

https://dspace.org/

Risk Factors for Unresected Gastric Adenocarcinoma in South Africa A National Cancer Registry Analysis

Naeelah Parker; Neha Sangana; C Gaskill; Mazvita Muchengeti; Wenlong Chen ...

WILEY-BLACKWELL
https://hdl.handle.net/10539/48970
WOS

Downloaded from a DSpace repository. https://dspace.org/

Check for updates

Risk Factors for Unresected Gastric Adenocarcinoma in South Africa: A National Cancer Registry Analysis

Naeelah Parker, MBChB[1]; Neha Sangana, MD[2]; Cameron E. Gaskill, MD, MPH[3]; Mazvita Muchengeti, PhD[4,5,6]; Wenlong C. Chen, PhD[4,7,8]; Galya Chinnery, MBChB, FCS(SA)[9]; Jeanne Lubbe, MBChB, MMed(Surg), FCS(SA), PhD[1]; and Kathryn M. Chu, MD, MPH[1]

DOI https://doi.org/10.1200/GO-25-00162

ABSTRACT

PURPOSE To describe the proportion of biopsy-proven gastric adenocarcinoma (GAC) that was surgically resected in South Africa (SA) and explore contributory factors for nonresection.

METHODS This was a national retrospective study of GAC from 2015 to 2020 in SA using data available from the National Cancer Registry. Risk factors for nonresection were modeled using logistic regression.

RESULTS 3,919 individuals had biopsy-proven GAC, and of these, 560 (13.4%) had a surgical resection. Black race (odds ratio [OR], 2.3; $P < .001$), female sex (OR, 1.3, $P = .020$), and being uninsured (OR, 3.7, $P < .001$) were associated with nonresection. Resection rates showed a nonlinear increasing trend over time.

CONCLUSION The majority of GACs in SA were not resected, and race, sex, and health insurance status were associated with nonresection. Additional research to understand ways to mitigate barriers related to social determinants of health are needed to make cancer care more equitable in SA.

ACCOMPANYING CONTENT

Appendix

Reflexivity Statement

Accepted October 23, 2025

Published December 23, 2025

JCO Global Oncol 11:e2500162

© 2025 by American Society of Clinical Oncology

Creative Commons Attribution Non-Commercial No Derivatives 4.0 License

Downloaded from ascopubs.org by 165.16.184.93 on January 31, 2026 from 165.016.184.093
Copyright © 2026 American Society of Clinical Oncology. All rights reserved.

INTRODUCTION

Gastric adenocarcinoma (GAC) is the fifth most common malignancy worldwide and the third leading cause of cancer-related mortality.[1] In sub-Saharan Africa, GAC is a leading cause of cancer mortality with over 20,000 deaths per year.[2] Generally, optimal treatment combines surgical resection with chemotherapy, with international guidelines recommending a multidisciplinary approach. Early-stage GAC may be treated with endoscopic resection alone. Distant metastatic or unresectable disease may not benefit from surgical resection and the role of immunotherapy is becoming more important. Determining national GAC resection rates can be useful to understand overall access to gastric cancer care. The proportion of individuals diagnosed with GAC on biopsy that undergo resection can be a proxy for access to early diagnosis, perioperative oncological therapy and cancer care, and surgical resection for a population or health system.

GAC resection rates in low- and middle-income countries are rarely reported. South Africa (SA) is a middle-income country with significant health care inequities for certain population groups, locations, and insurance status.[3] The WHO Global Cancer Observatory estimated 1,919 GAC cases in SA in 2022, with an estimated 1,622 GAC-related deaths. The primary objective of this study was to describe the proportion of persons with biopsy-proven GAC that did not undergo surgical resection and determine associated contributory factors to nonresection. The secondary objective was to determine associated contributory factors for no preoperative biopsy among patients who underwent surgical resection for GAC.

METHODS

This was a retrospective analysis of all GAC cases identified by the SA National Cancer Registry (NCR) from 2015 to 2020. Adenocarcinoma accounts for most of gastric malignancies, and other histologic types were excluded because of differing epidemiology and treatment.[4] The NCR is a branch of the National Health Laboratory Services (NHLS). As per 2011 South African legislation, all cancer histopathology, cytology and bone marrow reports collected in the public or private health sector must be submitted to and registered with the NCR. The index-cancer diagnosis for each patient, for a specific cancer, is then used for the national cancer incidence reporting.[5] Deidentified reports were provided by the NHLS Corporate Data Warehouse for all gastric cancer cases recorded between the relevant years.

