

Multi-level influence of school norms on tobacco use in South Africa: an econometric consideration of group differences

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Abstract

Objectives Tobacco use has been found to be related to contextual–environmental characteristics. This study focuses on the influence of contextual norms on adolescent smoking behavior with consideration of racial differences.

Methods Data for this study were derived from the South African Community Epidemiology Network on Drug Use survey. Students ($n = 1,277$) completed a self-administered questionnaire (available in Afrikaans, Xhosa, and English). School-level aggregate measures were developed from the items: whether they thought smoking was wrong, whether they thought they would be seen as “cool” if they smoked, how many of their closest friends smoked, and whether they had repeated a grade level in school.

Results The results of this analysis revealed that after controlling for demographic characteristics, aggregate measures of importance for ever smoking were whether there were school norms of perceiving that smoking was not wrong, perceiving that smoking was cool, and high prevalence of having friends who smoke. Recent smoking was only predicted by attendance at schools with increased

levels of academic failure. Black South Africans were less likely to ever smoke than Coloured or White.

Conclusions This study highlights the saliency of both compositional (academic failure) and ecological (collective perceptions about smoking) characteristics in predicting ever and recent smoking. Collective perceptions of smoking in a predominantly Black school were largely negative. These findings can be used to target school norms regarding tobacco use in Cape Town.

Keywords Adolescents · Tobacco · Epidemiology · South Africa · Secondary schools

Introduction

Tobacco is a leading cause of preventable death and disease globally [1, 2]. Prevention of tobacco use in adolescence is recognized as an important public health objective in developing countries. It is estimated that 60% of the 5.7 billion cigarettes smoked annually and 75% of tobacco users are in developing countries [2]. Globally, it is estimated that 250 million children alive today will eventually die from tobacco-related illness [3]. Those who start smoking at younger ages are less likely to quit as adults and more likely to experience tobacco-related health problems [4]. Tobacco-related disabilities negatively affect the psychosocial and economic opportunities of tobacco users and increase the burden on public health costs [1].

Additional research on psychosocial factors related to tobacco use in adolescence indicates fairly consistently that peer attitudes and norms, and peer smoking behavior are strong predictors of adolescent smoking behavior [5–8]. Recent work in the field of prevention science has emphasized the importance of focusing on contextual–environmental

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characteristics while controlling for individual and demographic characteristics [9–11]. Thus, schools serve as a ready medium for intervention during adolescence.

When examining the effect of contextual factors on health behavior, schools are important social contexts because they often reflect the normative standards and beliefs, history, and the social policies, socio-economic resources, and cultural milieu of a community. These collective identities or factors, in addition to individual behavior, may help to shape the health behavior of adolescents who spend most of their time in school settings [12, 13]. For example, the smoking status of peers, perceived social rewards for smoking (e.g., whether smoking is seen as cool or wrong), and student perception of the proportion of smokers in schools have been found to be significant predictors of adolescent smoking [5, 13–15]. In this regard, multilevel modeling has been used to investigate the effects of environmental characteristics defined at a contextual unit level (e.g., school or neighborhood), while accounting for between-school differences and controlling for individual socio-demographic characteristics.

This study utilizes a simplified version of the econometric [16] approach to explore social norms of the school environment by aggregating individual responses to obtain school-level characteristics. Much of the research to date utilizing multilevel modeling to assess adolescent tobacco use in schools has been conducted in developed countries [12, 13, 15]. Although South Africa has been classified as a developed nation, over 50% of residents live in developing country conditions. This study examines the school-level perceptions of smoking among high school students in Cape Town, South Africa, and the association with ever and past 30 days smoking prevalence while adjusting for the corresponding individual level perceptions and for individual socio-demographic characteristics.

