34 30-34 to 85+	-12.2 (-21.1, -2.4)* 16.2 (10.9, 21.7)*	0-4 to 30-34 30-34 to 85+	-11.5 (-18, -4.5)* 21.1 (17.8, 24.4)*
MZL						
Extranodal MZL	<20 to 45-49 45-49 to 85+	-12.6 (-18.9, -5.8)* 8.2 (6, 10.4)*	<20 to 25-29 25-29 to 70-74 70-74 to 85+	132.7 (70.2, 218.1)* 47.9 (46, 49.8)* 10.1 (5.5, 14.9)*	<20 to 25-29 25-29 to 65-69 65-69 to 85+	230.1 (-37.6, 1645.3) 48.9 (39.4, 59.1)* 6.5 (-3.5, 17.5)
Nodal MZL	<25 to 85+	2.4 (-0.6, 5.4)	<25 to 55-59 55-59 to 70-74 70-74 to 85+	83.3 (77.3, 89.5)* 43.5 (31.2, 56.9)* 14.4 (8.8, 20.3)*	<25 to 60-64 60-64 to 75-79 75-79 to 85+	71.5 (57, 87.4)* 31.2 (-0.7, 73.3) -5.6 (-30.7, 28.7)
Splenic MZL	<45 to 85+	5.4 (1.9, 8.9)*	45-49 to 55-59 55-59 to NA	399.6 (37.8, 1712)* 31.2 (19.5, 44.1)*	45-49 to 55-59 55-59 to 85+	370.8 (-21.8, 2733.1) 24.5 (8.8, 42.5)*
FL	<20 to 25-29 25-29 to 70-74 70-74 to 85+	-42.5 (-59.9, -17.5)* 0.5 (-0.8, 1.8) 6.2 (1.8, 10.8)*	<20 to 40-44 40-44 to 70-74 70-74 to 85+	115.7 (89.9, 144.9)* 37.3 (32.5, 42.3)* -1.6 (-10.7, 8.5)	<20 to 45-49 45-49 to 70-74 70-74 to 85+	94.8 (61.1, 135.4)* 33.1 (23, 44)* -6 (-18.6, 8.5)
HCL	<40 to 65-69 65-69 to 85+	9 (1.8, 16.7)* -13.5 (-25.1, -0.1)*	20-39 to 45-49	117.8 (84.9, 156.6)*	20-39 to 85+	21.4 (12.5, 31.1)*
PCN						
MM	<30 to 85+	4.8 (3.7, 5.8)*	45-49 to 85+ <30 to 45-49 45-49 to 70-74 70-74 to 85+	13.6 (11.6, 15.6)* 172.8 (71.4, 334)* 55.9 (41.8, 71.3)* 6.8 (-8.2, 24.2)	<30 to 45-49 45-49 to 70-74 70-74 to 85+	172.3 (61, 360.7)* 49.4 (34.5, 66)* 0.8 (-13.4, 17.5)
Plasmacytoma	<30 to 85+	0.2 (-2.3, 2.8)	<30 to 35-39 35-39 to 65-69 65-69 to 85+	219.9 (100.7, 410)* 42.9 (36.6, 49.5)* 10.2 (3.6, 17.2)*	<30 to 35-39 35-39 to 65-69 65-69 to 85+	206.9 (-29.6, 1238.2) 44.2 (24.4, 67.1)* 7.4 (-9.8, 27.9)
Mature T-cell lymphomas						
MF/SS	0-9 to 50-54 50-54 to 85+	1.7 (-3.8, 7.5) 11.6 (8.4, 14.9)*	0-9 to 65-69 65-69 to 85+	36.4 (33.2, 39.7)* 6.4 (-2.3, 15.8)	0-9 to 25-29 25-29 to 65-69 65-69 to 85+	60 (29.3, 98.1)* 23.9 (19.3, 28.6)* -4.8 (-13.5, 4.8)
PTCL						
PTCL, NOS/Others	<20 to 85+	0.5 (-1.3, 2.4)	<20 to 70-74 70-74 to 85+	39.4 (35.7, 43.2)* 7.5 (-7.6, 25)	<20 to 75-79 75-79 to 85+	35.7 (32.7, 38.7)* -1 (-21.8, 25.3)

