

Skin Cancer and Genital Cancer Risk Among Non-White Solid Organ Transplant Recipients in the US, 2000 – 2022

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Background

Solid organ transplant recipients (SOTRs) are at increased risk for developing skin cancer. Risk among Non-White SOTRs is poorly understood. Previous studies have shown an increased risk of genital cancers among Non-White SOTRs. Thus, we sought to characterize the risk of keratinocyte carcinoma, melanoma, and genital cancer among SOTRs stratified across six racial/ethnic groups using a nationwide transplant information database.

Methods

- IRB-approved cohort study (#23-38668)
- SOTRs in the United States between January 1, 2000 and September 30, 2022
- Data obtained from the United Network for Organ Sharing (UNOS) transplant information database
- 6 racial ethnic groups
- Compare rates of SCC, BCC, and melanoma: unadjusted incidence rates (IR) per 100,000 person-years, hazard ratios (HR) (adjust for age, sex, type of transplant, prior history of skin cancer)
- Compare rates of genital cancer: unadjusted IR per 100,000 person-years, HR (adjust for age, sex, and type of transplant)
- Stata v18.0 (Statacorp LLC) , p<0.05 was significant

Table 1. Clinical Characteristics of Solid Organ Transplant Recipients in the US from January 2000 to September 2022, stratified by Race/Ethnicity

Characteristic	Overall	White, Non-Hispanic	Non-White ^a	American Indian or Alaska Native	Hispanic	Native Hawaiian or Other Pacific Islander	Asian	Black
Total Number (%)	696,076	432,017 (62.1)	264,059 (37.9)	5,365 (0.8)	79,346 (11.4)	2,415 (0.4)	34,156 (4.9)	142,777 (20.5)
Sex								
Female	263,604 (37.9%)	157,696 (36.5%)	105,908 (40.1%)	2,368 (44.1%)	30,282 (38.2%)	1,057 (43.8%)	13,902 (40.7%)	58,299 (40.8%)
Male	432,472 (62.1%)	274,321 (63.5%)	158,151 (59.9%)	2,997 (55.9%)	49,064 (61.8%)	1,358 (56.2%)	20,254 (59.3%)	84,478 (59.2%)
Age and Follow-up time ^b								
Mean age (years) at transplant [SE]	49.1 [0.02]	50.1 [0.02]	47.5 [0.03]	48.2 [0.22]	46.2 [0.06]	45.7 [0.35]	49.9 [0.09]	47.6 [0.04]
Mean overall follow-up time (years) [SE]	6.44 [0.01]	6.81 [0.01]	5.84 [0.01]	5.87 [0.07]	5.37 [0.02]	6.00 [0.10]	6.35 [0.03]	5.97 [0.01]
Mean age (years) at first skin cancer diagnosis [SE]	63.1 [0.05]	63.1 [0.05]	62.8 [0.25]	61.9 [0.90]	63.0 [0.34]	60.9 [2.29]	66.7 [0.61]	60.8 [0.49]
Transplanted organ								
High risk ^c	101,991 (14.7%)	74,358 (17.2%)	27,633 (10.5%)	388 (7.2%)	7,756 (9.8%)	261 (10.8%)	2,818 (8.3%)	16,410 (11.5%)
Low risk	594,085 (85.3%)	357,659 (82.3%)	236,426 (89.5%)	4,977 (92.8%)	71,590 (90.2%)	2,154 (89.2%)	31,338 (91.7%)	126,367 (88.5%)
Skin cancer incidence								
No. (%) with any incident skin cancer ^d	43,201 (6.2)	41,311 (9.6)	1,890 (0.7)	92 (1.7)	939 (1.2)	27 (1.1)	278 (0.8)	554 (0.4)
No. (%) with incident SCC	32,491 (4.7)	31,085 (7.2)	1,406 (0.5)	65 (1.2)	642 (0.8)	17 (0.7)	204 (0.6)	478 (0.3)
No. (%) with incident BCC	18,047 (2.6)	17,521 (4.0)	526 (0.2)	28 (0.5)	334 (0.4)	11 (0.5)	77 (0.2)	76 (0.1)
No. (%) with incident melanoma	2,814 (0.4)	2,730 (0.6)	84 (0.0)	6 (0.1)	48 (0.1)	1 (0.0)	9 (0.0)	20 (0.0)
Mean [SE] time (years) from transplant to first skin cancer diagnosis	5.16 [0.02]	5.13 [0.02]	5.77 [0.09]	6.28 [0.45]	4.79 [0.11]	5.47 [0.76]	6.94 [0.27]	6.76 [0.19]
Genital cancer incidence								
No. (%) with genital cancer	538 (0.08)	385 (0.09)	153 (0.06)	0 (0.00)	6 (0.02)	115 (0.08)	32 (0.04)	0 (0.00)
Mean [SE] time from transplant to genital cancer diagnosis	7.09 [0.20]	7.14 [0.24]	6.98 [0.36]	N/A	6.61 [1.63]	7.41 [0.43]	5.49 [0.63]	N/A

Table 2. SCC, BCC, Melanoma incidence rates per 100,000 person-years (95% CI) and Adjusted Hazard ratios, stratified by Race/Ethnicity