Of particular interest in the South African context are the observed differences in youth smoking behavior between racially classified social groups. Studies show that Black South African youth report the prevalence of smoking to be far less than that reported by their White and Coloured counterparts [17, 18]. In addition to assessing multi-level influences of smoking perceptions on individual behavior, this study will assess the association between school level norms and student body composition. This study is an important step in the process of confirming findings from studies conducted in other developed countries and in promoting the use of econometric measurement in research on the environmental correlates of smoking. It is hypothesized that school social norms will be significantly associated with ever and recent smoking after controlling for the corresponding perceptions at the individual level and for socio-demographic factors. Additionally, it is expected that schools with higher proportions of Black

South Africans will be less likely to be classified as having pro-smoking norms.

Methods

Data for this study were derived from the 1997 South African Community Epidemiology Network on Drug Use (SACENDU) school survey administered to public school students in Cape Town. Schools were selected on the basis of postal code groupings. The probability of school selection was proportional to the number of students represented by the postal code. Students completed a self-administered questionnaire (available in Afrikaans, Xhosa, and English) during regular school periods in the absence of teachers or other school personnel. A total of 2,946 students at 39 schools completed Part I of the survey, which consisted of socio-demographic questions and items about substance abuse, sexual activity, and other adolescent health risk behavior. From these 2,946 students, a sub sample of 1,328 was randomly selected to complete part II of the survey, which focused on experiences in their communities and schools, and with their families and peers. The results presented in this paper are from 1,277 respondents at 39 schools for whom valid data were available in parts I and II of the survey. All of the schools invited to participate did so. The sampling methodology employed is described in detail elsewhere [17, 19].

Individual-level measures

Socio-demographic variables used in this analysis were age, gender, years of city residence, and racially classified social groups (RCSG). Age was recorded as 12–14, 15–17, and 18 or older, and years of residence in the city was categorized into <12, 13–15, and 16 or more years. The RCSG variable was based on the former apartheid government's classification system (i.e., Black, Coloured, White, and Asian). In South Africa, the term "Coloured" is used to refer to people who descend from multiple Asian, European, or African ancestry. Asian students were excluded from this analysis because of the relatively small number of respondents ($n = 16$). In this study, the use of RCSG refers explicitly to the social conception of race [20].

Traditional measures of socioeconomic status (SES) used in developed countries, for example family income and parental education were not collected from respondents because they are less salient in the South African context. Alternatively, students were asked about the number of household amenities (i.e., television, electricity, telephones, and automobile), which has broad applicability in South Africa and other developing countries [21, 22]. An index of the number of household amenities was created by

summing each participant's total number of amenities. Participants could have fewer than two amenities, two, three, or all four amenities.

School-level measures

Several questions were used to assess social norms regarding tobacco use in schools. Students were asked if they thought smoking was wrong, whether they thought they would be seen as “cool” if they smoked, and how many of their closest friends smoked. Repeating a grade was also used as a school-level variable, because academic failure has been found to be salient in understanding adolescent tobacco and other drug use in South Africa [18, 19]. As described below, multilevel models were used to aggregate these individual level items at the school-level using the ecometric approach. Once the aggregate scores were obtained they were split into tertiles and included as dummy variables in the models.

Dependent measures

The outcome variables in the final models were ever smoking and having smoked on one or more days in the past 30 days (this sample was limited to whether ever smokers had smoked recently).

Analyses

Multilevel models were used in two successive steps: first, to obtain the aggregate school-level variables according to the ecometric approach [16, 23, 24] and, second, to investigate the effects of these variables controlling for individual level variables on smoking [16, 25]. In the first step, multilevel models were used to determine if there were significant variations between schools in perceptions of social norms. If statistically significant, then it was deemed appropriate to construct school-level variables by aggregating individual responses to the questions on the social norms through multilevel modeling. School-level variables were constructed from multilevel models using individual responses corresponding to:

- 1 Whether children thought smoking was wrong;
- 2 Whether they thought they would be seen as “cool” if they smoked;
- 3 How many of their closest friends smoked; and
- 4 Having repeated a grade.