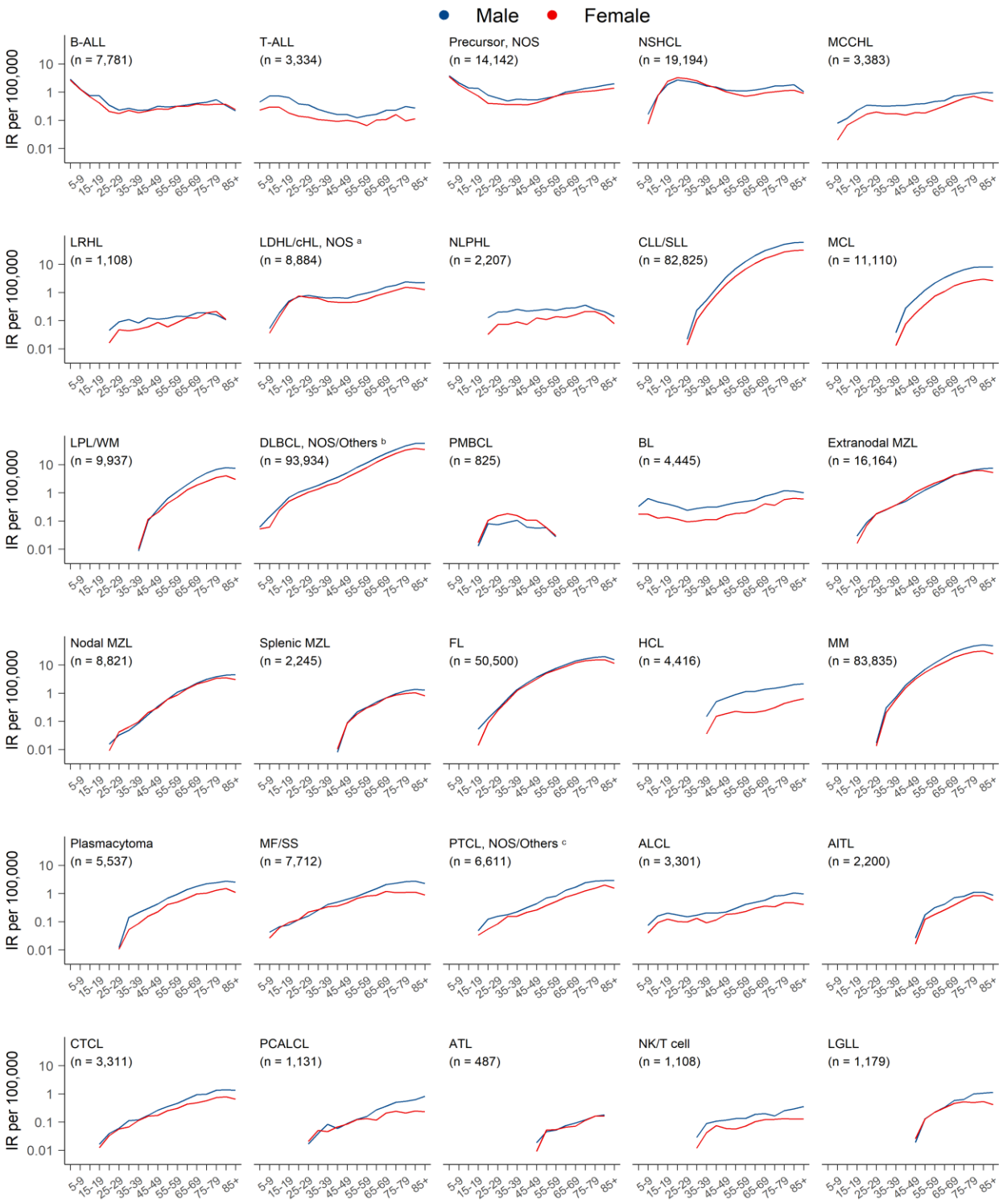
ALCL	0-9 to 85+	1.8 (-0.1, 3.8)	0-9 to 15-19 15-19 to 30-34 30-34 to 85+	58.8 (-3, 160.2) -10.3 (-43.8, 43.3) 21.2 (17.8, 24.7)*	0-9 to 85+	14.1 (11.3, 16.9)*
AITL	<50 to 85+	-2.5 (-6.6, 1.8)	<50 to 55-59 55-59 to 85+	266.6 (30.8, 927.6)* 22.3 (3.5, 44.5)*	<50 to 55-59 55-59 to 85+	259.5 (-27.7, 1687.9) 24.9 (0, 56)
CTCL	<20 to 85+	3.8 (1.8, 5.9)*	<20 to 25-29 25-29 to 65-69 65-69 to 85+	101.4 (-3.8, 321.5) 38.4 (31.9, 45.3)* 13.1 (2.4, 25)*	<20 to 35-39 35-39 to 75-79 75-79 to 85+	67.5 (33.8, 109.5)* 25.7 (19.9, 31.8)* -5.4 (-33.6, 34.8)
PCALCL	<30 to 85+	12.3 (7.3, 17.6)*	<30 to 85+	35.6 (29.8, 41.6)*	<30 to 50-54 50-54 to 85+	39.1 (20.5, 60.6)* 12.1 (2.6, 22.6)*
