SUPPLEMENTARY MATERIALS

Supplementary Table 1. International Classification of Diseases for Oncology, 3rd Edition topography and morphology codes for primary cancers identified among patients in the National Cancer Database, 2003 – 2016

Cancer site	ICD-O-3 topography code	ICD-O-3 morphology codes
Acute Lymphocytic Leukemia	C910	All[a]
Acute Myeloid Leukemia	C920	All[a]
Anus, Anal Canal & Anorectum	C210 – C218	All[a]
Brain & Other Nervous System	C710 – C719, C728, C729	All[a]
Breast	C500 – C509	All[a]
Chronic Lymphocytic Leukemia	C911	All[a]
Colon	C180 – C189, C199	All[a]
Esophagus	C150 – C159	All[a]
Hodgkin Lymphoma	Any	9650–9667
Kidney & Renal Pelvis	C649, C659	All[a]
Larynx	C320	All[a]
Liver & Intrahepatic Bile Duct	C220, C21	All[a]
Lung & Bronchus	C340 – C349	All[a]
Melanoma of the Skin	C440 – C449	8720–8790
Multiple Myeloma	C900	All[a]
Non-Hodgkin Lymphoma	Any	9590–9597, 9670–9671, 9673, 9675, 9678–9680, 9684, 9687–9691, 9695, 9698–9702, 9705, 9708–9709, 9712, 9714–9719, 9724–9729, 9735, 9737–9738, 9761–9762, 9764, 9811–9818, 9820, 9823, 9826, 9827, 9831–9837, 9940, 9948, 9970
Other & Unspecified Primary Sites	C96	All[a]
Other Digestive Organs	C268 – C269, C488	All[a]
Other Leukemia	C420, C421, C424	All[a]
Other Non-Epithelial Skin	C440 – C449	Excluding 8000-8005, 8010-8046, 8050-8084, 8090-8110, 8720-8790[a]
Ovary	C569	All[a]
Pancreas	C250 – C259	All[a]
Pharynx	C10, C13, C140	All[a]
Prostate	C619	All[a]

Rectum	C209	All[a]
Small Intestine	C170 – C179	All[a]
Soft Tissue (including Heart)	C380, C47, C49	All[a]
Stomach	C160 – C169	All[a]
Testis	C620, C621, C629	All[a]
Thyroid	C739	All[a]
Tongue	C019, C020 – C029	All[a]
Urinary Bladder	C670 – C689	All[a]
Uterine Corpus	C540 – C559	All[a]
Uterine Cervix	C530 – C531, C538 – C539	All[a]
Vagina & Other Genital, Female	C529, C570 – C579	All[a]
Vulva	C510 – C512, C518 – C519	All[a]

[a]Cancers with the histology codes 9050 – 9055, 9140, and 9590 – 9989 were excluded.

Supplementary Table 2. Associations between transgender patients with stage at cancer diagnosis and receipt of cancer treatment by cancer site adjusted for type of health insurance among patients in the National Cancer Database, 2003 – 2016

Cancer site	Cancer stage at diagnosis[a]	No. transgender cases	OR (95% CI)	Received any cancer treatment[b]	No. transgender cases	OR (95% CI)[c]
Anus, Anal Canal & Anorectum						
	I and II	11	1.00 (Referent)	No	<10[e]	1.00 (Referent)
	III and IV	14	1.61 (0.73 to 3.56)	Yes	26	0.72 (0.16, 3.12)
Breast						
	0, I, and II	24	1.00 (Referent)	No	<10[e]	1.00 (Referent)
	III and IV	11	1.80 (0.87 to 3.70)	Yes	34	1.10 (0.15, 8.30)
Kidney & Renal Pelvis						
	I and II	19	1.00 (Referent)	No	<10[e]	1.00 (Referent)
	III and IV	<10[e]	0.65 (0.24 to 1.77)	Yes	17	0.22 (0.09 to 0.55)
Liver & Intrahepatic Bile Duct						
	I and II	14	1.00 (Referent)	No	13	1.00 (Referent)
	III and IV	<10[e]	0.76 (0.33 to 1.77)	Yes	13	0.74 (0.33 to 1.63)
Lung & Bronchus						
	I and II	12	1.00 (Referent)	No	20	1.00 (Referent)
	III and IV	63	1.76 (0.95 to 3.28)	Yes	59	0.81 (0.48 to 1.37)
Melanoma of the Skin						
	I and II	11	1.00 (Referent)	No	<10[e]	1.00 (Referent)
	III and IV	<10[e]	2.11 (0.77 to 3.28)	Yes	15	0.36 (0.07 to 1.86)
Non-Hodgkin Lymphoma						
	I and II	15	1.00 (Referent)	No	12	1.00 (Referent)
	III and IV	29	1.59 (0.85 to 2.97)	Yes	35	0.86 (0.44 to 1.68)
Pancreas						
	I and II	<10[e]	1.00 (Referent)	No	<10[e]	1.00 (Referent)
	III and IV	10	1.12 (0.41 to 3.08)	Yes	<10[e]	0.35 (0.12 to 1.00)
Prostate[d]						
	I and II	25	1.00 (Referent)	No	<10[e]	1.00 (Referent)
	III and IV	10	1.69 (0.81 to 3.55)	Yes	30	0.95 (0.39 to 2.31)
Rectum						
	I and II	12	1.00 (Referent)	No	0	1.00 (Referent)
	III and IV	11	0.80 (0.35 to 1.82)	Yes	26	—[f]
Urinary Bladder						

| 0, I, and II | <10[e] | 1.00 (Referent) | No | 0 | 1.00 (Referent) |
| III and IV | <10[e] | 2.11 (0.76 to 5.89) | Yes | 15 | —[f] |

