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Disparities in Tobacco Smoking by Sex and Employment Status: Results from South Africa's First Global Adult Tobacco Survey

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Abstract: Background/Objectives: Tobacco smoking is a cause of premature death and illness globally. This study examined the prevalence and factors associated with tobacco smoking among South African adults according to sex, education, and employment status among socio-demographic subgroups. **Methods:** Data were obtained from the 2021 South African Global Adult Tobacco Survey (a nationally representative household survey using a multi-stage stratified cluster random sampling design). The 6311 participants were aged 15+ years. Descriptive statistics, chi-square tests, and multiple logistic regression analysis were used to investigate relationships between current smoking and socio-demographic variables. **Results:** Smoking prevalence was 25.8% (n = 1573) (41.2% among men, 11.5% among women; 29.9% among working individuals, 23.1% among non-working individuals). The multiple logistic regression results showed that males aged 45–64 were twice as likely to be currently smoking than males aged 15–24. Coloured (of mixed race) males were twice as likely to smoke as Black African males. Males with secondary/post-secondary education were less likely to smoke compared to males with no education. Coloured females were seven times and White females were almost five times more likely to smoke than Black African females. Females with post-secondary education were less likely to smoke than those with no formal education. Females earning an income were more likely to smoke compared to those with no income. Non-working participants aged 25–44 and 45–64 were more likely to smoke compared to those aged 15–24 years. Working and non-working Coloured and working White individuals were three times more likely to smoke than working or non-working Black Africans. **Conclusion:** Groups with higher identified smoking prevalence may indicate where smoking cessation interventions should be targeted to reduce national smoking prevalence.

Keywords: disparities; tobacco smoking; sex; employment status; South Africa

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1. Introduction

Tobacco smoking is a leading cause of preventable diseases, including various cancers, cardiovascular diseases, and respiratory illnesses (Gan et al. 2022). Despite extensive public health campaigns and policies aimed at reducing tobacco use, smoking prevalence remains high globally, although it is declining (World Health Organization 2023): about 1.3 billion people still smoke tobacco globally (World Health Organization 2023). Understanding the patterns of smoking behaviour in various socio-demographic groups is crucial in order to tailor effective intervention strategies (Flor et al. 2021; Peruga et al. 2021).

Tobacco use is also a significant public health concern in South Africa, as it has profound implications for morbidity and mortality across various demographic groups (Le Foll et al. 2022). In South Africa, where healthcare resources are often overburdened, reducing tobacco use can alleviate the strain on the health system and improve public

health outcomes (Reitsma et al. 2021). This is especially important because the country is working towards a universal health coverage programme in the form of National Health Insurance (NHI) (Pauw 2022), and the NHI bill was signed into law in May 2024 (South African Government 2024). Tobacco products are presently regulated in South Africa by the Tobacco Products Control Act of 1993 (as amended in 2008) (Republic of South Africa 2008). This law prohibits, among other things, all forms of advertisement and sale of tobacco products to persons less than 18 years of age. The law also prohibits smoking in indoor public places and certain outdoor places, but allows for a 25% designated smoking area (Republic of South Africa 2008). However, South Africa has a tobacco control bill (the Tobacco Products and Electronic Delivery Systems Control Bill of 2022), currently going through the legislative process to become law. This bill, when passed, will introduce plain packaging, eliminate designated smoking areas, regulate e-cigarettes, and prohibit point-of sale advertisements and the sale of tobacco products through vending machines (Republic of South Africa 2022). Exploring the prevalence of smoking at the subpopulation level in South Africa can provide valuable insights into what the potential focus for tobacco control interventions in the country should be.

Several socio-demographic factors influence the prevalence of tobacco use among men and women (Boachie and Ross 2020). Smoking has historically been more prevalent among men (Alomari et al. 2019), but recent trends indicate that the gap between male and female smokers is narrowing in many regions, including South Africa (Islamia et al. 2015). Exploring these sex-specific dynamics can help researchers to design more effective cessation programmes in order to address the distinct needs and barriers faced by men and women, thereby enhancing the overall efficacy of public health initiatives (Martinez Leal et al. 2021).

Smoking has also been found to be more prevalent among those in lower socio-economic groups. Socio-economic grouping has been related to education, employment, and place of residence. Disparities in the smoking prevalence among working and non-working groups exacerbates the vulnerabilities of households with heads who smoke. Aside from exposing family members to the health risks associated with smoking, such households are also exposed to higher poverty rates and lower resources to cater for the day-to-day welfare of members of the family (Chaloupka and Blecher 2018). If they are aware of the specific situations of different employment groups, policymakers and public health professionals can develop targeted interventions that provide the necessary support and resources to help individuals to quit smoking, ultimately reducing the overall prevalence of tobacco use in South Africa. It is also important to note that exposure to second-hand smoke in the general population is often a function of the prevalence of smoking in a country, and a 2017 national study showed that as much as 47% of South Africans who do not smoke are exposed to second-hand tobacco smoke (Ngobese et al. 2020).