Following the ecometric approach, aggregate scores at the school level were obtained from separate two-level (children, schools) multilevel models with each variable listed above [16, 23, 24]. Distinct school-level variables

were obtained, one based on each of the items by specifying a random effect at the school level, and using the estimated random effects of each school as explanatory variables in subsequent models.

In the second step, a series of multilevel logistic models were estimated considering ever smoking and recent smoking (among ever smokers) as separate outcomes. First, models were assessed that only included the school-level random effect to examine whether there were significant between-school variations in tobacco use. Subsequently, models were analyzed which included all of the individual-level variables (excluding the individual variables associated with aggregated perceptions variables). Finally, each of the aggregate school-level variables was entered into separate multilevel models controlling for demographic characteristics (gender, age, number of amenities, number years living in the city, ethnicity, and whether the student had repeated a grade). These models were also adjusted for the individual level perceptual item corresponding to the school-level variable being tested (e.g., when testing the effect of the collective perception of smoking being wrong, our model was adjusted for individual perception of the student on that issue, in order to determine whether such a dimension may affect individual smoking through individual-level or school-level processes). The resulting odds ratios were adjusted utilizing the formula recommended by Zhang and Yu [26] to adjust for the common occurrence (>10%) of ever and recent smoking in the models [26]. All analyses were performed using SAS 9.1.

Results

Descriptive statistics

As shown in Table 1, most respondents were female (56.9%) and Coloured (57.4%). The mean age was 15.7 (SD = 2.1). Most of the respondents had resided in an urban area for 13 or more years (70.7%) and approximately half reported having all four amenities (48.2%). Most students reported thinking that smoking was wrong (68.8%), did not believe they would be seen as cool if they smoked (69.6%), and had 0–2 friends who smoked (55.8%).

Approximately 30% of this sample reported ever smoking ($n = 486$). Of the ever smokers, 73% of them had smoked in the past 30 days ($n = 355$). Older respondents reported higher prevalence of ever ($\chi^2 = 16.34, p < 0.001$; Table 1) and recent ($\chi^2 = 14.95, p < 0.001$) smoking than their younger counterparts. A greater proportion of males had ever smoked ($\chi^2 = 6.43, p = 0.01$) and reported having smoked in the past 30 days than females ($\chi^2 = 5.33, p = 0.02$). A significantly lower proportion of Black

Table 1 Percentage of ever-smokers and recent smokers according to socio-demographic characteristics and aggregate school variables

Variables	Total <i>n</i> = 1,277 (%)	Ever smoke Highest <i>n</i> = 1,277 (Row %)	Recent smoke ^a Highest <i>n</i> = 486 (Row %)
Variables			
Age			
<14	468 (36.7)	33.6***	61.7***
14–16	402 (31.5)	43.5	75.5
17 or older	407 (31.9)	46.2	80.3
Gender			
Male	550 (43.1)	44.7*	77.4*
Female	727 (56.9)	37.7	68.1
RCSG			
Black	347 (28.4)	14.7***	65.9
Coloured	701 (57.4)	52.2	75.9
White	174 (14.2)	48.3	64.6
Urban years			
<12 years	375 (29.4)	34.9***	69.7*
13–15 years	458 (35.9)	37.6	67.5
16 or more years	444 (34.8)	48.9	79.6
Number of amenity			
One or two	306 (24.4)	27.1***	73.5
Three	344 (27.4)	36.1	74.1
Four	605 (48.2)	50.6	72.9
Repeat grade			
Yes	381 (30.5)	46.5**	80.7**
No	870 (69.5)	38.5	69.1
Best friends smoke			
Zero–two	674 (55.8)	21.5***	51.9***
Three	149 (12.3)	51.7	60.3
Four	385 (31.9)	73.0	86.0
Smoking not wrong			
Wrong	831 (68.8)	25.6***	60.2***
A little wrong	218 (18.1)	72.5	79.6
Not wrong at all	159 (13.2)	82.4	85.0
Smoking cool			
No or little chance	814 (69.6)	33.2***	69.6**
Some chance	140 (12.0)	58.6	67.1
Pretty good chance	16 (18.5)	66.7	83.6
Aggregate variables			
Repeat grade			
Low	437 (34.2)	43.3**	65.3*
Medium	372 (29.1)	35.2	74.0
High	468 (36.7)	42.7	79.4
Best friends smoke			
Low	369 (28.9)	19.2***	69.8
Medium	472 (37.0)	43.6	71.7
High	436 (34.1)	55.7	74.8
Smoking not wrong			
Low	412 (32.3)	22.6***	73.8
Medium	386 (30.2)	44.0	74.5
High	479 (37.5)	53.7	71.6

