A cross-sectional investigation of softening indicators among South African smokers: Results from the South African Social Attitudes Survey between 2007 and 2018

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ABSTRACT

Recent studies have shown softening among smokers in different countries and in different population groups i. e., as smoking prevalence declined remaining smokers made more quit attempts and smoked fewer cigarettes per day (CPD), as opposed to hardening. We examined tobacco use-related cross-sectional data from five waves of the South African Social Attitudes Survey (SASAS 2007–2018, N = 14,822). Accounting for the SASAS's complex survey design, we ran logistic and linear regressions for smoking prevalence, and for the following indicators of softening: plans to quit smoking within a month, time to first cigarette (5 min, TTFC) and cigarettes smoked per day (CPD). We controlled for survey wave, age, sex, race, marital status, educational level and urban/rural residence. Smoking prevalence remained stable from 2007 (20.7%) to 2018 (22.2%) in the overall population of smokers (p = 0.197), and within sex and race group of smokers. In the adjusted model, there was a significant decline in CPD over time, 0.12 cigarettes per year. There was also a significant decrease in TTFC among males over time. Among women, CPD declined significantly by 0.32 cigarettes per year. The proportion of Asians/ Indians planning to quit also decreased over time. South African smokers do not consistently show significant change in the softening indicators overall. Stronger tobacco control policies and better-tailored smoking cessation interventions are needed to achieve a significant decrease in smoking prevalence across sex and other subpopulations in South Africa.

1. Introduction

Nearly 80% of the world's smokers live in low and middle- income countries (LMICs). Deaths attributed to tobacco use are estimated to double in LMICs between 2002 and 2030 (World Health Organisation. Tobacco Control Factsheet, 2021). The smoking prevalence patterns in most African countries differ from those in high-income countries. The prevalence of tobacco use in Sub-Saharan Africa is about 10.2% (2.9% among females and 17.5% among males). Some of the factors known to influence prevalence are level of education, sex, income level and policy implementation (Brathwaite et al., 2015). Though Africa as a continent has the lowest smoking prevalence globally (Blecher and Ross, 2013), the World Health Organization (WHO) reports that only one country in the AFRO region is expected to meet the targeted 30% relative reduction in tobacco smoking prevalence by 2025 (World Health Organization, 2019). Africa is seen as at risk of having an increase in the number of smokers due to its higher population growth rate and being an industry target for marketing tobacco products through the promotion of positive images of smoking, and price cuts (Pampel, 2008). South Africa has one of the highest smoking prevalence rates in the African continent

(Statistica. Prevalence of tobacco users in Africa in, 2019). Results from the first South African National Health and Nutrition Examination Survey reported a prevalence of 17.9% in 2012 (Reddy et al., 2015) while the 2016 South Africa Demographic and Health Survey reported a prevalence of about 22% (National Department of Health (NDoH), 2016), both higher than the regional prevalence.

South Africa ratified the WHO Framework Convention on Tobacco Control (FCTC), the first global public health treaty, in 2005 (The United Nations Treaty Collection, 2021). The country's Tobacco Products Act, 83 of 1993 (South African Government, 1993) (amended in 2008) regulates tobacco products in the country. However, this law falls short of key recommendations of the WHO FCTC in some respect. For example, Section 2 of this Act allows the minister to permit smoking in prescribed areas, and in 2000, it allowed designated smoking areas of not more than 25% of an indoor public place (falling short of the 100% smoke-free indoor public places provisions of the WHO FCTC) (South African Government, 2000). Furthermore, textual health warnings on cigarettes packs cover 15% and 25% of the front and back of the tobacco package, respectively (Laws and Policies, 2021) which is not only lower than FCTC-recommended minimum coverage of 30% but falls short of including pictorial warnings as recommended by the FCTC guidelines in Article 11 (World Health Organization, 2021). In 2022, the minimum excise tax per 20 cigarette pack was set at R19.82 (Bowmans. South Africa: Budget Speech, 2022) which is about 50% of the retail price of the most popular cigarette brand. This tax is also lower than the FCTC recommended tax of 70% of retail price (Laws and Policies, 2021).

