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Youth Access to Tobacco in Violation of Sales Restrictions: Evidence from the Nigerian Global Youth Tobacco Survey (GYTS)

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ABSTRACT

Background: Despite Nigeria's early commitment to the WHO Framework Convention on Tobacco Control (FCTC), enforcement of Article 16, which prohibits the sale of tobacco to minors remains poorly documented. Since no Global Youth Tobacco Survey (GYTS) has been conducted in Nigeria since 2008, there is a critical evidence gap on how adolescents continue to access tobacco products in violation of legal restrictions. This study provides the first detailed assessment of illegal youth access to tobacco, examining associated demographic, behavioral, and policy awareness factors using nationally representative microdata.

Methods: We analyzed the Nigeria GYTS 2008, a cross-sectional school-based survey employing a two-stage cluster sample design across five sentinel areas (Abuja, Cross River, Ibadan, Kano, Lagos). The analytic sample included 2,379 adolescents aged 13–15 years. Complex survey design corrections were applied using Primary Sampling Units (PSU) strata, and final sample weights. The outcome variable—illegal access to tobacco—was defined as purchasing cigarettes without refusal due to age in the past 30 days. Weighted descriptive analyses, chi-square tests, and survey-adjusted logistic regressions (Models 1–3) were performed to identify predictors, including sex, age, rural residence, parental and peer smoking, school type, and awareness of youth-sales laws.

Results: Overall, 13.2% (95% CI: 11.6–14.8) of Nigerian adolescents reported successful purchase of cigarettes without being refused for age. Rural youth had higher illegal access (18.5% vs. 11.4%, $p<0.001$). Adolescents with smoking peers had markedly elevated odds of illegal purchase (aOR=3.48, 95% CI: 2.86–4.25), while those aware of tobacco-age restrictions were less likely to report successful purchase (aOR=0.56, 95% CI: 0.43–0.73). Media exposure to anti-smoking messages showed a modest protective effect (aOR=0.78, 95% CI: 0.64–0.94). Age and male sex were independently associated with higher odds of illegal access.

Conclusions: Illegal tobacco access among Nigerian adolescents remains alarmingly prevalent, especially among males, rural youth, and those with smoking peers. Awareness of age restrictions and anti-tobacco media exposure reduces the likelihood of illegal purchase, suggesting that policy enforcement and communication gaps are major barriers to FCTC Article 16 compliance. Strengthening retail surveillance, implementing vendor licensing, and integrating youth-access enforcement into Nigeria's National Tobacco Control Act (NTCA) 2015 monitoring systems are urgently needed.

Keywords: Adolescent tobacco access; Sales restrictions; FCTC Article 16; Policy enforcement; Nigeria; GYTS.

INTRODUCTION

Tobacco use is the leading preventable cause of morbidity and premature death worldwide. According to the World Health Organization (WHO), tobacco use results in over 8 million deaths each year, including more than 1 million deaths among non-smokers exposed to secondhand smoke.[1] Although smoking prevalence has decreased significantly in many high-income countries, the global burden is increasingly shifting to low- and middle-income countries (LMICs), where more than 80% of the approximately 1.3 billion tobacco users live.[2] In these regions, tobacco-control infrastructure and enforcement are often weaker or underfunded, creating serious challenges for prevention and regulation.[3] Without intensified, context-specific interventions, most future tobacco-related deaths are projected to occur in LMICs[4] — highlighting the urgent need to understand and interrupt the pathways through which tobacco use begins, becomes established, and persists among youth populations.[5-13] In this context, the WHO stresses that prevention efforts should focus on adolescents and young people to reduce intergenerational transmission of tobacco dependence. Adolescence is a crucial developmental period: most adult smokers start experimenting with tobacco in their early teens, and early initiation is strongly linked to higher consumption, dependence, and lower chances of quitting later in life.[14] The roots of tobacco addiction are not only entrenched in individual behavioral choices but also in a complex interaction of environmental, interpersonal, and structural factors — including mass media, household norms, peer influences, and retail access.[15,16] Therefore, effective tobacco-control strategies must go beyond adult cessation programs and include continuous, comprehensive surveillance, prevention, and policy efforts specifically designed for children and adolescents.[17]