Table 1 continued

	Total <i>n</i> = 1,277 (%)	Ever smoke Highest <i>n</i> = 1,277 (Row %)	Recent smoke ^a Highest <i>n</i> = 486 (Row %)
Smoking cool			
Low	407 (31.9)	21.9***	76.8
Medium	405 (31.7)	45.2	72.2
High	465 (36.4)	53.3	72.1

* $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$ ^a This column only includes those respondents who reported ever smoking

South Africans reported ever smoking than White and Coloured respondents ($\chi^2 = 139.47$, $p < 0.001$; Table 1).

A greater proportion of students who believed that smoking was not wrong reported ever ($\chi^2 = 281.75$, $p < 0.001$) and recent ($\chi^2 = 28.70$, $p < 0.001$) smoking compared to those who believed smoking was wrong (Table 1). Students who reported they would be seen as cool if they smoked had a higher prevalence of ever ($\chi^2 = 95.50$, $p < 0.001$) and recent ($\chi^2 = 10.52$, $p = 0.005$) smoking than those students who did not believe they would be seen as cool if they smoked. Having four friends who smoked was also associated with higher prevalence of ever ($\chi^2 = 275.20$, $p < 0.001$) and recent ($\chi^2 = 57.90$, $p < 0.001$) smoking than having two or fewer friends who smoked.

Multilevel models

Prior to investigating individual-level and school-level effects on smoking, logistic multilevel models without any explanatory variables were estimated to determine if there was any school-level variance in smoking behavior, perceived norms toward smoking, and repeating a grade. The between-school variance was statistically significant for all four of the targeted individual-level variables ($p < 0.01$ for all: repeating a grade, smoking is cool, smoking is wrong, and number of best friends who smoke). The variance explained ranged from 0.28 to 0.47. The between-school variance was 0.59 ($p < 0.001$) for smoking. As such, the full models for ever and recent smoking including individual-level adjustment variables and each of the four school-level measures (repeating a grade, whether smoking is cool, whether smoking is wrong, and number of friends who smoke) and the corresponding individual level variable were assessed. Three separate models were tested for ever and recent smoking to assess the aggregate and individual effect of whether

smoking is cool, whether smoking is wrong, and the number of friends who smoke). The inclusion of the variables yielded non-significant random effects of school across models (in other words variation in schools did not explain a significant portion of variance in ever and recent smoking).

Models of ever smoking

Perception that smoking is wrong

Regarding RCSG, Coloured and White respondents were more than twice as likely as Blacks to report ever smoking (Table 2, Model 1). Repeating a grade independently increased the odds of ever smoking (OR = 1.22, 95% CI = 1.02–1.43). Students who reported that they personally believed smoking was only a little wrong or not wrong at all were over 2–3 times more likely to have ever smoked than those who reported that smoking was wrong (OR = 2.61, CI = 2.29–2.90 and OR = 3.11, CI = 2.78–3.90, respectively; Table 2). After adjusting for individual-level perception, students who attended schools that had medium and high aggregate perceptions that smoking was not wrong were more likely to report ever smoking (OR = 1.45, CI = 1.02–1.95 and OR = 1.55, CI = 1.06–2.12, respectively) than students attending schools with the lowest perceptions.