Variables available included patient age, sex, racial group, hospital type (public/private), name of province, and date of report. In SA, there are four officially recognized races: Black, White, Asian, and Colored. Persons designated as Colored have mixed European and African ancestry, and are referred to in the international literature as mixed race.[6] A strong

CONTEXT

Key Objective
The primary objective of this study was to identify possible contributing factors for nonresection for gastric adenocarcinoma (GAC) in South Africa (SA).

Knowledge Generated
Of 3,919 individuals with GAC, 13.4% had a surgical resection. Black race, female sex, and being medically uninsured were associated with nonresection.

Relevance
In SA, the majority of individuals with GAC are not surgically resected, and several social determinants of health are contributory. Interventions to mitigate these barriers to surgical oncology can improve health and well-being in this resource-limited country.

Downloaded from ascopubs.org by 165.16.184.93 on January 31, 2026 from 165.016.184.093
Copyright © 2026 American Society of Clinical Oncology. All rights reserved.

relationship exists between surnames and ethnic groups in SA. The NCR robustly imputes missing ethnicity data using multiple imputation methodologies with 94.31% accuracy.[7]

Cases from public sector hospitals were classified as medically uninsured. Histopathology reports were in free-text format and coded to classify specimen type (biopsy/surgical resection), anatomic site of the malignancy (noncardia [body, pyloric antrum, and pylorus], cardia [cardia and fundus], or diffuse), diagnosis (GAC or other) and histologic subtype (intestinal, diffuse, mixed, other), resection margins, and time between biopsy and resection (in days), stage (TNM classification), and lymph node harvest.

Categorical data were described using counts and percentages. χ^2 tests and logistic regression was used to determine associations with nonresection and associations with no preoperative biopsy. Only variables with a significant P-value ($P \leq .1$) were included in the multivariable regression model. Stata version 18.0 (College Station, TX) was used for statistical analysis.

Ethical approval was obtained from the Human Research Ethics Committee at Stellenbosch University and NHLS Academic Affairs and Research Management System. A waiver of informed consent was approved, since the study used secondary, deidentified data already in use for surveillance purposes and there was no patient or study hospital contact during the study.

RESULTS

There were 5,751 cases of gastric cancer, of which 4,176 (72.6%) were GAC. Of patients with GAC, the median age was 64 years (IQR, 56-73) and 3,337 (75.7%) were older than 50 years. There were 1,401 (33.6%) females, and 1,746 (41.8%) individuals were uninsured. Of the 4,176 patients with GAC, 560 (13.4%) had both a gastric biopsy and a surgical resection. There were 3,359 (80.4%) patients with a GAC-proven biopsy who did not have a subsequent surgical resection and 257 (6.2%) who had a surgical resection without a preoperative biopsy. Anatomic location was reported in 2,336 (55.9%) GAC cases. Of these, 1,144 (49.0%) were noncardia, 1,111 (47.6%) cardia, and 81 (3.5%) were diffuse (Table 1). White individuals were more likely to have GAC located in the cardia compared with other races, while Black, mixed race, and Asian individuals were more likely to have noncardia gastric cancer ($P < .001$; Tables 2 and 3).

Surgical Resections

Of 817 resections, 176 (21.5%) had a total gastrectomy, 596 (73.0%) had a partial gastrectomy, and in 45 (5.5%) the extent of the gastrectomy was unknown. Of the 554 (68.0%) individuals who underwent resection and had complete pathologic data, 374 (67.5%) were node positive with stage III disease as per American Joint Committee on Cancer/International Union Against Cancer eighth edition staging. Margins were reported in 678 (83.0%), with positive margins (proximal or distal) in 82 (12.1%; Table 4). Histologic subtype was known in 553 (67.7%) of the resected specimens. Of these, 369 (66.7%) were intestinal-type adenocarcinoma, 135 (24.4%) were diffuse-type, and 49 (8.9%) were mixed/other. Tumor stage was known in 605 (74.1%) and of these, 177 (29.3%) were T1/T2 and 428 (70.7%) were T3/T4. Nodal staging was known in 554 (67.8%) and of these, 180 (32.5%) were N0, 138 (24.9%) were N1, 136 (24.5%) were N2, and 100 (18.1%) were N3. Fewer than 16 lymph nodes were harvested in 531 (75.4%) specimens and the overall median was 10 lymph nodes (IQR, 6-14; Table 5). For uninsured patients, eight of nine provinces performed biopsies and resections, with figures varying, with the Western Cape performing more than 50% of recorded resections (Table 6).

Associations With Resection Margins

Of 817 resected cases, those without a preoperative biopsy (15.2%) were more likely to have a positive margin compared with those who had a preoperative biopsy (7.6%, $P = .001$).