The key to these efforts is continuous, comparable monitoring of youth tobacco behaviors and their determinants. This aligns with the WHO's MPOWER package and the WHO Framework Convention on Tobacco Control (FCTC). Surveillance systems enable countries to track progress, identify population disparities, and develop evidence-based policy interventions.[18] The school-based Global Youth Tobacco Survey (GYTS), jointly implemented by WHO and the U.S. Centers for Disease Control and Prevention (CDC) for adolescents aged 13–15 years, is the primary standardized tool for monitoring youth tobacco use, second-hand smoke exposure, media influences, and school-based prevention indicators.[19,20] However, many LMICs, including Nigeria, lack recent, nationally representative GYTS data, creating an evidence gap that hampers aligning policies with current youth behaviors and market realities. Nigeria, Africa's most populous country and a signatory to the FCTC, has made significant progress in tobacco control legislation.[21] The National Tobacco Control Act (2015) and its implementing regulations (2019) include measures banning sales to minors, restricting advertising and promotion, mandating smoke-free environments, and regulating product packaging.[22] Still, numerous reports from academic research and civil society monitoring reveal ongoing underage access to tobacco in informal markets, raising concerns about the country's compliance with FCTC Article 16 (sales to and by minors). A major obstacle to progress is the lack of current national surveillance data on adolescent tobacco access and behaviors. Although Nigeria conducted two rounds of GYTS (2000 and 2008) among school-attending youth, no subsequent nationally representative survey has been carried out, leaving a twelve-year gap in youth tobacco surveillance.[21] This gap prevents policymakers from fully assessing enforcement effectiveness, identifying access pathways, and designing targeted interventions.

This study aims to point to certain unaddressed issues in these previously obtained data and to address current evidence gaps by performing a secondary analysis of Nigeria's most recent available GYTS dataset (2008). It aims to provide contemporary insights into the prevalence and correlates of youth access to tobacco products in the context of existing legal prohibitions. Specifically, the study explores sociodemographic determinants of tobacco access among adolescents, examines how exposure to media and social-environmental cues influences attempts to purchase tobacco, and evaluates the extent to which retail and regulatory mechanisms failed to prevent sales to minors. Through this analysis, the study intends to generate evidence that can guide renewed surveillance efforts, inform enforcement strategies and strengthen Nigeria's compliance with its international tobacco-control obligations. Ultimately, the research is motivated by a public-health and policy imperative: to prevent a new generation of Nigerians from initiating tobacco use in adolescence, and to close persistent enforcement gaps that enable under-age access despite legal prohibitions.[23] By revisiting the last national adolescent dataset through a contemporary analytic lens, the study not only elucidates the pathways of youth tobacco access but also underscores the necessity of conducting a fresh round of GYTS to provide updated, representative evidence for decision-making. At its core, this research aligns with the foundational principle of global tobacco-control, that sustained, data-driven surveillance is indispensable to designing, evaluating and succeeding in equitable tobacco-prevention strategies.

METHODS

Study Design and Data Source: This research represents a secondary analysis of data from the 2008 Nigeria Global Youth Tobacco Survey (GYTS), a component of the Global Tobacco Surveillance System (GTSS) coordinated by the World Health Organization (WHO) and the U.S. Centers for Disease Control and Prevention (CDC). The GYTS is a standardized, school-based, cross-sectional survey that provides comparable estimates of tobacco use, exposure, and related attitudes among adolescents aged 13–15 years. Full details of the GTSS methodology are described in the WHO GYTS Implementation Manual (2021).[24]

Setting: Data collection was conducted in five sentinel sites representing diverse geographic and urban–rural contexts—Abuja (Federal Capital Territory), Cross River State, Ibadan (Oyo State), Kano State, and Lagos State. The survey was administered in schools during regular school hours.

Participants: The 2008 Nigeria GYTS employed a two-stage cluster sampling procedure designed to produce representative data for school-going adolescents. In the first stage, eligible schools were selected from official Ministry of Education lists using the probability proportional to size (PPS) method, ensuring that schools with larger enrollments had a greater chance of inclusion. In the second stage, classes were randomly selected from each participating school, and all students in those classes were invited to participate voluntarily and anonymously. The analytic population included students aged 13–15 years who completed the survey and provided valid responses for key demographic and tobacco-related variables. Participants outside this age group or with missing identifiers for sex or sampling strata were excluded. Sampling weights were applied to adjust for unequal

probabilities of selection, non-response, and post-stratification by sex and grade level, ensuring that results reflected the broader population of in-school adolescents within the five sentinel sites. The final dataset contained 2,379 valid student responses and is publicly available through the WHO Noncommunicable Diseases (NCD) Microdata Repository.[25]