ATL	<50 to 55-59 55-59 to 80+	-29.2 (-34.8, -23.1)* 2.4 (0.5, 4.3)*	<50 to 55-59 55-59 to 80+	76.4 (40.9, 120.8)* 25.5 (18.5, 32.9)*	<50 to 80+	43.2 (21.9, 68.2)*
NK/T cell	<30 to 80+	1.3 (-2, 4.6)	<30 to 35-39 35-39 to 80+	85.4 (25.5, 173.7)* 12.9 (8.8, 17)*	<30 to 35-39 35-39 to 80+	122.3 (14.6, 331.2)* 9.4 (3.6, 15.7)*
LGLL	<50 to 85+	18.5 (12.3, 24.9)*	<50 to 55-59 55-59 to 85+	262.4 (56.9, 736.6)* 30.1 (15.5, 46.5)*	<50 to 55-59 55-59 to 85+	236.6 (49.3, 658.7)* 11.1 (-2.6, 26.8)
Others/Lymphoid, NOS	0-4 to 85+	0.6 (-0.7, 1.9)	0-4 to 35-39 35-39 to 70-74 70-74 to 85+	32.9 (24.5, 41.9)* 54.5 (50.8, 58.4)* 34.3 (28.1, 40.7)*	0-4 to 40-44 40-44 to 70-74 70-74 to 85+	35.6 (27.6, 44)* 56.5 (51.2, 61.9)* 28.8 (22.9, 34.9)*