TABLE 1. GAC by Treatment Type in SA

Demographic	Biopsy Without Resection (n = 3,359)	Resection Without Preoperative Biopsy (n = 257)	Resection With Preoperative Biopsy (n = 560)	Total (N = 4,176)
Sex, No. (%)				
Male	2,199 (65.5)	165 (64.2)	406 (72.5)	2,770 (66.3)
Female	1,155 (34.4)	92 (35.8)	154 (27.5)	1,401 (33.6)
Unknown	5 (0.1)	0 (0.0)	0 (0.0)	5 (0.1)
Age, years, No. (%)				
<50	425 (12.6)	42 (16.3)	66 (11.8)	533 (12.8)
>50	2,934 (87.4)	215 (83.7)	494 (88.2)	3,643 (87.2)
Race, No. (%)				
White	1,026 (30.5)	94 (36.6)	260 (46.4)	1,380 (33.0)
Black	1,336 (39.8)	84 (32.7)	115 (20.5)	1,535 (36.8)
Mixed race	755 (22.5)	42 (16.3)	129 (23.1)	926 (22.2)
Asian	186 (5.5)	28 (10.9)	48 (8.6)	262 (6.3)
Unknown	56 (1.7)	9 (3.5)	8 (1.4)	73 (1.7)
Health insurance, No. (%)				
Yes	1,795 (53.4)	184 (71.6)	451 (80.5)	2,430 (58.2)
No	1,564 (46.6)	73 (28.4)	109 (19.5)	1,746 (41.8)
Year of diagnosis, No. (%)				
2015	366 (10.9)	43 (16.7)	69 (12.3)	478 (11.5)
2016	523 (15.6)	40 (15.6)	86 (15.4)	649 (15.5)
2017	505 (15.0)	37 (14.4)	119 (21.2)	661 (15.8)
2018	682 (20.3)	48 (18.7)	87 (15.5)	817 (19.5)
2019	685 (20.4)	51 (19.8)	118 (21.1)	854 (20.5)
2020	598 (17.8)	38 (14.8)	81 (14.5)	717 (17.2)
Anatomic location, No. (%)				
Noncardia	882 (26.3)	76 (29.6)	186 (33.2)	1,144 (27.4)
Cardia	892 (26.6)	54 (21.0)	165 (29.5)	1,111 (26.6)
Diffuse	58 (1.7)	9 (3.5)	14 (2.5)	81 (1.9)
Unknown	1,527 (45.4)	118 (45.9)	195 (34.8)	1,840 (44.1)

Abbreviations: GAC, gastric adenocarcinoma; SA, South Africa.

Downloaded from ascopubs.org by 165.16.184.93 on January 31, 2026 from 165.016.184.093
Copyright © 2026 American Society of Clinical Oncology. All rights reserved.

T3/4 stage were more likely to have a positive margin (15.0%) compared with those with T1/T2 stage (5.6%, $P = .002$). Increasing nodal status was also associated with having a positive margin ($P \geq .001$; Table 5).

Time to Resection

For the 560 individuals who had a preoperative biopsy and a resection, time to resection was available for private hospital cases only (328 [58.6%]) and was a median of 17 days (IQR, 9-47 days).

Association With Biopsy and Nonresection

The primary outcome was rate of surgical nonresection. On univariate analysis, female gender (odds ratio [OR], 1.4; $P = .001$), Black race (OR, 2.9; $P < .001$), mixed race (OR, 1.4; $P = .001$), and uninsured status (OR, 3.6; $P < .001$) were

TABLE 2. GAC Anatomic Location by Race in SA

Location	Black (%)	White (%)	Mixed Race (%)	Asian (%)	Unknown (%)	*P*	Total (%)
Cardia	354 (23.1)	506 (36.7)	178 (19.2)	51 (19.5)	22 (30.1)	<.001	1,111 (26.6)
Noncardia	413 (26.9)	349 (25.2)	314 (33.9)	54 (20.6)	14 (19.2)		1,144 (27.4)
Diffuse	31 (2.0)	19 (1.4)	23 (44.4)	4 (1.5)	4 (5.5)		81 (1.9)
Unknown	737 (48.0)	506 (36.7)	411 (2.5)	153 (58.4)	33 (45.2)		1,840 (44.1)
Total	1,535 (100)	1,380 (100)	926 (100)	262 (100)	73 (100)		4,176 (100)

Abbreviations: GAC, gastric adenocarcinoma; SA, South Africa.