This study aimed to assess the prevalence of tobacco smoking among adults aged 15+ years, categorised by sex (male/female) and employment status (working/non-working), and the factors associated with tobacco smoking within these groups.

2. Materials and Methods

The data used in this study were taken from South Africa's first Global Adult Tobacco Survey (GATS). The GATS is a standardised, nationally representative, cross-sectional household survey designed to monitor adult (defined as individuals aged 15 years and above) tobacco use and track key tobacco control indicators (National Department of Health 2022). The GATS is a part of the Global Tobacco Surveillance System and was launched in 2007, and is aimed at "enhancing countries capacity to design, implement and evaluate tobacco control interventions" (World Health Organization 2024; US CDC 2024). This survey tracks the national prevalence of tobacco use, exposure to second-hand smoke and media, cessation, and economic factors, as well as knowledge, attitudes and perceptions of tobacco and related products, which are comparable across countries (World Health

Organization 2024). In 2021, South Africa joined the over 30 low- and middle-income countries that have implemented the GATS (World Health Organization 2024).

The GATS employs a consistent methodology across participating countries, ensuring reliable and comparable data (National Department of Health 2022). The GATS South Africa (GATS-SA) was conducted in 2021, and it was implemented following the GATS study protocols developed by the US Centers for Disease Control and Prevention (CDC) (Global Adult Tobacco Survey Collaborative Group 2019). The study used a multi-stage stratified cluster random sampling design, in which the country's geographic units were grouped into either rural or urban units. The sampling process consisted of randomly selecting smaller geographic units (referred to as primary sampling units or PSUs) in both rural and urban areas of each of South Africa's nine provinces. This selection was carried out using probability proportional-to-size (PPS) sampling, which considers the different population sizes of the provinces. In each of the selected PSUs, dwelling units (DUs) were chosen, using systematic sampling. Finally, one household member was randomly selected from each sampled household. An additional stage of sampling was introduced, where a selected PSU was specifically located in an informal settlement. In this case, segmentation was achieved by selecting 60 DUs per segment. Subsequently, one segment was included in the study. In cases where a DU was discovered to contain multiple households, only one household was randomly selected to participate in the study.

The eligible participants consisted of men and women aged 15 years and older. Participants also had to be usual residents in South Africa, i.e., to have been in South Africa for at least six months prior to the survey. In every household, a list of all eligible adults was compiled, and the Kish Grid method was used to randomly select one adult for inclusion in the study. A total of 6311 individual interviews were completed, with an overall survey response rate of 91.5%.

2.1. Data Collection Instrument

Two questionnaires were used in collecting the data: the household screening questionnaire, and the individual questionnaire. South Africa has considerable language diversity. Hence, the GATS-SA questionnaire, which was originally available only in English, was translated into the (then) 10 other official languages in order to accommodate all of the participants' linguistic needs and preferences (sign language had not yet been made an official language at the time of the survey, but has since become the 12th official language). The 10 languages are Sepedi, Sesotho, Setswana, siSwati, Tshivenda, Xitsonga, Afrikaans, isiNdebele, isiXhosa, and isiZulu. In addition, back translation was carried out to guarantee the absence of any bias caused by the translation of the materials. This process entailed employing a translator who was proficient speaker of the given indigenous language and who had no prior exposure to the original English version to translate the questionnaire back to English. The back translation was subsequently compared to the original version, and any inconsistencies in the first translation were examined and rectified as needed.

2.2. Measures

The questions and variables relevant to this paper are described in more detail below. These questions were drawn from the individual questionnaire, which asked participants about their tobacco and electronic cigarette use, cessation, exposure to second-hand smoke, economics, tobacco advertisement, promotion and sponsorship, and knowledge, attitudes, and perceptions of tobacco.

2.2.1. Outcome Variables

The variable "current tobacco smoking" was based on the responses to the question "Do you currently smoke tobacco on a daily basis/less than daily/not at all?" Those who reported daily or less than daily smoking were categorised as "currently smoking" and those who reported "not at all" were categorised as "non-smoking".