Perceptions that smoking is cool

Students who reported that they personally believed that there was some chance or a pretty good chance of being seen as cool if they smoked were approximately 1.75 times more likely to ever smoke than those who reported that there was no or little chance of being seen as cool if they smoked (OR = 1.76, CI = 1.47–2.04 and OR = 1.78, CI = 1.52–2.02, respectively). After adjustment for the

Table 2 Separate ever smoking aggregate models

Predictor	Model names		
	Model 1 Smoking not wrong ^a OR (95% CI)	Model 2 Smoking cool ^a OR (95% CI)	Model 3 Friends who smoke ^a OR (95% CI)
Individual variables			
RCSG			
Black	1.00	1.00	1.00
Coloured	2.46 (1.82–3.17) ^b	2.59 (1.98–3.10) ^b	2.08 (1.50–2.78) ^b
White	2.42 (1.65–3.34) ^b	2.30 (1.58–3.25) ^b	1.85 (1.21–2.67) ^b
Smoking not wrong?			
Wrong	1.00	–	–
A little wrong	2.61 (2.29–2.90) ^b	–	–
Not wrong at all	3.11 (2.78–3.90) ^b	–	–
Smoking cool?			
No or little chance	–	1.00	–
Some chance	–	1.76 (1.47–2.04) ^b	–
Pretty good chance	–	1.78 (1.52–2.02) ^b	–
Friends who smoke			
Zero–two	–	–	1.00
Three	–	–	2.14 (1.70–2.59) ^b
Four	–	–	3.11 (2.78–3.41) ^b
Repeat a grade			
No	1.00	1.00	1.00
Yes	1.22 (1.02–1.43) ^b	1.19 (1.01–1.38) ^b	1.18 (0.98–1.38)
Aggregate variables			
Smoking not wrong?			
Low	1.00	–	–
Medium	1.45 (1.02–1.95) ^b	–	–
High	1.55 (1.06–2.12) ^b	–	–
Smoking cool?			
Low	–	1.00	–
Medium	–	1.55 (1.14–2.01) ^b	–
High	–	1.59 (1.14–2.09) ^b	–
Number of friends who smoke			
Low	–	–	1.00
Medium	–	–	1.43 (0.98–2.02)
High	–	–	1.55 (1.03–2.19) ^b
Repeating a grade			
Low	1.00	1.00	1.00
Medium	1.12 (0.86–1.38)	1.07 (0.83–1.31)	1.00 (0.76–1.27)
High	1.26 (0.98–1.51)	1.11 (0.88–1.35)	1.21 (0.86–1.36)

Odds of ever smoking (yes)

Odds ratios corrected for common outcome as indicated in Zhang and Yu [26]

^a Adjusted for age, gender, racially classified social group, number of amenities, years of urban residence, repeating a grade, and individual-level variable

^b Significant odds ratio

individual-level perception, those students who attended school with medium and high aggregate levels of smoking being seen as cool were over 1.5 times more likely

to report ever smoking (OR = 1.55, CI = 1.14–2.01 and OR = 1.59, CI = 1.14–2.09, respectively; Table 2, Model 2).