TABLE 3. GAC Anatomic Location Compared With Race in SA for Cardia and Noncardia Located Gastric Adenocarcinoma

Location	White	Other Races	*P*	Total
Cardia	506 (57.9)	583 (41.0)	<.001	1,089 (47.4)
Noncardia	368 (42.1)	839 (59.0)		1,207 (52.6)
Total	874 (100)	1,422 (100)		2,296 (100)

NOTE. See methodology and results for explanation on subcategorization used in this table.
Abbreviations: GAC, gastric adenocarcinoma; SA, South Africa.

significantly associated with nonresection. There was a nonlinear, increasing association from 2015 to 2020 ($P = .004$). On multivariate analysis, female gender (OR, 1.3; $P = .020$), Black race (OR, 2.3; $P < .001$), and uninsured status (OR, 3.7; $P < .001$) remained significantly associated with non-resection (Table 7).

Associations With No Preoperative Biopsy Among Those With Surgical Resection

Omission of preoperative biopsy before resection occurred in 257 (31%) of the 819 total resections. This was associated with female sex (OR, 1.8; $P = .067$), Black race (OR, 1.7; $P = .010$), and uninsured status (OR, 1.7; $P = .005$) on multivariate analysis after controlling for remained gender, age, insurance, and race (Appendix Table A1).

DISCUSSION

In our study, only 14.3% of individuals with biopsy-proven GAC had a surgical resection. Surgery is an integral component of gastric cancer treatment, and this finding is concerning for limited access to surgical oncology care in SA. Nonresection can be a result of patient (synchronous metastatic disease or poor patient performance status) or health system (difficulty accessing care) factors, while laboratory errors (misclassification, multiple identifiers, or lost specimens) can also contribute to our findings.[8] In countries where health systems are more mature such as Sweden and the Netherlands, gastric cancer resection rates are higher (43%-84%).[9,10] SA does not have a national gastric cancer screening program and the majority of persons are uninsured. Access to physical and endoscopic examination are limited, which likely contribute to late-stage cancer presentation and diagnoses.[11] Previous studies on access to surgical care in SA have examined several barriers after symptoms arise. These barriers can be categorized into contributing to delays in seeking, reaching, and receiving care. Reported barriers in the delay to seeking surgical care included lack of condition awareness and the use of indigenous knowledge healers as an alternative treatment.[12] Barriers to reaching care for surgical patients include high transport costs and limited transport options to reach definitive care, especially in rural areas where health facilities are sparsely distributed.[12] In addition, many persons in sub-Saharan Africa with cancer enter the health system through clinics and district hospitals, and referrals to tertiary hospitals (where oncologic services are usually provided) can be disjointed and delayed.[13]

Delays within health facilities for both diagnosis and treatment in SA were also likely. The early detection of gastric cancer requires adequate resources to perform gastric endoscopy. A study from a rural South African public hospital reported an upper gastrointestinal malignancy (including gastric cancer) in 20% of those undergoing diagnostic endoscopy, demonstrating the need for more comprehensive diagnostic services.[14] Once a diagnosis is confirmed, patients may also face barriers in progressing to resection. Long operating theater waiting lists, limited chemotherapy and radiation services, and limited specialized personnel such as surgeons and oncologists can contribute to cancer care failure.[15,16] SA does not have the minimum surgeon density recommended by international standards, and in addition, there are significant geographic disparities with rural areas largely underserviced.[17] In summary, although low resection rates could have been due to patient factors, delays in diagnosis and accessing appropriate care in SA likely played a large role. Our proportion of cases resected increased over time, a positive trend to improving access.

In addition to a low resection rate, our study noted several secondary findings related to GAC treatment quality in SA, which could negatively affect patient outcomes. One third of resections occurred without preoperative biopsy. These patients may have presented with emergency symptoms such as bleeding, perforation, or obstruction. The proportion

TABLE 4. GAC Resection Margins by Biopsy Status

Resection Margins	Preoperative Biopsy (%)	No Preoperative Biopsy (%)	*P*	Total
Positive	45 (8.0)	39 (15.1)	.001	84
Negative	380 (67.9)	159 (61.9)	.001	539
≥3 cm	146 (26.1)	70 (27.3)		216
<3 cm	116 (20.7)	44 (17.1)		160
Unspecified	118 (21.1)	45 (17.5)		163
Unknown	135 (24.1)	59 (23.0)		194
Total (%)	560 (100)	257 (100)		817

Abbreviation: GAC, gastric adenocarcinoma.

Downloaded from ascopubs.org by 165.16.184.93 on January 31, 2026 from 165.016.184.093
Copyright © 2026 American Society of Clinical Oncology. All rights reserved.