With a less regulated tobacco control environment as well as a more recent slow increase in smoking prevalence, it is of interest to examine if South African smokers are exhibiting patterns of softening or hardening. Definitions of softening/hardening vary (Yin et al., 2019). We define softening as the smoking population, on average, becoming more willing to or more capable of quitting as smoking prevalence declines, implying that as more people quit, the smoking population would comprise of smokers who are smoking less, are less addicted to nicotine, and are more willing to quit (Cohen et al., 2012; Costa et al., 2010; Docherty and McNeill, 2012; Kulik and Glantz, 2017; Warner and Burns, 2003; Winter, 2014). On the other hand, hardening is said to occur if as smoking prevalence declines, the proportion of 'hardcore/hardened' smokers increases (Edwards, 2020). Hardcore smokers can be described as regular, relatively heavy tobacco users with a lack of recent quit attempts and/or interest in quitting (Darville and Hahn, 2014). Recent studies have shown softening among smokers in different countries and in different population groups (Kulik and Glantz, 2017; Kulik and Glantz, 2016). Buchanan et al. posit that even where hardening seems to be the case, the fact that there are some hardcore smokers is not always enough evidence to confirm hardening (Buchanan et al., 2020).

Less is known about the softening or hardening of smokers in low and middle-income countries (LMICs) (Edwards, 2020). A study by Yin and colleagues looking at prevalence of hardened smokers using Global Adult Tobacco Survey (GATS) data from 19 LMICs, found that in LMICs there are hardened smokers. However, the prevalence differs in population groups and countries (Yin et al., 2019). Our study therefore sought to determine if South African smokers exhibit patterns of softening or hardening using three softening indicators, namely, plans to quit within a month (in lieu of quit attempts), smoking within 5 mins of waking up (time to first cigarettes - TTFC) and cigarettes smoked per day (CPD) – the latter two being indicative of nicotine addiction (Branstetter et al., 2020; Pérez-Ríos et al., 2009). We investigated trends in these softening indicators by sex and race groups because there have been disparities in smoking prevalence by sex and race groups among South African smokers (National Department of Health (NDoH), 2016). Findings from this study could inform tobacco control policies and recommendations for the scaling up of general and targeted cessation support for smokers in South Africa.

2. Methods

2.1. Data

We used five waves of the nationally representative cross-sectional South African Social Attitudes Survey (SASAS: 2007, 2010, 2011, 2017, 2018) with a total of 14,822 respondents and 3,148 current smokers among them. SASAS has been conducted annually by the Human Sciences Research Council (HSRC) since 2003, and participants are aged from 16 years and above (Human Sciences Research Council, 2021). The survey uses a multi-stage probability sampling strategy, with census enumeration areas as the primary sampling unit.

In addition to smoking prevalence, we examined the following softening indicators: proportion of those planning to quit within a month (in lieu of actual quit attempts), proportion of those smoking within 5 min of waking (TTFC) and CPD. Not all variables were available in all five waves. TTFC was not asked in the 2017 wave, while the 2018 wave excluded roll-your-own (RYO) cigarettes in the question on CPD, hence 2018 data were excluded from the analysis of CPD.

2.2. Measures

The following tobacco-use related questions were used in this study: Current smokers were asked "do you use any of the following tobacco products currently every day or currently someday; manufactured cigarettes, RYO cigarettes? A current smoker was defined as someone who answered "currently every day" or "currently someday" to using manufactured cigarettes and/or roll-your-own cigarettes. CPD was ascertained with the question, "on the days that you smoke, on average, how many cigarettes including hand rolled cigarettes, do you smoke per day?" Planning to quit was ascertained by the question, "which of the following best describes you: I am planning to quit…" (only those planning to quit within the next one month were included in this analysis). Time to first cigarette was measured by the question "If you smoke daily, how soon after you wake up do you take your first cigarette?" (only those who reported smoking within 5 mins of waking up were included in this analysis). We also investigated these indicators within subpopulations (sex and race groups).