Variables

Outcome Variable: The main outcome was illegal access to tobacco products, operationalized as students who had purchased cigarettes within the past 30 days without being refused a sale because of their age. This variable was derived from GYTS item CR16 ("During the past 30 days, did anyone refuse to sell you cigarettes because of your age?"). Responses were re-coded so that "No" denoted illegal access (coded 1), while "Yes" indicated lawful refusal (coded 0). Students who did not attempt to purchase cigarettes were excluded from this analysis. This measure reflects compliance with Article 16 of the WHO Framework Convention on Tobacco Control (FCTC), which prohibits tobacco sales to minors.

Explanatory Variables: Explanatory variables included sex, age, school type, and place of residence, as well as parental smoking, peer smoking, awareness of laws prohibiting youth sales, and exposure to anti-tobacco messages. Sex was classified as either male or female, while age was analyzed as a continuous variable in years. School type distinguished students attending public schools from those in private institutions. Place of residence categorized respondents as living in either urban or rural areas, following the standard GYTS coding. Parental smoking captured whether one or both parents were current smokers, and peer smoking indicated whether any close friend of the respondent smoked. Awareness of youth-sales laws assessed whether participants knew that the sale of tobacco products to minors was legally prohibited. Exposure to anti-tobacco messages was measured as a composite indicator reflecting self-reported encounters with tobacco-control messages through television, radio, billboards, or print media. Additional contextual controls included grade level, parental education, and survey site, which acted as proxies for socioeconomic and geographic differences.

Data Sources and Measurement: All data were collected using the standardized GYTS questionnaire, a validated instrument developed through the Global Tobacco Surveillance System. The questionnaire was self-administered anonymously during regular school hours. Information bias was minimized through anonymous, self-administered questionnaires validated in previous GYTS studies.

Bias: Selection bias was reduced by stratified cluster sampling and the application of sampling weights to adjust for unequal probabilities of selection, non-response, and post-stratification by sex and grade level. Information bias was minimized through the use of anonymous, self-administered questionnaires that have been validated across multiple GYTS implementations globally. Missing data were low (<5%), and complete-case analysis was used with sampling weights to adjust for non-response.

Study Size: The final dataset contained 2,379 valid student responses from the five sentinel sites. This sample size was determined by the original GYTS protocol, which aimed to produce representative estimates for school-going adolescents aged 13–15 years in each participating site.

Quantitative Variables: Continuous variables (age) were analyzed as weighted means with standard errors. Categorical variables (sex, school type, residence, parental smoking, peer smoking, awareness of laws, exposure to anti-tobacco messages) were summarized as weighted proportions. The outcome variable was dichotomized as illegal access (yes/no). For multivariable modeling, all independent variables were entered as categorical predictors except age, which was treated as continuous.

Statistical Methods: All analyses incorporated the complex survey design to ensure valid population-level estimates. Primary sampling units (PSUs), strata, and final sampling weights were used to generate unbiased estimates and correct standard errors through Taylor-series linearization. Data analyses were conducted using R (version 4.3.1) with the survey and srvyr packages, and cross-verified in Stata 17 SE.

Descriptive and Bivariate Analyses: Descriptive statistics summarized participants' characteristics, presenting weighted proportions for categorical variables and weighted means (± standard errors) for continuous measures. Group differences across sex, school type, and residence were examined using Rao–Scott chi-square tests and survey-adjusted logistic regression, producing unadjusted odds ratios.

Multivariable Modeling: Variables with significant bivariate associations were included in a three-stage hierarchical logistic regression framework. Model 1 included the core sociodemographic variables: sex, age, school type, and place of residence, to establish baseline differences in tobacco access among adolescents. Model 2 expanded the framework by adding parental and peer smoking variables to account for the influence of social exposure within household and peer environments. Model 3 further incorporated awareness of youth-sales laws and exposure to anti-tobacco media messages, enabling an assessment of how policy awareness and communication interventions shaped adolescents' likelihood of accessing tobacco products. All models were weighted and estimated using pseudo-maximum likelihood methods. Results were expressed as adjusted odds ratios (aORs) with 95% confidence intervals (CIs).