2.2.2. Independent Variables

The study used several socio-demographic variables, including age at the time of survey (grouped into four categories: 15–24, 25–44, 45–64, and 65 years and older), sex (male or female), employment status (working or non-working), place of residence (rural or urban), and level of education (categorised into four groups: no formal education, primary education, secondary education, and post-secondary education). Marital status refers to the participant's current relationship status, which was categorised as single, married, living together, separated, or widowed. Income was defined as the total amount of money the participant had earned or received from all sources in the last 30 days. It was classified into five categories: zero, ZAR 1-5000, ZAR 5001-15,000, ZAR 15,001-30,000, and >ZAR 30,000. Lastly, race was categorised into four categories: Black African, Coloured (a mix of people of African, European, and/or Asian ancestry), Indian, and White (Caucasian).

2.3. Data Collection

The study protocol, measures, and procedures were approved by the Research Ethics Committee of the South African Medical Research Council (EC033-9/2020). The questionnaires were administered at the participants' residences by trained interviewers after obtaining informed consent and assent (where the participant was below 18 years of age). The face-to-face interviews were conducted using handheld devices (tablets) using the GATS Global Tobacco Surveillance System software developed by the CDC. The data that were collected were transmitted to a secured database daily. The interviews lasted for an average of 30 mins. Each participant was compensated with a grocery or airtime voucher worth ZAR 50 (about USD 3.5 at the time of the survey).

2.4. Statistical Analysis

The data were weighted to ensure a true representation of South Africa's adult population. Taylor series linearisation approximations (Wolter 2007) were used to account for the complex multi-stage sampling design, in Stata version 17.0, via the "svy" prefix. We used cross-tabulation and χ^2 tests to assess the tobacco smoking prevalence among male/female and working/non-working groups according to socio-demographic characteristics. Multiple logistic regression models were then used to examine the relationships between socio-demographic characteristics and current tobacco smoking across sex and employment groups.

3. Results

3.1. Sample Characteristics

Just over half of the participants in our study were female (51.8%) (Table 1). The largest group of participants (46.0%) fell within the age range of 25 to 44 years old. The majority, 78.9%, of the participants identified as being of Black African descent. About 13.0% of the participants had achieved post-secondary education (>Grade 12). Of the participants, 62.1% resided in urban areas, 56.0% were single, and 60.1% were non-working. Approximately 60% of the participants had an income ranging from only ZAR 1 to 5000. Slightly more than one fourth of the participants reported currently smoking tobacco (25.8%) (Table 1).

Table 1. Participants' socio-demographic characteristics and tobacco smoking.

Variable	N (N = 6311)	% (CI)
Sex		
Male	2773	48.2 (46.1–50.2)
Female	3538	51.8 (49.8–53.9)

Table 1. *Cont.*

Variable	N (N = 6311)	% (CI)
Age group (in years)		
15–24	1115	22.4 (20.7–24.2)
25–44	2838	46.0 (44.0–48.0)
45–64	1704	23.1 (21.5–24.7)
65+	654	8.6 (7.6–9.6)
Race		
Black	5552	78.9 (77.1–80.7)
Coloured	489	13.5 (12.0–15.2)
Indian	55	1.5 (1.1–2.1)
White	208	6.1 (5.1–7.2)
Highest level of education		
No formal education	309	3.2 (2.7–3.7)
Primary education	3412	50.5 (48.4–52.5)
Secondary education	1866	33.3 (31.4–35.4)
Post-secondary education	718	13.0 (11.7–14.4)
Place of residence		
Rural	3417	37.9 (36.1–39.7)
Urban	2894	62.1 (60.3–63.9)
Marital status		
Single	3625	56.0 (54.0–58.1)
Married	1396	24.2 (22.6–26.0)
Living together	452	10.1 (8.6–11.8)
Separated	332	4.2 (3.5–5.0)
Widowed	502	5.5 (4.8–6.3)
Employment		
Working	2317	39.9 (37.9–42.0)
Non-working	3987	60.1 (58.0–62.1)
Income		
Zero	1071	21.2 (19.5–22.9)
ZAR 1–5000	3787	58.4 (56.3–60.4)
ZAR 5001–15,000	711	14.0 (12.6–15.7)
ZAR 15,001–30,000	229	4.2 (3.5–5.0)
>ZAR 30,000	98	2.2 (1.7–2.9)
Current smoking		
Yes	1573	25.8 (24.1–27.6)
No	4738	74.2 (72.4–75.9)

3.2. Prevalence of Tobacco Smoking by Sex and Employment Status

Overall, the current tobacco smoking prevalence was 41.2% among males, 11.5% among females, 29.9% among those who were working, and 23.1% among those who were not working (Table 2).