In the adjusted models, we controlled for the following sociodemographic variables: age (continuous variable), sex (male/female), self-identified race groups (Black African, Coloured [mixed race], White, Asia/Indian), marital status (married, widowed/divorced/separated, never married) educational level (<Grade 12, Grade 12 and > Grade 12) and urban/rural residence.

2.3. Analyses

Data from all five waves were pooled. Percentages were used to describe the general sample. We conducted univariate and multivariate logistic and linear regression analyses for: smoking prevalence (wave years 2007, 2010, 2011, 2017, 2018), plans to quit smoking within a month (wave years 2007, 2010, 2011, 2017, 2018), time to first cigarette (5 min) (wave years 2007, 2011, 2018) and a simple and multiple linear regression for number of cigarettes smoked per day (CPD) (wave years 2007, 2010, 2011, 2017). We applied weights in order to yield nationally representative samples and controlled for year, age, sex (except for analyses stratified by sex), race groups (except for analyses stratified by race), marital status, educational level and residence location. Softening indicators were only investigated among current smokers (n = 3,148).

2.4. Ethical consideration

The South African Social Attitude Surveys are approved by the Human Sciences Research Council Research Ethics Committee (Human Sciences Research Council, 2021). Participation was voluntary, and

participants were assured of confidentiality and anonymity. All data were de-identified.

3. Results

The sample from all five waves was made up of 14,822 participants, aged 16 years and above. About 51% ($n = 8771$) were female; 77.5% ($n = 9072$) were Black Africans and about 26% ($n = 3241$) of the sample were 25–34 years old. About 58% ($n = 8551$) of the sample had an education level less than grade 12. The majority of the sample (56%, $n = 6538$) were never married and lived in urban areas (67.3% $n = 10766$) (Table 1).

3.1. Smoking prevalence and demographic characteristics

Smoking prevalence decreased from 20.7% in 2007 to 17.6% in 2010, but increased from 19.5% in 2011 to 22.2% in 2018 (Fig. 1a). However, the change in smoking prevalence was not significant in the unadjusted model (OR = 1.01; 95% CI: 0.99–1.03), or after adjusting for other demographic characteristics (Table 2). Smoking prevalence by sex also reflects the pattern for the whole sample. For males, there was a decrease between 2007 and 2010 and an increase from 2011 to 2018, resulting in an overall slight decrease from 32.5% in 2007 to 32.2% in 2018. For females, a decrease was found between 2010 (9.7%) and 2011 (8.9%) while there was an increase from 8.4% in 2017 to 11.4% in 2018. Among the race groups, prevalence only declined among Asian/Indians from 27.6% in 2007 to 23.7% in 2018. (Fig. 1). None of the changes

Table 1
Demographic characteristics of overall sample and subsamples by survey year.