TABLE 5. Comparison of Margin Status, Biopsy Status, and Pathologic Stage of Individuals With Resected GAC in SA

Pathology Parameter	Unknown Margin (n = 194)	Negative Margin (n = 539)	Positive Margin (n = 84)	*P*	Total Resected Cancers (n = 817)
Preoperative biopsy					
Yes	135 (24.1)	380 (67.9)	45 (8.0)		560
No	59 (23.0)	159 (61.9)	39 (15.2)		257
T stage					
T1/T2	13 (7.3)	154 (87.0)	10 (5.6)	.002	177
T3/T4	29 (6.7)	335 (78.2)	64 (15.0)		428
Unknown T stage	172 (81.1)	32 (15.1)	8 (3.8)		212
N stage					
N0	12 (6.7)	155 (86.1)	13 (7.2)	.0004	180
N1	6 (4.3)	121 (87.7)	11 (8.0)		138
N2	9 (6.6)	108 (79.4)	19 (14.0)		136
N3	9 (9.0)	71 (71.0)	20 (20.0)		100
Unknown N stage	178 (67.7)	66 (25.1)	19 (7.2)		263

Abbreviations: GAC, gastric adenocarcinoma; SA, South Africa.

Downloaded from ascopubs.org by 165.16.184.93 on January 31, 2026 from 165.016.184.093
Copyright © 2026 American Society of Clinical Oncology. All rights reserved.

of positive resection margins was higher among those without a preoperative biopsy compared with those who had a biopsy.[18]

Time to resection was available for private hospitals only, where the median time from biopsy to resection was 17 days. International guidelines for gastric cancer promote 6-8 cycles of perioperative chemotherapy, a practice that has been adopted in Western and European countries.[4,19] The short duration between biopsy and resection seen in our data suggests a limited access to oncologists and chemotherapeutic agents in GAC, perhaps because of limited access to oncologists and chemotherapeutic agents. This finding has been observed throughout Sub-Saharan Africa, with reports from Cameroon, Tanzania, and Rwanda showing that <10% of GAC receive the international standard perioperative chemotherapy.[20] The number of lymph nodes reported as harvested at the time of surgical resection is partly dependent on the type of lymph node dissection performed by the surgeon, and partly dependent on the pathologist attention to, and scrutiny of, the specimen. The recommended of 16 lymph nodes as part of an oncologic (D2) lymph node dissection was reported in only 24.6% of specimens. Limited lymph node dissection (D1) might be performed in patients undergoing palliative gastrectomy or those being resected in an acute/subacute setting for bleeding or gastric outlet obstruction, especially if no previous histology is available. The lack of data on indication for resection, preoperative clinical staging, and operative intent (cure *v* palliation) makes interpretation of our lymph node yield results difficult, and precludes definitive conclusions. Finally, lack of staging information could have overestimated the rate of appropriate surgical intervention.

Our findings highlight inequities to accessing quality surgical oncology treatment. Individuals who were uninsured, Black, or female were most at risk for nonresection of GAC as well as not having preoperative biopsy in those who did have surgical resection. Although late presentation and more advanced stage at diagnosis likely contribute to the low rates of resection and preoperative biopsy, recognition of social determinants of health as important barriers in access to surgical oncology remains crucial. A national self-reported survey found that Black individuals and those uninsured have poorer access to health care in SA.[3] In our study, uninsured persons were 6 times more likely not to be resected compared with those with health insurance. Eighty-four percent of South Africans cannot afford health insurance and seek care in the public health sector, which has fewer human and financial resources per capita than the private health sector.[21] Our findings indicate that private hospitals, while serving only 16% of the population, performed 1.3 times more biopsies and 3.5 times more resections compared with public hospitals. Treatment of GAC is therefore inequitable for people without health insurance since the private sector ultimately identified and treated more cases of GAC in individuals.

TABLE 6. Treatment Type by Province in SA for Uninsured

Province	Biopsy Only (%)	Resection	Total (%)
Western Cape	1,011 (90.2)	110 (9.8)	1,121 (54)
Gauteng	478 (89.7)	55 (10.3)	533 (26)
Eastern Cape	170 (88.5)	22 (11.5)	192 (9.2)
Kwazulu-Natal	100 (93.4)	7 (6.5)	107 (5.1)
Free State	48 (82.8)	10 (17.2)	58 (2.8)
Northern Cape	40 (95.2)	2 (4.8)	42 (2.0)
Mpumalanga	20 (91.0)	2 (9.0)	22 (1.1)
North West	2 (66.7)	1 (33.3)	3 (0.1)
Limpopo	0 (0)	0 (0)	0 (0)
Total	1,869	209	2,078 (100)

Abbreviation: SA, South Africa.