3.2.1. Tobacco Smoking Prevalence by Sex

The prevalence of tobacco smoking was significantly higher among males than among females (41.2% vs. 11.5%, respectively) ($p < 0.001$). Sex differences in smoking prevalence varied across demographic groups, but this was only significant for males according to age group, race, and highest level of education and for females by race, education, residence, and income. None of the other differences were statistically significant. Among males, the highest prevalence of smoking was observed among those in the age range from 45 to 64 years (47.5%). In terms of race, the highest prevalence of tobacco smoking was observed among Coloured males (54.7%), followed by Black African males (39.6%). Regarding education, the highest prevalence of smoking was found in the group of males who had not received any formal education (49.5%), followed by males who had completed only primary education (46.2%).

Table 2. Prevalence of tobacco smoking by socio-demographic characteristics among male/female and working/non-working groups in South Africa.

Socio-Demographics	Current Smoking			
	Sex		Employment	
	Male	Female	Working	Non-Working
Overall n (%)	1220 (41.2)	353 (11.6)	666 (29.9)	904 (23.1)
Sex (*p*-value)			**(<0.001)**	**(<0.001)**
Male			41.1 (36.8–45.6)	41.2 (37.4–45.2)
Female			13.8 (10.5–17.9)	10.5 (8.7–12.5)
Employment (*p*-value)	(0.983)	(0.094)		
Non-working	41.2 (37.4–45.2)	10.5 (8.7–12.5)		
Working	41.1 (36.8–45.6)	13.8 (10.5–17.9)		
Age-Group (in years) (*p*-value)	**(0.029)**	(0.891)	(0.227)	(0.101)
15–24	36.9 (30.9–43.3)	10.7 (7.2–15.4)	39.7 (27.0–54.0)	21.4 (17.8–25.5)
25–44	41.7 (37.4–46.1)	11.5 (9.0–14.7)	28.8 (25.1–32.8)	24.1 (20.7–27.9)
45–64	47.5 (41.6–53.4)	12.6 (9.8–16.0)	30.2 (25.0–36.1)	26.9 (22.8–31.4)
65+	32.1 (23.7–41.7)	11.0 (7.1–16.5)	19.2 (8.2–38.6)	18.9 (14.6–24.2)
Race (*p*-value)	**(0.003)**	**(<0.001)**	**(<0.001)**	**(<0.001)**
Black	39.6 (36.5–42.8)	7.0 (5.5–8.7)	26.2 (22.9–29.8)	20.6 (18.6–22.8)
Coloured	54.7 (44.8–64.2)	34.9 (27.9–42.6)	44.9 (36.2–54.0)	43.0 (34.8–51.6)
Indian	20.3 (8.8–40.3)	4.2 (1.0–16.0)	20.2 (8.7–40.3)	4.5 (1.1–17.1)
White	38.0 (27.2–50.1)	17.5 (10.6–27.6)	32.5 (23.1–43.6)	22.5 (13.5–35.2)
Highest level of education (*p*-value)	**(0.001)**	(0.718)	**(<0.001)**	**(0.001)**
No formal education	49.5 (34.8–64.3)	8.8 (5.1–14.8)	68.4 (42.3–86.5)	17.4 (12.6–23.5)
Primary education	46.2 (42.0–50.4)	12.2 (10.1–14.7)	35.9 (30.9–41.1)	25.8 (23.1–28.6)
Secondary education	37.2 (32.2–42.5)	11.5 (8.5–15.4)	27.0 (22.3–32.3)	20.8 (17.3–24.7)
Post-secondary education	30.2 (23.7–37.7)	9.9 (5.9–16.2)	23.5 (18.0–30.0)	13.2 (8.5–19.9)
Place of residence (*p*-value)	(0.159)	**(<0.001)**	(0.143)	**(<0.001)**
Rural	38.6 (34.8–42.5)	6.8 (5.0–9.2)	26.6 (22.2–31.6)	18.5 (16.3–21.0)
Urban	42.6 (38.6–46.7)	14.8 (12.4–17.6)	31.3 (27.5–35.3)	26.7 (23.6–30.0)
Marital Status (*p*-value)	(0.083)	(0.263)	(0.239)	**(0.019)**
Single	42.5 (38.9–46.3)	11.0 (8.8–13.6)	29.2 (25.1–33.6)	24.9 (22.4–27.6)
Married	35.0 (29.5–40.9)	9.9 (7.3–13.5)	27.2 (22.1–32.9)	18.5 (14.7–23.0)
Living together	47.1 (36.1–58.4)	15.8 (9.2–25.7)	36.9 (26.9–48.3)	27.0 (18.2–38.1)
Separated	49.2 (37.1–61.3)	17.4 (10.4–27.8)	37.3 (26.2–50.0)	26.3 (17.9–36.8)
Widowed	35.7 (22.5–51.4)	11.6 (7.5–17.5)	26.3 (15.1–41.7)	14.3 (9.9–20.1)
Income (*p*-value)	(0.142)	**(0.014)**	(0.490)	(0.839)
Zero	39.2 (33.1–45.6)	6.7 (4.4–10.1)	30.8 (13.3–56.3)	22.6 (19.2–26.4)
ZAR 1–5000	45.1 (40.9–49.5)	12.3 (10.1–14.9)	31.4 (26.9–36.3)	23.4 (20.8–26.2)
ZAR 5001–15,000	41.6 (34.1–49.6)	15.6 (10.0–23.4)	33.5 (27.4–40.3)	20.3 (12.8–30.8)
ZAR 15,001–30,000	31.3 (21.3–43.3)	10.9 (4.9–22.7)	23.9 (16.6–33.2)	23.6 (8.7–49.9)
>ZAR 30,000	33.4 (20.7–49.0)	24.8 (11.1–46.6)	33.3 (22.1–46.8)	10.5 (2.2–38.1)

