



Racial and gender disparities in the incidence of anal cancer: analysis of the Nationwide Inpatient Sample (NIS)

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Background: Racial and gender disparities have been shown in other gastrointestinal cancers. However, there is a paucity of data on racial and gender disparities in anal cancer (AC). The aim of this study was to assess racial and gender disparities among patients with AC.

Methods: We analyzed data from the National Inpatient Sample (NIS) 2011 database of patients diagnosed with AC with age ≥ 18 . Demographic data including age, race and gender were assessed. Patients were stratified based on race and gender. Log binomial regression was used to generate risk ratios.

Results: A total of 6,013,105 patients were assessed and 1,956 (0.03%) patients had AC. Female patients were more at risk of developing AC [relative risk (RR): 1.14, $P=0.02$]. Whites and Blacks had the highest incidence followed by Asians/Pacific Islanders. Black males had increased risk of AC (RR: 1.43, $P<0.01$). Amongst Hispanics; both males (RR: 0.69, $P=0.05$) and females (RR: 0.46, $P<0.0001$) had decreased risk of developing AC. Finally, we saw that Asian females had a much lower risk of developing AC (RR: 0.33, $P<0.01$).

Conclusions: Racial disparities and gender differences exist in the incidence of AC. Potential causes for this disparity are disparate access to healthcare, lack of education, and lack of awareness. Greater understanding of the racial disparity in AC can help identify at risk population and eventually lead to improved preventative measures to ultimately reduce the incidence of AC.

Keywords: Racial and gender disparities in anal cancer

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Introduction

Anal cancer (AC) is an uncommon form of cancer with a low prevalence of 0.2%, and a lifetime risk of about 1 in 500 people (1,2). AC accounts for 1.5% of gastrointestinal cancer cases, and 4% of cancer-related deaths (3). Symptoms for AC include: rectal bleeding, rectal itching, lump or mass at the anal opening, pain or feeling of fullness in the anal area, changes in bowel movements, abnormal

discharge from the anus, and swollen lymph nodes in the anal or groin areas (3,4).

Incidence of AC has risen over the past 25 years with an estimated 8,580 new cases and about 1,600 projected deaths due to AC in 2018 (5). Cultural changes have introduced risk factors contributing to the increase in AC. These changes include infection with human papilloma virus (HPV), suppressed immune system due to human immunodeficiency virus (HIV) or organ transplants,

smoking, genital or anal warts, anoreceptive intercourse, multiple sex partners, and history of cervical, vulvar, or vaginal cancer (6-8). Clinical research in AC describes its relationship with income levels and demographic factors, where lower income levels have more severe cases of AC (9-11). Interestingly, other research suggests that higher levels of education are associated with increased incidence in AC for males and females (12).

Delay in diagnosis is not uncommon as patients and physicians might attribute symptoms to hemorrhoids or other colorectal complications. In addition, approximately 20% of patients show no symptoms at time of diagnosis (4). Early detection of AC is easily treatable, but complications arise as AC progresses (13). Current treatments for AC involve combinations of chemoradiation and surgery, which ultimately depends on the staging of AC and response to treatment (4,14).

Racial and gender disparities have been well-documented for most colorectal cancer cases, but AC is yet to be well established. Previous studies suggest that Black males and White females have increased risk for AC (15).

The aim of this study is to assess racial and gender disparities among patients with AC. Greater understanding of AC will result in earlier detection, prevention methods, improved treatments, and better prognosis.

Methods

Data source

This is a 1-year (January – December 2011) retrospective cohort analysis of the National Inpatient Sample (NIS) database which is maintained by the Agency for Healthcare Research and Quality as part of the Healthcare Cost and Utilization Project (HCUP). The NIS database is the largest all-payer in-patient care database publicly available in the United States. It covers 95% of the US population and includes comprehensive abstracted discharged data. The data in the NIS are derived from a stratified sample of 20% of the discharges from all community hospitals (non-federal, short-term, general, and specialty hospitals) in the US (10). The data are weighted back to help make population estimates of the various parameters. For the year 2009, the NIS contains information for 7.4 million weighted discharges from 4,121 hospitals across 44 states (10).

For our study, the use of NIS database was conformed to the data-use agreement from HCUP. This study was reviewed by the University of Arizona, Institutional Review

Board and was determined to be exempt from the need for approval.

Patient population

Patients age >18 with diagnosis of AC were identified using the International Classification of Diseases and Injuries codes (Ninth Revision). Patients with missing information of age, diagnosis, and race description were excluded.

Data points collected

From the 2011 NIS database, we retrieved age, gender, race, and diagnoses for AC.

Statistical analysis

Patients were then stratified by race (Whites, Blacks, Hispanics, Asians/Pacific Islanders, and Native Americans). Data are reported as mean \pm standard deviation (SD) for continuous descriptive variables, median [range] for ordinal descriptive variables and as proportions for categorical variables. We performed One-way Analysis of Variance (ANOVA), Pearson's Chi-square test (categorical variables), and independent *t*-test (continuous variables) to compare demographics. Log-binomial regression was performed to derive relative risk (RR), while adjusting for age and gender, and then for IBD. For our study, we considered P value ≤ 0.05 as statistically significant. All statistical analyses were performed using Statistical Package for Social Sciences (SPSS, Version 20; SPSS, Inc., Chicago, IL, USA).