Variable	All the years n (%)	95% CI	2007 n (%)	95% CI	2010 n (%)	95% CI	2011 n (%)	95% CI	2017 n (%)	95% CI	2018 n (%)	95% CI
Sex												
Male	6050 (48.9)	47.6 – 50.2	1221 (48.7)	45.8 – 51.5	1268 (47.8)	45.2 – 50.4	1240 (47.5)	45.0 – 50.0	1199 (48.3)	45.0 – 51.5	1122 (51.7)	48.8 – 54.6
Female	8771 (51.1)	49.8 – 52.4	1686 (51.3)	48.5 – 54.2	1844 (52.2)	49.6 – 54.8	1763 (52.5)	50.0 – 55.0	1864 (51.8)	48.5 – 55.0	1614 (48.3)	45.4 – 51.2
Race												
Black African	9072 (77.5)	76.0 – 79.0	1812 (76.7)	73.0 – 80.1	1781 (76.6)	73.0 – 79.9	1883 (76.7)	73.3 – 79.9	1872 (78.5)	74.7 – 81.9	1724 (78.7)	74.6 – 82.4
Coloured	2375 (9.2)	8.3 – 10.3	434 (9.4)	7.4 – 11.8	564 (9.3)	7.5 – 11.6	473 (9.5)	7.6 – 11.8	495 (9.0)	7.1 – 11.4	409 (9.1)	6.9 – 11.8
White	1734 (10.4)	9.3 – 11.5	335 (11.2)	8.9 – 13.9	401 (11.1)	9.0 – 13.7	387 (10.9)	8.9 – 13.4	348 (9.6)	7.4 – 12.5	263 (9.3)	6.8 – 12.7
Asian/Indian	1635 (2.9)	2.5 – 3.3	326 (2.8)	2.0 – 3.7	365 (3.0)	2.2 – 4.0	259 (2.9)	2.2 – 3.8	348 (2.8)	2.1 – 3.9	337 (2.9)	2.1 – 3.9
Age												
16–24	2801 (25.8)	24.6–27.1	686 (27.4)	25.0–30.0	618 (27.5)	24.9–30.2	566 (26.8)	24.3–29.5	498 (24.2)	21.8–26.7	433 (24.0)	21.0–27.3
25–34	3241 (26.1)	25.0–27.2	633 (26.0)	23.8–28.2	699 (25.6)	23.4–28.0	707 (25.6)	23.5–27.8	637 (26.5)	24.2–28.9	565 (26.6)	23.9–29.5
35–44	2964 (18.4)	17.5–19.3	614 (17.0)	15.3–18.9	656 (17.9)	16.3–19.7	568 (18.4)	16.6–20.4	613 (19)	17.4–20.8	513 (19.3)	17.0–21.8
45–54	2257 (13.1)	12.3–13.9	440 (13.5)	11.8–15.4	449 (12.1)	10.5–13.8	507 (13.2)	11.7–14.8	437 (13.4)	11.7–15.4	424 (13.1)	11.4–15.0
55–64	1860 (9.2)	8.6–9.8	295 (8.7)	7.4–10.2	382 (9.6)	8.2–11.3	360 (9.1)	7.9–10.5	413 (9.3)	8.1–10.7	410 (9.2)	7.9–10.6
65+	1685 (7.5)	6.9–8.1	231 (7.5)	6.2–9.0	306 (7.3)	6.1–8.7	292 (6.9)	6.0–8.1	465 (7.6)	6.4–9.0	391 (7.9)	6.6–9.5
Highest level of education												
<Grade 12	8551 (57.6)	56.1–59.1	1832 (63.1)	59.9–66.2	1739 (57)	53.9–60.1	1709 (56.7)	53.7–59.7	1788 (58.8)	55.5–62.0	1483 (53.5)	49.6–57.3
Grade 12	4309 (32.9)	31.6–34.2	752 (28.0)	25.4–30.7	880 (31.0)	28.4–33.7	871 (32.3)	29.7–35.0	895 (33.2)	30.5–36.1	911 (38.6)	35.0–42.3
>Grade 12	1664 (9.5)	8.7–10.3	302 (9.0)	7.4–10.8	420 (12.0)	10.2–14.1	376 (11.0)	9.4–12.9	313 (8.0)	6.5–9.9	253 (8.0)	6.3–10.1
Marital Status												
Married	5458 (32.9)	31.6–34.2	1086 (33.9)	31.0–36.8	1204 (33.8)	31.1–36.6	1090 (32.1)	29.6–34.8	1254 (38.6)	35.9–41.3	824 (26.8)	23.7–30.1
Widow/divorce/ Separate	2343 (10.9)	10.2–11.6	430 (12.0)	10.3–14.0	447 (10.2)	8.9–11.8	456 (10.5)	9.4–11.8	507 (10.3)	8.9–11.8	503 (11.6)	10.0–13.5
Never Married	6538 (56.2)	54.8–57.6	1378 (54.2)	51.1–57.2	1337 (56.0)	52.9–59.1	1374 (57.4)	54.7–60.1	1189 (51.2)	48.3–54.1	1260 (61.6)	58.1–65.1
Geo-location												
Urban	10,766 (67.3)	66.0–68.6	2011 (67.5)	62.5–72.1	2246 (65.6)	60.3–70.4	2131 (64.7)	59.8–69.3	2324 (69.2)	63.8–74.1	2054 (69.0)	63.5–74.1
Rural	4056 (32.7)	31.4–34.0	896 (32.5)	27.9–37.5	866 (34.4)	29.6–39.7	873 (35.3)	30.7–40.2	739 (30.8)	25.9–36.2	682 (31.0)	25.9–36.5