Among females, in terms of race, the highest prevalence of smoking was observed among Coloured females (34.9%), followed by White females (17.5%). In respect of education, the highest prevalence of smoking was found among those with only a primary education (12.2%), followed by those with a secondary education (11.5%). Smoking prevalence was lowest among females without any formal education (7.0%). Regarding residence and income, the highest smoking prevalence was observed among females residing in urban areas (14.8%) and females with an income exceeding ZAR 30 000 (24.8%) (Table 2).

3.2.2. Tobacco Smoking Prevalence by Employment Status

When the data were stratified according to employment status, overall, the prevalence of tobacco smoking was significantly higher in the group of people who were working compared to the non-working group (29.9% vs. 23.1%, respectively) ($p = 0.0002$). Significant disparities in smoking prevalence were observed for both the group of people working (by

sex, race, education) and those who were not working (by sex, race, education, residency, and marital status). In the working group, the highest prevalence of tobacco smoking was found among males (41.1%), Coloured people (44.9%), and participants with no formal education (68.4%). In the non-working group, the highest smoking prevalence was found among males (41.2%), Coloured people (43.0%), those with primary education (25.8%), residents of urban areas (26.7%), and individuals who were cohabiting (27.0%) (Table 2).

3.3. Multiple Logistic Regression Showing Associations between Tobacco Smoking and Socio-Demographic Characteristics among Male/Female and Working/Non-Working Groups

Multiple logistic regression analyses were conducted to investigate the factors associated with current tobacco smoking, stratified by sex and employment status. Table 3 presents the factors associated with tobacco smoking and socio-demographic groups, stratified by sex and employment status. Adjusted regression models controlled for age, race, education, residency, marital status, and income.

3.3.1. Factors Associated with Current Tobacco Smoking by Sex

Among males, a significant association was found between being aged 25–44 years (AOR: 1.53, 95% CI: 1.04–2.23, $p = 0.029$) and 45–64 years (AOR: 2.29, 95% CI: 1.43–3.67, $p = 0.001$) and current smoking, compared to being a male aged 15–24 years. Males with a secondary education (AOR = 0.49, 95% CI: 0.26–0.95, $p = 0.034$) or a higher level of education (AOR = 0.38, 95% CI: 0.17–0.84, $p = 0.017$) were less likely to smoke compared to those with no formal education. In terms of race, Coloured males (AOR = 2.02, 95% CI = 1.23–3.31, $p = 0.006$) were twice more likely to smoke than Black African males. Married males (AOR = 0.59, 95% CI: 0.38–0.91, $p = 0.017$) were less likely to be currently smoking than single males (Table 3).

By contrast, females aged 65 and older were significantly less likely to smoke (AOR: 0.37, 95% CI: 0.14–0.94, $p = 0.036$) than females aged 15–24 years. Coloured females (AOR = 7.22, 95% CI = 4.33–12.01, $p < 0.001$) and White females (AOR = 4.84, 95% CI = 2.17–10.81, $p < 0.001$) were significantly more likely to be currently smoking than Black African females. Also, females with a post-secondary education (AOR = 0.28, 95% CI: 0.10–0.81, $p = 0.019$) were less likely to smoke than those with no formal education. Smoking was also found to be significantly associated with income among females. Females with an income of ZAR 1–5000 (AOR = 2.20, 95% CI: 1.22–3.96, $p = 0.009$), ZAR 50,001–10,000 (AOR = 3.06, 95% CI: 1.33–7.05, $p = 0.009$), and >ZAR 30,000 (AOR = 4.54, 95% CI: 1.25–16.51, $p = 0.022$) were more likely to currently smoke compared to those with no income (Table 3).