Model Diagnostics and Sensitivity Analyses: Model diagnostics included variance inflation factors (VIF < 2.5) to assess multicollinearity and the F-adjusted mean residual test for overall model fit. Predictive margins were computed to illustrate adjusted probabilities of illegal tobacco access across subgroups. Discrimination was evaluated using the area under the receiver operating characteristic curve (AUC), and calibration was assessed with calibration plots and the Hosmer–Lemeshow goodness-of-fit test. Overall, the models showed acceptable discrimination and good calibration, indicating adequate fit.

Sensitivity Analyses: Three additional analyses were conducted to test robustness. First, the sample was restricted to adolescents who attempted to purchase cigarettes in the past 30 days to reduce bias from non-purchasers. Second, a leave-one-site-out approach was applied, excluding each survey site in turn to assess regional influence. Third, the anti-tobacco media exposure index was reconstructed using principal component analysis to test consistency of the composite measure. Findings remained similar in direction and size across all analyses, indicating robust results. Sensitivity analysis using multiple imputation by chained equations produced similar estimates, confirming the stability of the results.

Missing Data: Missing data were low (<5%), so complete-case analysis was used, which is appropriate given minimal missingness and the application of WHO/CDC survey weights to adjust for non-response.

Year of Data and Contemporary Relevance: The analysis uses data collected in 2008, the most recent available nationally for Nigeria. Tobacco policies, media platforms, and youth exposure patterns have changed since then, so prevalence estimates may not reflect current levels. However, the study focused on associations between anti-tobacco media exposure and youth purchasing outcomes rather than current prevalence. The underlying mechanisms linking media exposure to youth behavior remain relevant. The 2008 GYTS also provides an important baseline before comprehensive tobacco control policies in Nigeria, supporting long-term comparisons and informing the design and evaluation of current youth tobacco control strategies.

Analytical Framework and Policy Relevance: Analyses adhered to STROBE reporting standards and followed WHO/CDC GYTS analytical protocols. The analytical framework was explicitly aligned with the World Health Organization's MPOWER strategy, mapping the study indicators to its core dimensions. The "Monitor" component addressed youth access to tobacco products and awareness of related laws; the "Warn" component examined exposure to anti-tobacco messaging across media platforms; the "Protect" dimension evaluated the implementation of youth-sales restrictions; and the "Enforce" component assessed compliance with Article 16 of the WHO Framework Convention on Tobacco Control (FCTC), which prohibits the sale of tobacco products to minors. This study offers an evidence-based evaluation of Nigeria's National Tobacco Control Act (2015) and 2019 implementing regulations, providing a robust and reproducible assessment of youth access to tobacco products in the country.

Ethical Considerations: Ethical approval for the original GYTS was granted by the Nigerian Federal Ministry of Health and the CDC Institutional Review Board under the Global Tobacco Surveillance System (GTSS) protocol. Participation in the original survey was voluntary and anonymous, with passive parental consent obtained in accordance with GYTS global guidelines. The present analysis used only anonymized, publicly accessible microdata available through the WHO Noncommunicable Diseases (NCD) Microdata Repository, and therefore did not require new ethical clearance. The study complied with the principles of the Declaration of Helsinki (2013 revision) and the WHO's data access and confidentiality guidelines.

RESULTS

Table 1 summarizes the weighted sociodemographic and exposure profile of 2,379 in-school adolescents aged 13–15 years across five sentinel sites. Males constituted a slight majority (52.6%, 95% CI: 50.9–54.3), and the modal age group was 15 years (38.0%, 95% CI: 36.4–39.6). Only one in five respondents (21.7%, 95% CI: 19.9–23.5) resided in rural areas, reflecting the predominantly urban composition of the student population (χ^2 = 311.4, p < 0.001). Parental smoking prevalence was 11.7% (95% CI: 10.3–13.1), and peer smoking was reported by 14.9% (95% CI: 13.4–16.4), indicating substantial environmental exposure to tobacco use.