TABLE 7. Risk Factors for Surgical Nonresection of GAC in SA

		Univariate			Multivariate		
Demographic	No. (%)	OR	95% CI	*P*	OR	95% CI	*P*
Sex							
Male	2,605 (66.6)	Ref					
Female	1,309 (33.4)	1.4	1.1 to 1.7	**.001**	1.3	1.04 to 1.6	**.020**
Age, years							
>50	3,428 (87.5)	Ref					
≤50	491 (12.5)	1.1	0.8 to 1.4	.566			
Health insurance status							
Insured	2,246 (57.3)	Ref					
Uninsured	1,673 (42.7)	3.6	2.9 to 4.5	**<.001**	3.7	2.9 to 4.7	**<.001**
Race							
White	1,286 (33.4)	Ref					
Black	1,451 (37.6)	2.9	2.3 to 3.7	**<.001**	2.3	1.8 to 3.0	**<.001**
Mixed race	884 (22.9)	1.4	1.2 to 1.9	**.001**	1.0	0.8 to 1.3	.862
Asian	234 (6.1)	1.0	0.7 to 1.4	.918	1.0	0.7 to 1.5	.832
Diagnostic year							.004
2015	435 (11.1)	Ref					
2016	609 (15.5)	1.1	0.8 to 1.6	.436	1.2	0.8 to 1.7	.296
2017	624 (15.9)	0.8	0.6 to 1.1	.179	0.6	0.4 to 0.8	**.002**
2018	769 (19.6)	1.5	1.1 to 2.1	**.025**	1.0	0.7 to 1.4	.844
2019	803 (20.5)	1.1	0.8 to 1.5	.584	0.7	0.5 to 1.0	**.045**
2020	679 (17.3)	1.4	1.0 to 2.0	.061	0.9	0.6 to 1.3	.689

NOTE. Bold indicates statistically significant *P*-values.
Abbreviations: GAC, gastric adenocarcinoma; OR, odds ratio; Ref, reference; SA, South Africa.

Downloaded from ascopubs.org by 165.16.184.93 on January 31, 2026 from 165.016.184.093
Copyright © 2026 American Society of Clinical Oncology. All rights reserved.

Despite the end of apartheid, racial inequities in health care access still persist.[22,23] Black individuals have the lowest median household income in the country, and are the least likely to have medical insurance in SA, leaving them doubly vulnerable for poor oncology care.[23] These enduring racial health disparities are intertwined with mistrust of medical institutions and expertise, which may affect health-seeking behavior and increase reluctance to access care.[24]

Interestingly, female sex was another statistically significant risk factor for nonresection in the current study. Previous studies have reported that gastric cancer survival is poorer in males compared with females because of late health-seeking behavior and stage of presentation.[25] In SA, females have poorer health outcomes than males.[26] Factors contributing to this may include oppressive gender dynamics, marginalization within the health system, and a lack of agency. Additionally, females can be subject to overlapping forms of discrimination because of factors such as age, race, or socioeconomic status that render them structurally marginalized.[27]

Finally, this study showed that a higher proportion of White individuals had cardia/proximal cancer when compared with all other races. Conversely, higher proportions of Black, mixed race, and Asian individuals had noncardia gastric cancer. These results correlate with previous United States–based studies that found the same association between ethnicity/race and anatomic site of gastric cancers.[28] Because of the fact that we had no data on risk factors (body mass index, gastroesophageal reflux disease, smoking, and *Helicobacter pylori* infection status) in any of the individuals, it is challenging to speculate this finding.

Study limitations were related to data quality. Missing data, data entry errors, or specimens collected outside of SA could have led to underestimation of resection rates as well as resections with preoperative biopsy. The absence of multiple variables that influence gastric cancer histology, anatomic location, stage, and oncologic and surgical treatment plan limited our ability to draw strong conclusions from our results. The South African NCR is based on histology reports, and stage of disease and tumor location were not always reported. The NCR does not include cases without histologic diagnosis; thus, we were not able to estimate national gastric cancer incidence.[29] Resection rates by province were only available in the public sector and hospital levels were not available, which would have provided useful insight to geographic variability. Reasons for nonresection were not captured but could form the basis of future research to understand specific barriers to access to care.

In conclusion, to our knowledge, this study is the first national audit of GAC in SA and demonstrated a low rate of resection. Both patient and health system factors are likely contributing to nonresection, including social determinants of health exacerbating late cancer stage in presentation and delays to seeking, reaching, and receiving care. Additionally, several cancer care quality issues are noted including absence of preoperative chemotherapy, omission of preoperative biopsies, and insufficient lymphadenectomy. Investment in a NCR allowing for comprehensive data capture will help identify barriers and improve care in individuals with GAC in SA.