Graph A: Smoking prevalence by survey year and by sex and race groups
Graph B: Proportion of smokers planning to quit within one month by survey year and by sex and race groups
Graph C: Proportion of smokers who smoke within 5 mins of waking up by survey year and by sex and race groups
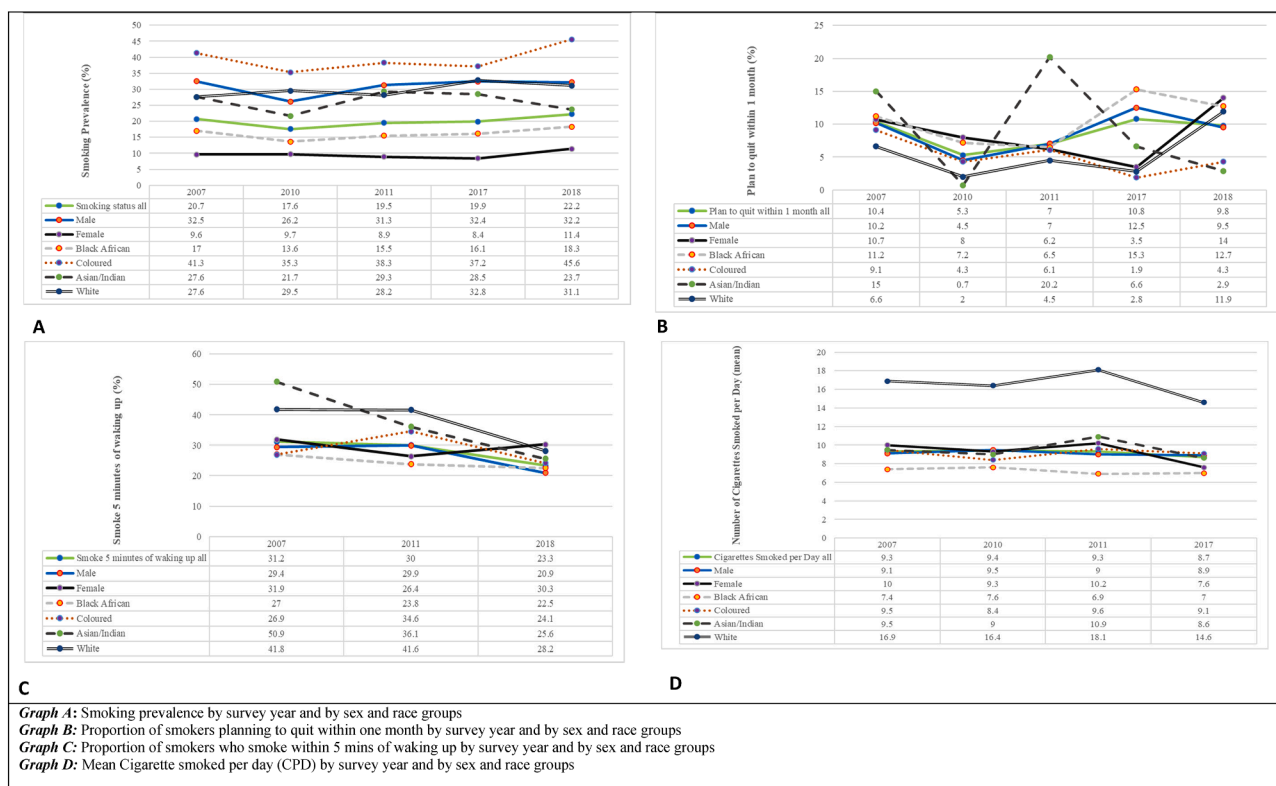Graph D: Mean Cigarette smoked per day (CPD) by survey year and by sex and race groups

Fig. 1. Change in smoking prevalence and three softening indicators among South African smokers by sex and race groups.