Results

There were a total of 6,013,105 cases analyzed in our study, of which 40.5% were male. Of these, 70.7% [4,250,073] of our total cases were classified as White, 15.7% [944,957] as Black, 10.9% [652,905] as Hispanic, 2.2% [130,472] as Asian/Pacific Islander, and 0.6% [34,698] as Native American (Table 1). Of all the patients sampled, 0.02% [1,305] had a diagnosis of AC. Stratifying by race, we see that out of the Whites, Blacks, Hispanics, Asian/Pacific Islanders, and Native Americans, 0.02% [986], 0.02% [222], 0.01% [77], 0.01% [15], and 0.01% [5] had a diagnosis of AC, respectively.

After adjusting for age, gender, and race in log-binomial regression, we find that out of all patients, increasing age (RR: 1.005, $P < 0.001$) and female gender (RR: 1.14, $P = 0.02$)

Table 1 Demonstrates the total amount of cases diagnosed with anal cancer

Variable	Total number of cases with anal cancer (% for all cases)	Total number of all cases
Race		
White	986 (0.02)	4,250,073
Black	222 (0.02)	944,957
Hispanic	77 (0.01)	652,905
Asian/Pacific Islander	15 (0.01)	130,472
Native American	5 (0.01)	34,698
Total	1,305 (0.02)	6,013,105

Table 2 Demonstrates risk ratios

Variable	RR (95% CI)		RR (95% CI)		M vs. F ^b (P value)
	Unadjusted	Adjusted ^a	Male ^b	Female ^b	
Age	1.005** (1.003, 1.008)	1.005* (1.002, 1.007)	–	–	–
Female	1.10 (0.99, 1.23)	1.14* (1.02, 1.28)	–	–	–
Race (vs. White)					
Black	1.01 (0.88, 1.17)	1.05 (0.91, 1.22)	1.43* (1.14, 1.78)	0.86 (0.70, 1.04)	0.74
Hispanic	0.51** (0.40, 0.64)	0.54** (0.42, 0.68)	0.69* (0.48, 1.00)	0.46** (0.34, 0.62)	0.82
Asian	0.50* (0.30, 0.83)	0.51* (0.31, 0.85)	0.93 (0.46, 1.87)	0.33* (0.16, 0.70)	0.91
Native American	0.62 (0.26, 1.50)	0.65 (0.27, 1.57)	0.78 (0.20, 3.16)	0.58 (0.19, 1.81)	0.49
IBD	1.86* (1.23, 2.80)	1.85* (1.22, 2.79)	–	–	–

*, $P \leq 0.05$; **, $P < 0.0001$; ^a, adjusted for age, gender, race, and IBD; ^b, adjusted for age and IBD.

conferred an increased risk for developing AC, whereas Asian race (RR: 0.51, $P=0.01$), and Hispanic race (RR: 0.54, $P<0.0001$) conferred a decreased risk for developing AC (Table 2).

When taking both race and gender into consideration, we find that Black males (RR: 1.43, $P<0.01$) have an increased risk of developing AC with no difference seen in Black females ($P=0.12$). In Hispanics, we see that both Hispanic males (RR: 0.69, $P=0.05$) and females (RR: 0.46, $P<0.0001$) had a decreased risk of developing AC. Finally, we see that Asian females (but not Asian males) have a much lower risk of developing AC (RR: 0.33, $P<0.01$).

Interestingly we did a subgroup analysis of patients with AC and IBD. Patients with diagnosis of IBD had an increased the risk of developing AC (RR: 1.85, $P<0.01$).

Discussion

Our study sought to identify any racial and gender disparities present in individuals with AC. Our results

showed that there are clearly racial disparities in the incidence of AC. Black males have an increased risk of developing AC. Increased risk of AC is less about race and affected more by gender.

Previous studies have shown that the decreased risk of AC seen in Hispanics and Asians may be due to more access to HPV vaccines at early ages (16). Access to HPV vaccines at an early age decreases the likelihood of being infected with any strains associated with AC (11,12,17).

Interestingly, we also saw that patients with IBD have an increased risk for AC. This may be due to Crohn's disease causing fistula-associated anal carcinoma for patients who suffer from long-term fistulas. Mucin-producing variants have also been reported to cause adenocarcinoma in the anus (18,19). Previous studies have shown that IBD increases an individual's chance of developing colon cancer which may be true for AC (20). Our data set did not distinguish between Crohn's or ulcerative colitis and AC. Further studies would need to be done in order to

thoroughly understand the relationship of IBD and AC.

This study has limitations. The fact that it is a retrospective study confers inherent limitation. Our sample size encompassed more than 6 million individuals, but due to the small number of individuals with AC (Asian/Pacific Islanders and Native Americans), it may be prudent to perform meta-analyses to generate more power for statistical analysis. Another limitation is that we were not able to separate Crohn's diseases from ulcerative colitis to better understand which confers more risk of developing AC. One of the risk factors for developing AC is infection with HPV, but this data was not available in the database and could not be included in our analyses. A previous study demonstrates that higher levels of education are associated with increased risk of AC, but in our study, we could not control for levels of education due to our database not having that information (12). Our results show that Black males have increased risk of AC, but we cannot conclude that it is due to race instead of levels of education since we could not control for that variable. Despite the study's limitations, it is significant enough to show that there are racial and gender disparities in individuals with AC.

Future studies to incorporate larger and more detailed data sets should shed more light on this rare but significant disease. Greater understanding will help identify at-risk populations and eventually lead to improved preventative measures to ultimately reduce the incidence of AC.

Conclusions

Racial disparities and gender differences exist in the incidence of AC. Potential causes for this disparity are disparate access to healthcare, lack of education, and lack of awareness. Greater understanding of the racial disparity in AC can help identify at risk population and eventually lead to improved preventative measures to ultimately reduce the incidence of AC.

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None.

Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

Ethical Statement: This study was reviewed by the University

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