Skin Cancer Type	Overall	White, Non-Hispanic	Non-White ^a	American Indian or Alaska Native	Hispanic	Native Hawaiian or Other Pacific Islander	Asian	Black
Incidence rates per 100,000 person-years [95% CI] ^{b,c}								
Any skin cancer ^d	1007 [998, 1017]	1500 [1485, 1514]	123 [118, 129]	295 [241, 362]	222 [208, 237]	188 [129, 274]	129 [115, 145]	65 [60, 71]
SCC	750 [742, 759]	1113 [1101, 1126]	91 [87, 96]	208 [163, 265]	151 [140, 164]	118 [73, 190]	94 [82, 108]	56 [51, 61]
BCC	411 [405, 417]	615 [606, 624]	34 [31, 37]	89 [62, 129]	79 [71, 87]	76 [42, 138]	36 [28, 44]	9 [7, 11]
Melanoma	63 [61, 65]	93 [90, 97]	5 [4, 7]	19 [9, 42]	11 [8, 15]	7 [1, 49]	4 [2, 8]	2 [2, 4]
Adjusted hazard ratio of incident skin cancer [95% CI] ^{b,c,e}								
Any skin cancer ^d	N/A	1.00	0.10 [0.10, 0.11]	0.25 [0.20, 0.31]	0.19 [0.18, 0.21]	0.17 [0.12, 0.25]	0.10 [0.09, 0.11]	0.05 [0.05, 0.06]
SCC	N/A	1.00	0.10 [0.10, 0.11]	0.24 [0.19, 0.31]	0.18 [0.16, 0.19]	0.15 [0.09, 0.24]	0.10 [0.08, 0.11]	0.06 [0.06, 0.07]
BCC	N/A	1.00	0.07 [0.06, 0.07]	0.18 [0.12, 0.26]	0.16 [0.14, 0.18]	0.16 [0.09, 0.30]	0.06 [0.05, 0.08]	0.02 [0.01, 0.02]
Melanoma	N/A	1.00	0.07 [0.06, 0.09]	0.25 [0.11, 0.55]	0.15 [0.11, 0.19]	0.10 [0.01, 0.68]	0.05 [0.03, 0.09]	0.03 [0.02, 0.05]

Table 3. Genital cancer incidence rates per 100,000 person-years (95% CI) and Adjusted Hazard ratios, stratified by Race/Ethnicity								
	Overall	White, Non-Hispanic	Non-White ¹	American Indian or Alaska Native	Asian	Black	Hispanic	Native Hawaiian or Other Pacific Islander
Incidence rates per 100,000 person-years [95% CI] ²								
Overall cohort	12.2 [11.2, 13.3]	13.3 [12.0, 14.7]	10.2 [8.7, 11.9]	0 [N/A]	2.8 [1.3, 6.3]	13.9 [11.6, 16.7]	7.6 [5.4, 10.8]	0 [N/A]
Female Recipients	26.4 [24.1, 29.0]	29.8 [26.7, 33.2]	20.6 [17.3, 24.5]	0 [N/A]	4.5 [1.7, 11.9]	27.5 [22.5, 33.6]	17.2 [11.9, 25.0]	0 [N/A]
Male Recipients	3.3 [2.7, 4.0]	3.5 [2.7, 4.5]	2.8 [1.9, 4.2]	0 [N/A]	1.6 [0.4, 6.5]	4.0 [2.5, 6.2]	1.5 [0.6, 4.1]	0 [N/A]
Adjusted hazard ratio of incident skin cancer [95% CI] ^{3,4}								
Overall cohort	N/A	1.00	0.80 [0.66, 0.96]	N/A	0.21 [0.09, 0.47]	1.05 [0.85, 1.29]	0.67 [0.47, 0.96]	N/A
Female Recipients	N/A	1.00	0.78 [0.63, 0.95]	N/A	0.16 [0.06, 0.44]	1.01 [0.80, 1.27]	0.69 [0.47, 1.02]	N/A
Male Recipients	N/A	1.00	0.93 [0.58, 1.48]	N/A	0.49 [0.12, 1.98]	1.30 [0.78, 2.18]	0.53 [0.19, 1.47]	N/A

Results

696,076 SOTRs (38% female, 15% high-risk transplanted organ-type), (62% White, Non-Hispanic, 38% Non-White). (Table 1).

SCC, BCC, Melanoma

White, Non-Hispanic recipients had IR per 100,000 person-years of 1113 [95% CI 1101, 1126], 615 [95% CI 606, 624], and 93 [95% CI 90, 97] for SCC, BCC, and melanoma, respectively. Non-White recipients had significantly lower IR of all analyzed skin cancers (p<0.01).

Genital Cancer

538 genital cancers were reported, with 83% occurring among female SOTRs. White, Non-Hispanic SOTRs had a genital cancer IR of 13.3 [95% CI 12.0, 14.7] per 100,000 person-years. Non-White SOTRs had a lower overall rate of genital cancer (HR = 0.80 [95% CI 0.66, 0.96], p = 0.02).

Discussion

SCC, BCC, Melanoma

Non-White SOTRs had significantly lower risk of SCC, BCC, and melanoma compared to Whites. Our findings align with a 2019 Delphi consensus: 1) high-risk Caucasian, 2) low-risk Caucasian, Hispanic, Asian, and high-risk Black, and 3) low-risk Black. Our findings support the addition of AIANs and Native Hawaiian or Other Pacific Islanders to the second risk category.

Genital Cancer

Non-White SOTRs had a significantly lower rate of genital cancer, which diverges from prior studies. While the risk of genital cancers amongst SOTRs was low overall, the risk is markedly increased from baseline (0.002% for male SOTRs vs less than 0.001% risk of penile cancer in the general population and 0.20% for female SOTRs vs 0.00003% risk of vulvar cancer in the general population).

Conclusion

- **Black and White recipients, women in particular, should be asked about a history of genital warts and be counseled about genital self-exams**
- **Full-skin assessments should still be performed in all recipients in accordance with screening guidelines**