Table 2
Univariate and multivariate logistic regression of Current smokers (2007 – 2018), Plans to quit within a month (2007 – 2018), Smoking within 5 min of waking up (2007, 2011, 2018) and linear regression of Number of cigarettes smoked per day (2007 – 2017), Only change over time is shown.

	Current smokers** (2007 – 2018) (N = 3,148)			Plans to quit within a month** (2007 – 2018) (N = 235)			Smoking within 5 min of waking up** (2007, 2011, 2018) (N = 577)			Number cigarettes per day≈ including RYO** (2007 – 2017) (N = 2,493)		
	OR	95%CI	p-value	OR	95%CI	p-value	OR	95%CI	p-value	Coef.	95%CI	p-value
UNADJUSTED												
Overall (time, per year)	1.01	(0.99–1.03)	0.197	1.02	(0.97–1.08)	0.455	0.96	(0.93–1.00)	**0.049***	−0.10	(-0.24–0.04)	0.169
Sex (time per year)												
Male	1.01	(0.99–1.03)	0.386	1.02	(0.96–1.09)	0.481	0.96	(0.92–1.00)	**0.031***	−0.05	(-0.22–0.12)	0.574
Female	1.01	(0.98 – 1.04)	0.618	1.02	(0.88–1.18)	0.780	0.98	(0.91–1.06)	0.646	−0.27	(-0.47 - −0.08)	**0.006***
Race (time per year for)												
Black African	1.01	(0.99–1.04)	0.228	1.06	(0.99–1.13)	0.119	0.97	(0.92–1.02)	0.278	−0.08	(-0.19–0.04)	0.218
Coloured	1.01	(0.98 – 1.05)	0.450	0.90	(0.81–1.01)	0.069	0.97	(0.91–1.04)	0.454	−0.07	(-0.35–0.22)	0.650
White	1.02	(0.98–1.06)	0.348	0.91	(0.78–1.05)	0.196	0.94	(0.86–1.04)	0.254	−0.26	(-0.82–0.31)	0.368
Asian/Indian	1.00	(0.95 – 1.05)	0.915	0.89	(0.79–0.99)	**0.040***	0.91	(0.82–1.02)	0.095	−0.11	(-0.42–0.21)	0.505
ADJUSTED ANALYSES*												
Overall (time per year)	1.01	(0.99–1.03)	0.365	1.02	(0.96–1.08)	0.460	0.97	(0.93–1.01)	0.161	−0.12	(-0.25 - −0.00)	**0.048***
Time, per year for												
Male	1.01	(0.99–1.03)	0.526	1.03	(0.96–1.09)	0.436	0.97	(0.93–1.01)	0.111	−0.08	(-0.21–0.07)	0.294
Female	1.02	(0.99 – 1.06)	0.114	0.99	(0.87–1.14)	0.922	0.98	(0.90–1.07)	0.686	−0.32	(-0.55 - −0.09)	**0.006***
Time, per year for												
Black African	1.01	(0.99–1.04)	0.360	1.06	(0.99–1.13)	0.118	0.98	(0.93–1.04)	0.503	−0.09	(-0.21–0.04)	0.166
Coloured	1.02	(0.98 – 1.05)	0.348	0.90	(0.80–1.01)	0.085	0.98	(0.91–1.04)	0.464	−0.14	(-0.44–0.17)	0.385
White	1.01	(0.97 – 1.06)	0.493	0.90	(0.79–1.04)	0.147	0.94	(0.86–1.03)	0.202	−0.26	(-0.82–0.31)	0.368
Asian/Indian	0.98	(0.93 – 1.03)	0.510	0.88	(0.79–0.99)	**0.039***	0.94	(0.85–1.05)	0.271	−0.08	(-0.37–0.21)	0.599

Boldface indicates statistical significance (*p < 0.05).
≈Univariate and multivariate linear regression analyses.
**Dependent variables: softening indicators.
*** Adjusted analyses controlling for sex [ref-male] (except for trends by sex), race [black] (except for trends by race), age (cont.), highest level of education (ref- <Grade 12), marital status [ref-married], location of residence [ref- rural] (adjusted OR reported).

were found to be significant in either the unadjusted or the adjusted models (Table 2).