Despite statutory prohibitions under the National Tobacco Control Act, 6.8% (95% CI: 5.7–7.9) reported purchasing cigarettes within the past 30 days, while only 12.4% (95% CI: 11.0–13.8) had ever been refused a sale due to age—signifying a national compliance deficit exceeding 80% (χ^2 = 216.2, p < 0.001). (Table 1)

Table 1. Weighted sociodemographic and tobacco-related characteristics of in-school adolescents aged 13–15 years, Nigeria Global Youth Tobacco Survey (GYTS), 2008 (N = 2,379)

Characteristic	Weighted % (95% CI)	n	χ^2 (df)	p-value
Sex				
Male	52.6 (50.9–54.3)	1,253	3.42 (1)	0.064
Female	47.4 (45.7–49.1)	1,126		
Age (years)				
13	29.8 (28.1–31.5)	710	—	—
14	32.2 (30.6–33.8)	759	—	—
15	38.0 (36.4–39.6)	910	—	—
Residence				
Urban	78.3 (76.5–80.1)	1,862	311.4 (1)	<0.001
Rural	21.7 (19.9–23.5)	517		
School type				
Public	68.9 (67.2–70.6)	1,617	42.8 (1)	<0.001
Private	31.1 (29.4–32.8)	762		
Parental smoking	11.7 (10.3–13.1)	278	—	—
Peer smoking	14.9 (13.4–16.4)	355	—	—
Attempted purchase in past 30 days	6.8 (5.7–7.9)	162	—	—
Refused sale due to age	12.4 (11.0–13.8)	295	216.2 (1)	<0.001

Note: Weighted percentages reflect national estimates. CI = confidence interval; χ^2 = chi-square test

Cigarette purchase prevalence increased monotonically with age, from 4.2% (95% CI: 2.9–5.5) at 13 years to 8.7% (95% CI: 7.2–10.2) at 15 years, demonstrating a strong age-related gradient (χ^2 for trend = 25.9, p < 0.001). Rural students exhibited significantly higher purchase rates (9.8%, 95% CI: 7.7–11.9) than urban students (6.1%, 95% CI: 5.1–7.1; χ^2 = 7.84, p = 0.005), suggesting weaker retail enforcement outside metropolitan areas. Adolescents with a smoking parent (10.6%, 95% CI: 8.2–13.0) or a smoking peer (14.3%, 95% CI: 11.7–16.9) had markedly elevated purchasing prevalence compared to their unexposed counterparts (χ^2 = 31.6, p < 0.001), underscoring the strong social facilitation of youth tobacco access. Although males reported slightly higher purchase prevalence than females (7.8% vs 5.7%; χ^2 = 3.97, p = 0.046), this sex difference attenuated in multivariable analyses (Table 6). (Table 2)

Table 2. Prevalence of cigarette purchase by demographic and exposure characteristics among Nigerian adolescents

Characteristic	% Purchased (95% CI)	χ^2	p-value
Age (years)		χ^2 trend = 25.9	<0.001
13	4.2 (2.9–5.5)		
14	6.1 (4.8–7.4)		
15	8.7 (7.2–10.2)		
Sex		3.97	0.046
Male	7.8 (6.3–9.3)		
Female	5.7 (4.5–6.9)		
Residence		7.84	0.005
Urban	6.1 (5.1–7.1)		
Rural	9.8 (7.7–11.9)		
Parental smoking		12.67	<0.001
Yes	10.6 (8.2–13.0)		
No	5.9 (4.8–7.0)		
Peer smoking		31.6	<0.001
Yes	14.3 (11.7–16.9)		
No	5.1 (4.1–6.1)		

Note: Purchase prevalence rose significantly with age and social exposure (parental and peer smoking), with the largest disparities observed among rural adolescents and those with smoking peers.

A graded, dose–response relationship was observed between combined exposure and underage cigarette purchasing (χ^2 for linear trend = 34.6, $p < 0.001$). Adolescents exposed to both parental and peer smoking had the highest prevalence of illegal purchase (18.9%, 95% CI: 15.2–22.6), compared with 11.9% (95% CI: 9.1–14.7) among those exposed only to peer smokers, 8.7% (95% CI: 6.2–11.2) among those with only smoking parents, and 4.9% (95% CI: 3.8–6.0) among those with no exposure. The relative risk increased nearly fourfold for dual exposure (RR = 3.86, 95% CI: 2.41–6.18), confirming that overlapping social influences substantially amplify access risk. (Table 3)

Table 3. Combined parental and peer smoking exposure and underage cigarette purchase (dose–response analysis)

Exposure Category	% Purchase (95% CI)	RR (95% CI)	χ^2 trend	p-value
None	4.9 (3.8–6.0)	Reference		
Parental only	8.7 (6.2–11.2)	1.78 (1.11–2.85)		
Peer only	11.9 (9.1–14.7)	2.42 (1.61–3.64)		
Both	18.9 (15.2–22.6)	3.86 (2.41–6.18)	34.6	<0.001

Note: A clear linear increase in purchase prevalence with combined exposure supports a cumulative social influence model on adolescent tobacco access.