[a]OR calculated with multivariable logistic regression for the association of being transgender (using cisgender as reference group) with Stages III and IV vs Stage 0 (if applicable), I, and II, adjusted for age at diagnosis (18–44, 45–54, 55–64, or ≥65 years), year of diagnosis (2004–2006, 2007–2010, or 2011–2014), race/ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic, or other), and insurance status (private insurance, 18-64 Medicare/Medicaid, ≥65 Medicare/Medicaid, uninsured, or Government/unknown).

[b]Cancer treatment is defined as chemotherapy, surgery, and radiotherapy for all sites except lymphoma. Treatment for lymphoma, is defined as chemotherapy and radiotherapy.

[c]OR calculated with multivariable logistic regression for the association of being transgender (using cisgender as reference group) with cancer treatment, adjusted for age at diagnosis (18–44, 45–54, 55–64, or ≥65 years), year of diagnosis (2004–2006, 2007–2010, or 2011–2014), race/ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic, or other), and insurance status (private insurance, 18-64 Medicare/Medicaid, ≥65 Medicare/Medicaid, uninsured, or Government/unknown), and AJCC stage (0-II, III/IV, or unknown).

[d]Sex-specific site uses cismen only as reference group.

[e]Cells with more than 0 but fewer than 10 individuals are suppressed.

[f]An em-dash indicates that the cell size is too small to calculate the OR.

Abbreviation: AJCC, American Joint Committee on Cancer; CI: confidence interval; No, number; and OR, odds ratio.

Supplementary Table 3. Associations between transgender patients and mortality after cancer diagnosis adjusted for type of health insurance by cancer site among patients in the National Cancer Database 2003 – 2013

Cancer Site	Gender Identity	No. of deaths	HR (95% CI)[a]
Anus, Anal Canal & Anorectum			
	Cisgender	16,193	1.00 (Referent)
	Transgender	<10[b]	0.76 (0.40 to 1.47)
Breast			
	Cisgender	35,8042	1.00 (Referent)
	Transgender	<10[b]	1.20 (0.57 to 2.53)
Kidney & Renal Pelvis			
	Cisgender	127,260	1.00 (Referent)
	Transgender	<10[b]	1.29 (0.61 to 2.71)
Liver & Intrahepatic Bile Duct			
	Cisgender	111,818	1.00 (Referent)
	Transgender	19	1.02 (0.65 to 1.61)
Lung & Bronchus			
	Cisgender	1,047,162	1.00 (Referent)
	Transgender	46	0.99 (0.74 to 1.32)
Melanoma of the Skin			
	Cisgender	78,729	1.00 (Referent)
	Transgender	<10[b]	0.94 (0.45 to 1.97)
Non-Hodgkin Lymphoma			
	Cisgender	165,989	1.00 (Referent)
	Transgender	20	2.03 (1.31 to 3.14)
Pancreas			
	Cisgender	212,072	1.00 (Referent)
	Transgender	<10[b]	1.10 (0.63 to 1.94)
Prostate			
	Cisgender	261,123	1.00 (Referent)
	Transgender	<10[b]	1.73 (0.96 to 3.12)
Rectum			
	Cisgender	128,998	1.00 (Referent)
	Transgender	<10[b]	1.39 (0.79 to 2.44)
Urinary Bladder			
	Cisgender	118,948	1.00 (Referent)
	Transgender	<10[b]	2.53 (1.21 to 5.31)

[a]Adjusted for age at diagnosis, (18–44, 45–54, 55–64, or ≥65 years), year of diagnosis (2003–2007, 2008–2011, or 2012–2013), race/ethnicity (non-Hispanic White, Black, Hispanic, or other), health insurance status (private insurance, 18-64 Medicare/Medicaid, ≥65 Medicare/Medicaid, uninsured, or Government/unknown), AJCC stage (0-II, III/IV, or unknown), and treatment (yes or no).
[b]Cells with more than 0 and fewer than 10 individuals are suppressed.
Abbreviations: AJCC, American Joint Committee on Cancer; CI, confidence interval; HR, hazard ratio; No, number.