3.2. Proportion of those planning to quit within one month

Overall, the proportion of those planning to quit within a month remained stable between 2007 and 2018 (Fig. 1 and Table 2). An investigation stratified by sex and race groups showed that in the un-adjusted models there was no significant change in the proportion of those with plans to quit within one month among females and males and all race groups except Asians/Indians between 2007 and 2018. The proportion of Asians/Indians planning to quit within a month signifi-cantly decreased over the 11-year period from 15% in 2007 to 2.9% in 2018 (Fig. 1 and Table 2) (OR = 0.89; 95% CI: 0.79–0.99; p = 0.040). This remained significant after adjusting for sex, age, highest level of education, marital status and location of residence (AOR = 0.88; 95% CI: 0.79–0.99; p = 0.039) (Table 2).

3.3. Smoking within 5 min of waking up

Overall, the proportion of those smoking within 5 min of waking up significantly declined from 31.2% in 2007 to 23.3% in 2018 (Fig. 1) (OR = 0.96; 95% CI: 0.93 – 1.00; p = 0.049, unadjusted model) (Table 2). There was no significant change in the proportion of those smoking within 5 mins of waking up among females and smokers of the different self-identified race groups over the 11-year period (Table 2). However, the proportion of males smoking within 5 mins of waking up signifi-cantly decreased over time (OR = 0.96; 95% CI: 0.92 – 1.00; p = 0.031, unadjusted model) but this was not significant after adjusting for race, age, highest level of education, marital status, and location of residence (AOR = 0.97; 95% CI: 0.93 – 1.01; p = 0.111) (Table 2).

3.4. Cigarettes smoked per day (CPD)

In both the unadjusted and adjusted models, CPD did not signifi-cantly decline during the period between 2007 and 2017 (Coef: −0.10; 95% CI: −0.24 – −0.04; p = 0.169) (Table 2). However, in the adjusted model CPD was found to have significantly declined by 0.12 CPD per year (95% CI: −0.25 – −0.00; p = 0.048). Further investigation stratified by sex and by race showed a significant decline in CPD among females by 0.27 CPD per year (95% CI: −0.47 – −0.08; p = 0.006). CPD decline among females over time remained significant after adjusting for race, age, highest level of education, marital status and urban/rural residence (Coef:-0.32; 95% CI: −0.55 – −0.09; p = 0.006) (Table 2). Table 2 only reports the dependent variables' change over time (for example, change in smoking prevalence over time stratified for each group listed in the Table [male/female or each race group]). Other independent variables are not shown in Table 2.

In summary, of the three softening indicators investigated among South African smokers, overall, there was a significant change in one indicator over time (decrease in TTFC) indicative of softening. There was also a significant change in one softening indicator each among females (decrease in CPD) and males (decrease in TTFC) over time. Investigation of these three indicators within race groups between 2007 and 2018 showed a significant decline in one indicator among Asians/Indians (decrease in plans to quit within one month), indicative of hardening. In the adjusted models, CPD significantly declined by 0.12 CPD per year among all smokers and 0.32 CPD per year among female smokers. The proportion of those with plans to quit within a month significantly declined among Asian/Indian smokers over time.

4. Discussion

The findings of this study do not allow for a refutation or confir-mation of softening among smokers in South Africa. Recent studies have shown that more softening is occurring around the world than hardening

(Edwards et al., 2017; Fernández et al., 2015). Softening is characterized by a decrease in the proportion of those smoking within 5mins of waking up, decline in CPD and increase in the proportion of those having attempted to quit or planning to quit. Our results show that CPD, especially among South African women has been declining significantly over the period of the study. A decrease in CPD is indicative of softening (Kulik and Glantz, 2019).