Table 3 Separate recent smoking aggregate models

Predictor	Model names		
	Model 1 Smoking not wrong ^a OR (95% CI)	Model 2 Smoking cool ^a OR (95% CI)	Model 3 Friends who smoke ^a OR (95% CI)
Individual variables			
RCSG			
Black	1.00	1.00	1.00
Coloured	1.05 (0.78–1.26)	1.09 (0.83–1.28)	1.00 (0.69–1.24)
White	1.01 (0.26–1.26)	1.06 (0.75–1.28)	0.87 (0.53–1.18)
Smoking not wrong?			
Wrong	1.00	–	–
A little wrong	1.36 (1.20–1.47) ^b	–	–
Not wrong at all	1.44 (1.29–1.53) ^b	–	–
Smoking cool?			
No or little chance	–	1.00	–
Some chance	–	0.98 (0.85–1.28)	–
Pretty good chance	–	1.19 (1.06–1.30) ^b	–
Friends who smoke			
Zero–two	–	–	1.00
Three	–	–	1.20 (0.90–1.47)
Four	–	–	1.71 (1.58–1.80) ^b
Aggregate variables			
Smoking not wrong?			
Low	1.00	–	–
Medium	1.03 (0.81–1.18)	–	–
High	0.97 (0.73–1.15)	–	–
Smoking cool?			
Low	–	1.00	–
Medium	–	0.90 (0.69–1.07)	–
High	–	0.90 (0.67–1.08)	–
Number of friends who smoke			
Low	–	–	1.00
Medium	–	–	0.95 (0.66–1.16)
High	–	–	0.89 (0.59–1.14)
Repeating a grade			
Low	1.00	1.00	1.00
Medium	1.18 (0.99–1.32)	1.16 (0.97–1.31)	1.21 (1.02–1.35) ^b
High	1.24 (1.07–1.37) ^b	1.23 (1.05–1.35) ^b	1.29 (1.14–1.40) ^b

Odds of recent smoking (yes)

Odds ratios corrected for common outcome as indicated in Zhang and Yu [26]

^a Adjusted for age, gender, racially classified social group, number of amenities, years of urban residence, repeating a grade, and individual-level variable^b Significant odds ratio*Number of best friends who smoke*

Similar to the other models Coloured and White youth were more likely to report ever smoking than their Black counterparts (Table 2, model 3). Students who reported they had three best friends who smoked were more likely to

report ever smoking than those who reported having two or fewer friends who smoked (OR = 2.14, CI = 1.70–2.59). Students who reported they had four best friends who smoked were over three times more likely to ever smoke than students who had two or fewer smoking friends (OR = 3.11, CI = 2.78–3.41). Students who attended

schools where the prevalence of having friends who smoke was high were more likely to report ever smoking than students who attended schools where the prevalence was low (OR = 1.55, CI = 1.03–2.19).

Models of recent smoking

Among ever smokers, predictors of recent smoking were the individual-level norms regarding perceptions of whether smoking is cool, whether it is wrong, and number of best friends who smoke (Table 3). However, in contrast with ever smoking, aggregate school-level perceptions on whether smoking is cool or wrong and number of best friends who smoke were not significantly associated with recent smoking after controlling for the corresponding individual perceptions. Repeating a grade was a significant predictor at individual and aggregate levels. Specifically, students attending schools with the highest levels of failure were at least 1.2 times more likely to have smoked recently than those in schools with low levels of failure. There were no significant differences in recent smoking by RCSG across the models.

Effect of racially classified social groups

To further explore the association of lower smoking prevalence with racially classified social group status, the proportion of black youth who attended a particular school was dichotomized to represent schools at which <40% or 40% or more of their student body comprised Black South African youth. Approximately 76% of the sample attended a school at which <40% of the students were Blacks. Across all three perceived norms, the proportion of Black South Africans in the school was associated with a lack of pro-smoking perceptions at the individual and school level. For example at the aggregate level, schools with a higher proportion of Black students were significantly less likely to be classified in the highest tertile of thinking smoking was cool ($\chi^2 = 398$, $df = 2$, $p < 0.0001$). The same association held true at the individual level ($\chi^2 = 36.8$, $df = 2$, $p < 0.0001$).

Discussion

This is the first study to investigate the influence of aggregate social perceptions of smoking among South African youth by use of the ecometric approach. The results of this analysis revealed that age, gender, RCSG, and SES were associated with smoking behavior in this sample of South African youth. There were four variables of interest at the school level. Each of the corresponding individual perceptions was significantly associated with

smoking status. After adjusting for individual perceptions, aggregate measures that significantly predicted ever smoking were whether there were school norms suggesting that smoking was not wrong and that smoking was “cool”. Students who attended schools with the highest prevalence of having friends who smoked were also significantly more likely to have ever smoked.