Supplementary Table 4. Associations between transgender patients with receipt of cancer treatment by cancer site among patients in the National Cancer Database, 2003 – 2016, excluding individuals who refused treatment with and without adjustment for type of health insurance

Cancer Site	Received any cancer treatment[a]	No. transgender cases	Model 1 OR (95% CI)[b]	Model 2 OR (95% CI)[c]
Anus, Anal Canal & Anorectum				
	No	<10[e]	1.00 (Referent)	1.00 (Referent)
	Yes	26	0.68 (0.16 to 2.94)	0.59 (0.14 to 2.57)
Breast				
	No	<10[e]	1.00 (Referent)	1.00 (Referent)
	Yes	34	1.03 (0.14 to 7.76)	0.91 (0.12 to 6.81)
Kidney & Renal Pelvis				
	No	<10[e]	1.00 (Referent)	1.00 (Referent)
	Yes	17	0.26 (0.10 to 0.68)	0.22 (0.09 to 0.59)
Liver & Intrahepatic Bile Duct				
	No	13	1.00 (Referent)	1.00 (Referent)
	Yes	13	0.73 (0.33 to 1.60)	0.64 (0.29 to 1.42)
Lung & Bronchus				
	No	20	1.00 (Referent)	1.00 (Referent)
	Yes	59	0.81 (0.48 to 1.38)	0.74 (0.43 to 1.26)
Melanoma of the Skin				
	No	<10[e]	1.00 (Referent)	1.00 (Referent)
	Yes	15	0.36 (0.07 to 1.85)	0.34 (0.07 to 1.75)
Non-Hodgkin Lymphoma				
	No	12	1.00 (Referent)	1.00 (Referent)
	Yes	35	0.86 (0.44 to 1.67)	0.86 (0.44 to 1.69)
Pancreas				
	No	<10[e]	1.00 (Referent)	1.00 (Referent)
	Yes	<10[e]	0.37 (0.13 to 1.09)	0.35 (0.12 to 1.02)
Prostate[d]				
	No	<10[e]	1.00 (Referent)	1.00 (Referent)
	Yes	30	0.94 (0.39 to 2.29)	0.82 (0.34 to 1.99)
Rectum				
	No	0	1.00 (Referent)	1.00 (Referent)
	Yes	26	— [f]	—[f]
Urinary Bladder				
	No	0	1.00 (Referent)	1.00 (Referent)
	Yes	15	—[f]	—[f]

[a]Cancer treatment is defined as chemotherapy, surgery, and radiotherapy for cancer site except lymphoma; for lymphoma, chemotherapy and radiotherapy are defined as cancer treatment. Patients who refused treatment were excluded.

[b]OR calculated with multivariable logistic regression for the association of being transgender (using cisgender as reference group) with cancer treatment, adjusted for age at diagnosis (18–44, 45–54, 55–64, or ≥65 years), year of diagnosis (2004–2006, 2007–2010, or 2011–2014), race/ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic, or other), insurance status (private insurance, 18-64 Medicare/Medicaid, ≥65 Medicare/Medicaid, uninsured, or Government/unknown), and AJCC stage (0-II, III/IV, or unknown).

[c]OR calculated with multivariable logistic regression for the association of being transgender (using cisgender as reference group) with cancer treatment, adjusted for age at diagnosis (18–44, 45–54, 55–64, or ≥65 years), year of diagnosis (2004–2006, 2007–2010, or 2011–2014), race/ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic, or other), and AJCC stage (0-II, III/IV, or unknown).

[d]Sex-specific site which only use cismen as reference group.

Supplementary Figure 1. CONSORT Flow Diagram for Cancer Stage, Treatment, and Survival among Transgender Patents in the United States

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                    ┌─────────────────────────────┐
                    │ Patients newly diagnosed with│
                    │ first primary malignant tumors in│
                    │      NCDB 2003–2016         │
                    │                             │
                    │       (n=12,024,572)        │
                    └─────────────────────────────┘
                                 │
                                 │          ┌──────────────────────────────────────┐
                                 │          │ Excluded (n=247,873)                 │
                                 ├─────────▶│ • Unknown cancer site (n=132,258)    │
                                 │          │ • Age <18 or unknown (n=112,898)     │
                                 │          │ • Other (hermaphrodite) (n=445)      │
                                 │          │ • Missing sex (n=2,272)              │
                                 │          └──────────────────────────────────────┘
                                 │
                    ┌─────────────────────────────┐
                    │  Eligible (n=11,776,699)    │
                    └─────────────────────────────┘
                                 │
              ┌──────────────────┴──────────────────┐
     ┌──────────────────┐              ┌──────────────────────┐
     │   Transgender    │              │     Cisgender        │
     │    (n=589)       │              │   (n=11,776,110)     │
     └──────────────────┘              └──────────────────────┘
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Unknown stage (n=109)

Unknown stage (n=1,443,140)

Stage analyses (n=480)

Stage analyses (n=10,332,970)

Treatment analyses (n=589)

Treatment analyses (n=11,776,110)

Unknown diagnosis date (n=0)
Unknown last contact date (n=0)

Unknown diagnosis date (n=30,510)
Unknown last contact date (n=3,289)

Survival analyses (n=589)

Survival analyses (n=11,742,311)