South Africa is a racially diverse nation, and our results show that the degree of softening varies in different racial groups with Asians showing some signs of hardening in their significant decline to plan quitting within a month. In contrast, Kulik and Glantz found that though smoking prevalence differed among racial and ethnic groups, similar softening was found across the racial/ethnic groups in California (Kulik and Glantz, 2019). Taking into consideration South Africa's diversity, it is important to note such differences when designing population level smoking cessation interventions and other tobacco control measures.

The lack of significant change in the overall number of smokers reporting a plan to quit within one month as found in our study is an important result to inform cessation efforts in South Africa. It is even more troubling for the Asian/Indian race group where we found a sig-nificant decline in the proportion of those planning to quit over time. This lack of change or decline in plans to quit may be indicative of a dearth of effective cessation support for smokers in the country. The WHO has reported that quit aids can play a huge role in decreasing smoking prevalence (World Health Organisation, 2019). South Africa presently has a national quitline (which is not toll-free as recommended by the WHO FCTC), as well as a WhatsApp line in addition to other online resources available to assist smokers to quit (Egbe and Ngobese, 2020). Also, a combination of psychological and pharmaceutical cessa-tion aids have been found to be more effective in helping smokers quit than monotherapies (Shah et al., 2008). The results of this study can be used to encourage the government to implement more comprehensive tobacco control policies and champion evidence-based smoking cessa-tion interventions, and for different subpopulations, which can lead to a decrease in tobacco use (Buchanan et al., 2020) in the country and further help to soften the smoking population in South Africa.

The passing and implementation of a comprehensive and FCTC-compliant tobacco control policy is urgently needed to more signifi-cantly drive softening among South African smokers. The speedy passing of the Control of Tobacco and Electronic Delivery Systems bill (Republic of South Africa: Government Gazette. Co., 2018) would go a long way to achieve improved tobacco control in South Africa. This bill seeks to have tobacco products in standardized packages, completely ban smoking in indoor public places, ban the sale of tobacco products through vending machines, as well as regulate electronic cigarettes among other mea-sures (Egbe, 2018). These measures would place South Africa at a van-tage position to tackle current tobacco control challenges highlighted in this paper.

4.1. Limitations of the study

We caution that some of our results did not include all of the survey waves. Some questions were excluded from some analyses either due to an absence of specific questions from a particular wave or question not being asked in a consistent format across survey waves (see methods section). The nature of a cross-sectional study does not allow for the determination of causal effects, therefore the reason for any change (or its lack) in trends of softening indicators over time could not be ascer-tained in this study. Feliu et al. (2019) found that smokers with low socioeconomic statuses (SES) have a higher likelihood of being hardcore smokers. However, we only included one of three main measures of SES (i.e. education) in our analysis because other measures were not consistently available across data points or were not reliable. Further, the validity of a self-reported measure of smoking is limited given that participants may give socially desirable answers.

4.2. Strength of the study

This paper uses cross-sectional surveys with nationally representative samples over a 10-year period. It provides a basis for the continuous surveillance of softening indicators in this and similar settings in order to inform appropriate policies to help smokers quit or reduce tobacco consumption.

5. Conclusion

The results presented in this paper show that overall, the South African smoking population is not hardening nor sufficiently softening. The results also indicate that Asian/Indians showed signs of hardening with a significant decrease in the proportion of those planning to quit over time. Stronger tobacco control policies and culturally and better-tailored smoking cessation interventions are needed to achieve a significant decrease in smoking prevalence and encourage smokers to quit.

6. Data availability statement.

Data are available on reasonable request. Requests will be considered on a case-by-case basis.

7. Authors' contribution

COE and MCK conceptualized the study. COE, MCK, ML, and SPN wrote the first draft. COE, OAA, ML and MCK critically reviewed and revised the manuscript. All authors approved the final manuscript as submitted.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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