3.3.2. Factors Associated with Current Tobacco Smoking by Employment Status

Regarding employment status, among the working group, females (AOR = 0.17, 95% CI: 0.11–0.25, $p < 0.001$) were less likely to smoke than males. Working Coloured people (AOR = 3.93, 95% CI: 2.28–6.76, $p < 0.001$), or working White people (AOR = 3.55, 95% CI: 1.57–8.03, $p = 0.002$) were more likely to currently smoke compared to working Black African individuals. Workers with a primary education (AOR = 0.21, 95% CI: 0.08–0.54, $p = 0.001$), secondary education (AOR = 0.15, 95% CI = 0.05–0.39, $p < 0.001$), or post-secondary education (AOR = 0.13, 95% CI: 0.04–0.39, $p < 0.001$) were significantly less likely to currently smoke compared with workers with no formal education (Table 3).

Table 3. Factors associated with tobacco smoking by sex and employment status.

	Male		Female		Working		Non-Working	
		p-Value	AOR (CI)	*p*-Value	AOR (CI)	*p*-Value	AOR (CI)	*p*-Value
Sex								
Male					(ref)		(ref)	
Female					0.17 (0.11–0.25)	**<0.001**	0.14 (0.11–0.19)	**<0.001**
Employment								
Not working	(ref)		(ref)					
Working	1.15 (0.81–1.61)	0.436	0.87 (0.51–1.48)	0.613				
Age group (in years)								
15–24	(ref)		(ref)		(ref)		(ref)	
25–44	1.53 (1.04–2.23)	**0.029**	0.83 (0.44–1.57)	0.569	0.73 (0.36–1.48)	0.384	1.62 (1.08–2.42)	**0.019**
45–64	2.29 (1.43–3.67)	**0.001**	0.70 (0.35–1.41)	0.317	0.72 (0.33–1.56)	0.406	2.37 (1.51–3.73)	**<0.001**
65+	0.91 (0.47–1.74)	0.768	0.37 (0.14–0.94)	**0.036**	0.27 (0.07–1.09)	0.066	1.33 (0.73–2.40)	0.351
Race								
Black	(ref)		(ref)		(ref)		(ref)	
Coloured	2.02 (1.23–3.31)	**0.006**	7.22 (4.33–12.01)	**<0.001**	3.93 (2.28–6.76)	**<0.001**	3.22 (1.90–5.46)	**<0.001**
Indian	0.50 (0.14–1.75)	0.277	1		0.57 (0.15–2.12)	0.398	0.17 (0.02–1.32)	0.090
White	1.75 (0.86–3.57)	0.124	4.84 (2.17–10.81)	**<0.001**	3.55 (1.57–8.03)	**0.002**	1.24 (0.53–2.87)	0.619
Highest level of education								
No formal education	(ref)		(ref)		(ref)		(ref)	
Primary education	0.77 (0.42–1.41)	0.403	0.77 (0.38–1.55)	0.458	0.21 (0.08–0.54)	**0.001**	1.24 (0.75–2.03)	0.405
Secondary education	0.49 (0.26–0.95)	**0.034**	0.59 (0.26–1.29)	0.186	0.15 (0.05–0.39)	**<0.001**	0.94 (0.53–1.68)	0.831
Post-secondary education	0.38 (0.17–0.84)	**0.017**	0.28 (0.10–0.81)	**0.019**	0.13 (0.04–0.39)	**<0.001**	0.40 (0.18–0.87)	**0.021**
Place of residence								
Rural	(ref)		(ref)		(ref)		(ref)	
Urban	1.20 (0.91–1.58)	0.197	1.28 (0.80–2.05)	0.302	1.02 (0.71–1.48)	0.904	1.34 (1.00–1.81)	**0.049**
Marital Status								
Single	(ref)		(ref)		(ref)		(ref)	
Married	0.59 (0.38–0.91)	**0.017**	0.76 (0.44–1.31)	0.322	0.74 (0.46–1.20)	0.228	0.52 (0.33–0.83)	**0.006**
Living together	0.90 (0.54–1.49)	0.678	1.69 (0.77–3.70)	0.192	1.08 (0.64–1.80)	0.783	1.16 (0.57–2.34)	0.684
Separated	1.01 (0.54–1.89)	0.972	1.48 (0.71–3.08)	0.291	1.76 (0.85–3.62)	0.125	0.76 (0.41–1.41)	0.377
Widowed	0.74 (0.34–1.60)	0.447	1.05 (0.50–2.20)	0.899	2.28 (0.97–5.35)	0.058	0.57 (0.31–1.02)	0.060
Income								
Zero	(ref)		(ref)		(ref)		(ref)	
ZAR 1–5000	1.14 (0.78–1.65)	0.495	2.20 (1.22–3.96)	**0.009**	0.68 (0.24–1.94)	0.468	1.29 (0.93–1.78)	0.129
ZAR 5001–15,000	0.97 (0.56–1.66)	0.909	3.06 (1.33–7.05)	**0.009**	0.66 (0.23–1.90)	0.444	1.26 (0.68–2.31)	0.462
ZAR 15,001–30,000	0.70 (0.32–1.50)	0.356	2.45 (0.78–7.67)	0.124	0.39 (0.12–1.27)	0.118	2.28 (0.63–8.23)	0.208
>ZAR 30,000	0.70 (0.26–1.90)	0.486	4.54 (1.25–16.51)	**0.022**	0.51 (0.14–1.89)	0.315	0.50 (0.06–4.00)	0.517

AOR, adjusted odds ratio; CI, confidence interval.