* Denotes statistically significant APC changes at p-value < 0.05.

APC reflect the Joinpoint analyses across age groups for the incidence rates for each sex independetly.

Because of low counts, we combined age groups as follows: ages 0-9 years for ALCL, LDHL/NOS, MCCHL, MFS/SS, NSCHL, T-ALL; ages 0-19 years for NLPHL, DLBCL, NOS, PMBCL, extranodal MZL, FL, PTCL, NOS/Others, CTCL; ages 0-24 years for LRHL, nodal MZL; ages 0-29 years for CLL/SLL, MM, NK/T cell, Plasmacytoma, PCALCL; ages 0-39 years for MCL, LPL/WM, HCL; ages 0-44 years for splenic MZL; ages 0-49 years for AITL, ATL, LGLL; ages 55-85+ for PMBCL; ages ≥80 years for T-ALL, LRHL, NLPHL, ATL, NK/T cell.

Abbreviations: APC, Average percent change; CI, Confidence interval.


Male
Female
IR per 100,000
10
1
0.1
0.01
B-ALL
(n = 7,781)
T-ALL
(n = 3,334)
Precursor, NOS
(n = 14,142)
NSHCL
(n = 19,194)
MCCHL
(n = 3,383)
LRHL
(n = 1,108)
LDHL/cHL, NOS a
(n = 8,884)
NLPHL
(n = 2,207)
CLL/SLL
(n = 82,825)
MCL
(n = 11,110)
LPL/WM
(n = 9,937)
DLBCL, NOS/Others b
(n = 93,934)
PMBCL
(n = 825)
BL
(n = 4,445)
Extranodal MZL
(n = 16,164)
Nodal MZL
(n = 8,821)
Splenic MZL
(n = 2,245)
FL
(n = 50,500)
HCL
(n = 4,416)
MM
(n = 83,835)
Plasmacytoma
(n = 5,537)
MF/SS
(n = 7,712)
PTCL, NOS/Others c
(n = 6,611)
ALCL
(n = 3,301)
AITL
(n = 2,200)
CTCL
(n = 3,311)
PCALCL
(n = 1,131)
ATL
(n = 487)
NK/T cell
(n = 1,108)
LGLL
(n = 1,179)
5-9
15-19
25-29
35-39
45-49
55-59
65-69
75-79
85+

Supplementary Figure 1. Male and female incidence rates across 5-year age groups for lymphoid neoplasms. Cases diagnosed between 2001 and 2017 from 16 registries of the Surveillance, Epidemiology, and End Results Program.

a LDHL cases were combined with cHL, NOS because of limited case counts across age groups.
b Others include intravascular large B-cell lymphoma, primary effusion lymphoma, and plasmablastic lymphoma. Cases were combined because of low counts across age groups.
c Others include subcutaneous panniculitis-like T-cell lymphoma, enteropathy-type T-cell lymphoma, and hepatosplenic T-cell lymphoma. Cases were combined because of low counts across age groups.

Abbreviations: AITL, angioimmunoblastic T-cell lymphoma; ALCL, anaplastic large cell lymphoma; ATL, adult T-cell leukemia/lymphoma; B-ALL, B-cell lymphoblastic leukemia/lymphoma; BL, Burkitt leukemia/lymphoma; cHL, classical Hodgkin lymphoma; CLL/SLL, chronic lymphocytic leukemia/small lymphocytic lymphoma; CTCL, cutaneous T-cell lymphoma, NOS; DLBCL, diffuse large B-cell lymphoma; FL, follicular lymphoma; HCL, hairy cell leukemia; IR, incidence rate; LDHL, Lymphocyte-depleted Hodgkin lymphoma; LGLL, T-cell large granular lymphocytic leukemia; LPL/WM, lymphoplasmacytic lymphoma/Waldenström macroglobulinemia; LRHL, lymphocyte-rich Hodgkin lymphoma; MCCHL, mixed cellularity Hodgkin lymphoma; MCL, mantle cell lymphoma; MF/SS, mycosis fungoides/Sézary syndrome; MM, multiple myeloma; MZL, marginal zone lymphoma; NK/T cell, NK/T cell lymphoma; NLPHL, nodular lymphocyte predominant Hodgkin lymphoma; NOS, not otherwise specified; NSCHL, nodular sclerosis Hodgkin lymphoma; PCALCL, primary cutaneous anaplastic large cell lymphoma; PCN, plasma cell neoplasms; PMBCL, primary mediastinal large B-cell lymphoma; PTCL, peripheral T-cell lymphoma; T-ALL, T-cell lymphoblastic leukemia/lymphoma.