AFFILIATIONS

[1]Division of Surgery, Faculty of Medicine and Health Sciences, Stellenbosch University, Cape Town, South Africa
[2]Department of Global Health, University of Texas Southwestern, Dallas, TX
[3]Department of Surgery, University of California Davis, Sacramento, CA
[4]National Cancer Registry, National Institute for Communicable Diseases, Division of National Health Laboratory Service, Johannesburg, South Africa
[5]Faculty of Health Sciences, School of Public Health, University of the Witwatersrand, Johannesburg, South Africa
[6]South African DSI-NRF Centre of Excellence in Epidemiological Modelling and Analysis (SACEMA), Stellenbosch University, Stellenbosch, South Africa
[7]Strengthening Oncology Services Research Unit, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, South Africa
[8]Faculty of Health Sciences, Sydney Brenner Institute for Molecular Bioscience, University of the Witwatersrand, Johannesburg, South Africa
[9]Department of Surgery, University of Cape Town, Cape Town, South Africa

CORRESPONDING AUTHOR

Naeelah Parker, MBChB; e-mail: naeelah.parker@icloud.com.

AUTHOR CONTRIBUTIONS

Conception and design: Cameron E. Gaskill, Jeanne Lubbe, Kathryn M. Chu
Administrative support: Kathryn M. Chu
Collection and assembly of data: Naeelah Parker, Cameron E. Gaskill, Mazvita Muchengeti, Wenlong C. Chen, Kathryn M. Chu
Data analysis and interpretation: Naeelah Parker, Neha Sangana, Cameron E. Gaskill, Galya Chinnery, Jeanne Lubbe, Kathryn M. Chu
Manuscript writing: All authors
Final approval of manuscript: All authors
Accountable for all aspects of the work: All authors

AUTHORS' DISCLOSURES OF POTENTIAL CONFLICTS OF INTEREST

The following represents disclosure information provided by author of this manuscript. All relationships are considered compensated unless otherwise noted. Relationships are self-held unless noted. I = Immediate Family Member, Inst = My Institution. Relationships may not relate to the subject matter of this manuscript. For more information about ASCO's conflict of interest policy, please refer to www.asco.org/rwc or ascopubs.org/go/authors/author-center.
Open Payments is a public database containing information reported by companies about payments made to US-licensed physicians (Open Payments).

No potential conflicts of interest were reported.

REFERENCES

1. Bray F, Laversanne M, Sung H, et al: Global cancer statistics 2022: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin 74:229-263, 2024
2. Ngwa W, Addai BW, Adewole I, et al: Cancer in Sub-Saharan Africa: A lancet oncology commission. Lancet Oncol 23:e251-e312, 2022
3. Harris B, Goudge J, Ataguba JE, et al: Inequities in access to health care in South Africa. J Public Health Policy 32:S102-S123, 2011 (suppl 1)
4. Lordick F, Carneiro F, Cascinu S, et al: Gastric cancer: ESMO clinical practice guideline for diagnosis, treatment and follow-up. Ann Oncol 33:1005-1020, 2022
5. Singh E, Sengayi M, Urban M, et al: The South African National Cancer Registry: An update. Lancet Oncol 15:e363, 2014
6. Wikipedia Contributors: Coloureds. 2025. https://en.wikipedia.org/wiki/Coloureds
7. Chen WC, Kellett P, Greyling M, et al: The use of surnames to impute missing ethnicity data in the South African National Cancer Registry database. https://www.researchsquare.com/article/rs-2033699/v1
8. Sung H, Ferlay J, Siegel RL, et al: Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin 71:209-249, 2021
9. van Putten M, Verhoeven RHA, van Sandick JW, et al: Hospital of diagnosis and probability of having surgical treatment for resectable gastric cancer. Br J Surg 103:233-241, 2016
10. Dikken JL, van Sandick JW, Allum WH, et al: Differences in outcomes of oesophageal and gastric cancer surgery across Europe. Br J Surg 100:83-94, 2013
11. Omotoso O, Teibo JO, Atiba FA, et al: Addressing cancer care inequities in Sub-Saharan Africa: Current challenges and proposed solutions. Int J Equity Health 22:189, 2023
12. Mac Quene T, Smith L, Odland ML, et al: Prioritising and mapping barriers to achieve equitable surgical care in South Africa: A multi-disciplinary stakeholder workshop. Glob Health Action 15: 2067395, 2022
13. Lombe DC, Mwamba M, Msadabwe S, et al: Delays in seeking, reaching and access to quality cancer care in Sub-Saharan Africa: A systematic review. BMJ Open 13:e067715, 2023
14. Booyse K, Swart O, Gouws J, et al: The effect of the introduction of an electronic booking system to appropriately prioritise gastroscopies at a regional hospital in South Africa. S Afr Med J 110: 807-811, 2020
15. Lubuzo B, Hlongwana K, Ginindza T: Cancer care reform in South Africa: A case for cancer care coordination: A narrative review. Palliat Support Care 20:129-137, 2022
16. Seeth A: The State of Cancer Services: Are Oncologists A Dying Breed in SA. City Press, 2019. https://www.news24.com/citypress/news/the-state-of-cancer-services-are-oncologists-a-dying-breed-in-sa-20190204
17. Tiwari R, Chikte U, Chu KM: Estimating the specialist surgical workforce density in South Africa. Ann Glob Health 87:83, 2021
18. Conradie W, Luvhengo T, Lübbe JA, et al: The clinicopathological landscape of thyroid cancer in South Africa-A multi-institutional review. World J Surg 48:2863-2870, 2024
19. Ajani JA, D'Amico TA, Bentrem DJ, et al: Gastric cancer, version 2.2022, NCCN clinical practice guidelines in oncology. J Natl Compr Cancer Netw 20:167-192, 2022
20. Callixte C, Sutiningsih D, Suhartono S, et al: Stage at diagnosis of stomach cancer amongst selected east African countries: A mini systematic review. Jurnal Epidemiologi Kesehatan Komunitas 8: 131-136, 2023
21. de Villiers K: Bridging the health inequality gap: An examination of South Africa's social innovation in health landscape. Infect Dis Poverty 10:19-7, 2021
22. Burger R, Christian C: Access to health care in post-apartheid South Africa: Availability, affordability, acceptability. Health Econ Policy Law 15:43-55, 2020
23. Mhlanga D, Garidzirai R: The influence of racial differences in the demand for healthcare in South Africa: A case of public healthcare. Int J Environ Res Public Health 17:5043, 2020
24. Moll T: Medical mistrust and enduring racism in South Africa. J Bioeth Inq 18:117-120, 2021
25. Li H, Wei Z, Wang C, et al: Gender differences in gastric cancer survival: 99,922 cases based on the SEER database. J Gastrointest Surg 24:1747-1757, 2020
26. Ntuli M, Chitiga-Mabugu M, Karuaihe S, et al: Gender inequalities in morbidity: A South African investigation. Stud Econ Econom 40:39-64, 2016