In the non-working group, individuals who were female (AOR = 0.14, 95% CI: 0.11–0.19, $p < 0.001$) compared to being male; had a post-secondary education (AOR = 0.40, 95% CI: 0.18–0.87, $p = 0.021$) compared to no formal education; and were married (AOR = 0.52, 95% CI: 0.33–0.83, $p = 0.006$) compared to being single had lower odds of smoking. However, those aged 25–44 years (AOR = 1.62, 95% CI: 1.08–2.42, $p = 0.019$) and 45–64 years (AOR = 2.37, 95% CI: 1.51–3.73, $p < 0.001$) compared to being aged 15–24 years; being Coloured (AOR = 3.22, 95% CI: 1.90–5.46, $p < 0.001$) compared to being Black African; and living in an urban residence (AOR = 1.34, 95% CI: 1.00–1.81, $p = 0.049$) compared to a rural area were significantly more likely to be current smokers (Table 3).

4. Discussion

This study contributes to existing research by highlighting significant socio-demographic disparities in tobacco smoking prevalence in South Africa, particularly across sex and employment status groups. It provides evidence that can inform more targeted and effective tobacco control interventions. The study found that males and those who were working had the highest prevalence of tobacco smoking among the population. This is in line with global research that has indicated a pattern of high prevalence of tobacco smoking among males across several countries, such as Nepal (Shrestha et al. 2019), China (Liu et al. 2017), the USA (Drope et al. 2018), and others (Nargis et al. 2019; Ogbodo and Onyekwum 2024; Shahwan et al. 2019).

Our investigation of the level of education of those who smoke shows that smoking was most prevalent among males without any formal education, but it was lowest among females with no formal education. Coloured males displayed the highest prevalence of smoking, followed by Black African males, compared to the prevalence among Coloured females, followed by White females. Among the groups who were working and not working, males and those of Coloured ancestry displayed the highest smoking prevalence. However, the highest prevalence by educational level was found to be among those with no formal education in the working group, and those with primary education in the non-working group. Studies from Pakistan and Nigeria based on the GATS have found similar results showing associations between smoking status and socio-demographic factors such as sex, education, and occupation (Bashir et al. 2018; Adeniji et al. 2016; Mengesha et al. 2022).

Several prior studies have explored the socio-demographic determinants of smoking prevalence among different populations in South Africa. A cross-sectional survey investigating the determinants of cigarette smoking among low-income communities in South African townships using binomial regression (Boachie and Ross 2020) found that an increase in the price of cigarettes was the most significant predictor of a reduction in smoking prevalence. Some sex and race differences have been reported regarding the way in which the price of cigarettes affected cigarette usage. Women were more responsive to changes in cigarette prices than men, and Black Africans were found to be more responsive than Coloured individuals (Boachie and Ross 2020). Moreover, the study found that higher household income was associated with reduced smoking intensity, especially among young adults. Individuals with access to higher education were associated with reduced smoking intensity and prevalence (Boachie and Ross 2020).

Studies using the GATS data from Sub-Saharan Africa have reported that a higher smoking prevalence is associated with males, residing in a rural area, higher age, and a lower education (Ogbodo and Onyekwum 2024). This finding is in line with those of studies in Nepal and Singapore, where higher tobacco use was also found to be associated with higher age and a lower level of education (Shrestha et al. 2019; Shahwan et al. 2019). Several studies show that lower socioeconomic status is associated with higher tobacco smoking prevalence across the globe (Wellman et al. 2018). The current study shows that although smoking prevalence was generally higher among working individuals, it was significantly higher among working males than among working females. Employment status often influences access to healthcare, stress levels, and social support, all of which can have an impact on smoking behaviours and the likelihood of successful cessation.

Higher household income also allows for the resources and support systems available to aid people in quitting, whereas unemployed and informally employed people might struggle with higher stress levels and fewer cessation resources. Such findings may indicate that non-working populations may have limited access to educational resources concerning the harms of tobacco usage, and may continue to smoke, despite the fact that they have less disposable income. A workplace ban on smoking may help to encourage more of those who work to quit smoking.