Recent smoking was only significantly associated with attendance at schools with medium and high levels of academic failure. No other aggregate measures were significant predictors of recent smoking. Previous studies on the correlates of recent smoking among adolescents indicated that a school norm of approval of substance use is salient in understanding the likelihood of recent tobacco use [5, 27]. This was not supported by this study, which may indicate that the correlates of continued smoking may be different from those associated with ever smoking in this particular sample. For example, it is plausible that although thinking smoking is cool may be predictive of ever smoking, perhaps other factors not tested here, for example mental health problems, are more salient for continued use.

This study has limitations which should be noted. First, it is possible that given the large reduction in sample size for the recent smoking models (only included ever smokers who responded to recent smoking questions) the effects of school-level aggregates were masked or reduced. Data sparseness precluded assessing a full model with all of the school norm aggregate variables and their individual level counterparts. Future research should investigate such measures concurrently because they are likely to be correlated. The data are based on self-report, and therefore, adolescents may have under-reported tobacco use. Finally, this study only included students who attended public school and the data cannot be generalized to the general adolescent population in Cape Town which includes those who attend private schools and adolescents who do not go to school. Despite these limitations, the findings from this study provide support for the importance of school norms in adolescent smoking behavior in Cape Town.

Recent epidemiologic trends show that over the past two decades the major causes of deaths of adolescents have shifted from infectious diseases to preventable injuries and modifiable health behavior [28, 29]. Because of the prevalence of smoking among South African youth it is of long-term public health significance to identify ways to prevent initiation of smoking. Previous studies have demonstrated that variations in smoking between schools may be because of both compositional characteristics (e.g., gender ratio) and ecological characteristics (e.g., norms in school accepting tobacco use) [30]. The importance of perceived social norms is also apparent at the community level among South African youth. King et al. [17] found that

adolescents were more likely to smoke if they believed adults in the community thought it was acceptable for youth to use drugs. This study highlights the saliency of both compositional (academic failure) and socio-ecological (smoking not wrong) characteristics in understanding correlates of ever and recent smoking.

The results also confirm findings from other studies that Black South Africans are far less likely to smoke in adolescence than their White or Coloured counterparts [18]. This study extends previous research by showing that Black South Africans also have strong anti-smoking normative perceptions at the individual and aggregate school level. Thus, this study supports the possibility of a strong cultural proscription against smoking among Blacks. Black South Africans in this study had fewer amenities than Whites and Coloureds and attended schools with higher aggregate levels of failure, yet, they had the lowest prevalence of smoking. Potentially, prevalence of smoking was highest among Coloured South Africans, because of greater exposure to White culture. Given the history of apartheid, which institutionalized social stratification by race, and current disparities in SES, treatment, and access to health care experienced by Black South Africans it is important to identify and expand protective factors to further continue amelioration of a potential smoking epidemic.

Our findings can also be used to target school norms in Cape Town by using teachers to promote a more healthful frame of reference for students. Use of teachers in this context might serve as a cost-effective means of helping to reduce smoking. Teachers can help influence perceptions of normative behavior, potentially reduce ever smoking, and increase cessation among recent smokers. Future research must include more schools. Multi-level modeling can be computationally intensive and requires rather large sample sizes to detect effects. Additional work might feature community or neighborhood-based sampling so that those not attending school can be included. Inclusion of adolescents not in school might enable researchers to assess tobacco use in South Africa more comprehensively.

Adolescence is an important developmental period to be targeted for health education and prevention efforts. Schools serve as a ready medium for intervention during this time. Studies at the individual level [31–34] have found student bonding to schools (e.g., commitment to academic and school norms, student relationships with teachers and pupils) to be associated with lower levels of substance use. Tobacco use is a leading cause of preventable morbidity and mortality globally. Few epidemiological studies have been conducted to assess multi-level correlates of smoking among South African youth. This study provides evidence that there are several school characteristics that may be targeted in prevention programming to reduce ever smoking among adolescents in

Cape Town. Among those who have ever smoked targeting school-wide academic failure may serve to reduce recent smoking.

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