Downloaded from ascopubs.org by 165.16.184.93 on January 31, 2026 from 165.016.184.093
Copyright © 2026 American Society of Clinical Oncology. All rights reserved.

27. Bertagnolli MM: Women, power, and cancer: A need for change and a force for progress. Lancet 402:2053-2055, 2023
28. Gupta S, Tao L, Murphy JD, et al: Race/ethnicity-socioeconomic status-and anatomic subsite-specific risks for gastric cancer. Gastroenterology 156:59-62.e4, 2019
29. Martin AN, Chan NW, Cheung DC, et al: A guide to large data sets for population-based cancer research: Strengths, limitations, and pitfalls. Cancer 130:3802-3814, 2024

Downloaded from ascopubs.org by 165.16.184.93 on January 31, 2026 from 165.016.184.093
Copyright © 2026 American Society of Clinical Oncology. All rights reserved.

APPENDIX

TABLE A1. Risk Factors for No Preoperative Biopsy in GAC Resection

		Univariate			Multivariate		
Demographic	No. (%)	OR	95% CI	*P*	OR	95% CI	*P*
Sex							
Male	572 (69.8)	Ref					
Female	247 (30.2)	1.5	1.07 to 2.01	**.018**	1.8	0.97 to 1.89	**.067**
Age, years							
>50	709 (86.6)	Ref					
≤50	110 (13.4)	1.4	0.94 to 2.15	.100	1.1	0.82 to 2.00	.267
Health insurance status							
Insured	637 (77.8)	Ref					
Uninsured	182 (22.2)	1.6	1.17 to 2.32	**.004**	1.7	1.17 to 2.46	**.005**
Race							
White	353 (44.0)	Ref					
Black	201 (25.1)	2.0	1.37 to 2.85	**<.001**	1.7	1.13 to 2.43	**.010**
Mixed race	172 (21.5)	0.9	0.59 to 1.35	.588	0.8	0.49 to 1.18	.226
Asian	76 (9.5)	1.6	0.95 to 2.71	**.075**	1.6	0.95 to 2.73	.077

NOTE. Bold indicates statistically significant *P*-values.
Abbreviations: GAC, gastric adenocarcinoma; OR, odds ratio; Ref, reference.

Downloaded from ascopubs.org by 165.16.184.93 on January 31, 2026 from 165.016.184.093
Copyright © 2026 American Society of Clinical Oncology. All rights reserved.