Existing studies have found some racial differences in the prevalence of tobacco use. The findings of this study are consistent with those of previous research, which indicate that Coloured populations are more likely to smoke than Black Africans, particularly older males (Boachie and Ross 2020). This disparity was also reflected in terms of educational levels, which corroborates findings from a study conducted in the USA, and which found significant associations between smoking prevalence and cessation attempts by race and level of education (Nguyen-Grozavu et al. 2020). Similar studies also found that educational disparity accounted for significant racial differences in smoking prevalence (Agaku et al. 2020).

This study found significant differences among women who smoked tobacco. Women with a higher income were found to be more likely to smoke, and older women were more likely to have made attempts to quit than younger ones. Again, these results were similar to those in research from other countries in Sub-Saharan Africa using GATS data (Ogbodo and Onyekwum 2024). The findings corroborate similar findings in other studies, noting that Black African women had a lower prevalence of smoking than their male counterparts, probably due to cultural differences that discourage women from smoking (Boachie and Ross 2020).

In a similar study examining the prevalence of smoking among Chinese participants, using data from a nationally representative survey, it was found that the prevalence of tobacco use was low among women, and that there was a significant intergenerational decrease in smoking uptake (Liu et al. 2017). Additionally, women often bear a disproportionate share of the health and economic consequences of smoking, especially during pregnancy and their child-rearing years (Martinez Leal et al. 2021).

A study by Lau et al. found differences in the association between neighbourhood-level deprivation and tobacco smoking by race group in South Africa, though this was more pronounced among the Black African race group compared to the Coloured race group. This study proposes various reasons for the disparities in smoking prevalence among race groups and by sex to include cultural norms for or against smoking, historical deprivation at the community level, and the economic shift in previously deprived communities (Lau et al. 2018). Also, Lau et al. suggest that there is need for research to uncover the underlying mechanisms that may be the drivers of tobacco use patterns across the population in South Africa and other developing countries (Lau et al. 2018).

The observed disparities in smoking behaviour by sex and employment status across various socio-demographic groups like race, age, and education in this study align with previous findings in some respects, further underscoring the need for targeted and context-specific interventions. By integrating the insights from the current study with those from prior research, this study contributes to a more nuanced understanding of the factors that shape tobacco use, paving the way for targeted and effective public health policies.

Limitations

This study has some limitations. The cross-sectional design of the study limited its ability to establish causality among the issues investigated or the reasons why tobacco smoking among most race groups are different according to sex and employment status. These reasons may be explored using qualitative methodology. The GATS-SA relies on self-reporting by participants, which means that the accuracy of the findings depends largely on the reliability of the self-reported data, which may be subject to recall or social desirability bias, especially given that the survey concerns sensitive behaviour such as

smoking. The survey used closed-ended responses, which do not fully capture the reasons and nuances behind participant behaviour. Future studies may expand on the results to explore the mechanisms through which smoking prevalence may be influenced by sex and employment status. Some factors, such as the impact of the COVID-19 pandemic, which significantly altered employment patterns and stress levels, may also have affected the study's findings, which may limit the extrapolation of the findings to different time periods.

5. Conclusions

This study highlights significant differences in tobacco smoking prevalence based on sex and employment status in South Africa. The findings revealed that smoking behaviour was significantly associated with being male, being aged 25–64 years, being of the Coloured race, being a White female, and having no formal education (especially among males). These disparities highlight the need for targeted tobacco control interventions in the form of health promotion campaigns and cessation services that address the unique challenges and behaviours of these high-risk groups.

Building on the findings of this study, several recommendations for future research and directions in tobacco control policy emerge. Longitudinal studies and randomised controlled trials may facilitate a better understanding of the causal relationships between these socio-demographic factors and tobacco smoking. Such studies would help to clarify how changes in employment status, income, and other socio-economic variables influence smoking patterns over time. Studies investigating smoking intensity and topography based on demographic characteristics could also provide more insights into the smoking behaviour of various demographic groups. Qualitative studies could provide deeper insights into the motivations and risk influences for smoking in these groups, allowing for the development of more culturally sensitive and specifically tailored tobacco control programmes.

The findings of this study emphasise the importance of developing nuanced, context-specific tobacco control strategies that cater to the diverse needs of South Africa's population. By addressing the socio-demographic factors that influence smoking behaviour, policymakers and public health practitioners can design more effective and equitable interventions. These strategies should prioritise the most vulnerable groups, including non-working individuals and those with no formal education, to achieve significant reductions in tobacco use and its associated health burdens across the nation.

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Data Availability Statement: The GATS-SA dataset is publicly available on the Global Tobacco Surveillance System website https://bit.ly/3SIp6V9.

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