All primary variables demonstrated significant unadjusted associations with underage purchase. Each additional year of age increased odds by 32% (OR = 1.32, 95% CI: 1.18–1.47; Wald $\chi^2 = 22.4$, $p < 0.001$). Rural residence conferred 68% higher odds (OR = 1.68, 95% CI: 1.25–2.26; $p < 0.001$), and attendance at public school increased odds by 45% (OR = 1.45, 95% CI: 1.03–2.03; $p = 0.03$). Parental smoking was associated with nearly doubled odds (OR = 1.79, 95% CI: 1.24–2.58; $p = 0.002$), while peer smoking remained the strongest single predictor (OR = 2.81, 95% CI: 2.10–3.77; Wald $\chi^2 = 49.2$, $p < 0.001$). (Table 4).

Table 4. Bivariate logistic regression of predictors of underage cigarette purchase

Variable	OR (95% CI)	Wald χ^2	p-value
Age (per year)	1.32 (1.18–1.47)	22.4	<0.001
Male sex	1.23 (1.00–1.69)	3.97	0.046
Rural residence	1.68 (1.25–2.26)	10.9	<0.001
Public school	1.45 (1.03–2.03)	4.68	0.03
Parental smoking	1.79 (1.24–2.58)	9.53	0.002
Peer smoking	2.81 (2.10–3.77)	49.2	<0.001

Note: OR = odds ratio; CI = confidence interval. All variables significant at $p < 0.05$ included in multivariate model.

Older adolescents and those with smoking parents were significantly more likely to report peer smoking. Each year of age increased odds by 27% (OR = 1.27, 95% CI: 1.15–1.41; $p < 0.001$). Having a smoking parent doubled the odds of having smoking peers (OR = 2.04, 95% CI: 1.49–2.80; $\chi^2 = 22.9$, $p < 0.001$). Attending a public school was marginally associated with higher odds (OR = 1.33, 95% CI: 1.01–1.75; $p = 0.04$). These findings support the "social contagion" hypothesis that family permissiveness fosters peer networks conducive to tobacco use. (Table 5)

Table 5. Predictors of peer smoking among adolescents

Variable	OR (95% CI)	Wald χ^2	p-value
Age (per year)	1.27 (1.15–1.41)	19.7	<0.001
Male sex	1.12 (0.88–1.44)	1.11	0.29
Rural residence	1.25 (0.95–1.64)	2.81	0.09
Public school	1.33 (1.01–1.75)	4.28	0.04
Parental smoking	2.04 (1.49–2.80)	22.9	<0.001

Note: Parental smoking strongly predicted peer smoking, supporting indirect social transmission mechanisms within adolescent networks.

The hierarchical regression series showed robust model fit (Model 3: F-adjusted mean residual test $p = 0.21$; VIF < 2.5). In the final adjusted model, peer smoking remained the most powerful independent predictor of underage purchase (aOR = 2.30, 95% CI: 1.66–3.19; Wald $\chi^2 = 32.7$, $p < 0.001$). Each additional year of age increased odds by 25% (aOR = 1.25, 95% CI: 1.12–1.40; $p < 0.001$), and rural residence remained significant (aOR = 1.38, 95% CI: 1.03–1.84; $p = 0.03$). Parental smoking also retained a moderate association (aOR = 1.49, 95% CI: 1.04–2.13; $p = 0.03$). Sex and school type lost significance after full adjustment ($p > 0.10$), indicating that social and contextual exposures mediate their effects. (Table 6)

Table 6. Multivariable logistic regression models predicting underage cigarette purchase

Variable	Model 1 aOR (95% CI)	Model 2 aOR (95% CI)	Model 3 aOR (95% CI)
Sex (male)	1.21 (0.93–1.59)	1.14 (0.87–1.49)	1.10 (0.84–1.46)
Age (per year)	1.28 (1.14–1.43)***	1.26 (1.13–1.40)***	1.25 (1.12–1.40)***
Rural residence	1.52 (1.12–2.06)**	1.42 (1.06–1.90)*	1.38 (1.03–1.84)*
Public school	1.31 (0.97–1.77)	1.24 (0.91–1.69)	1.18 (0.85–1.63)
Parental smoking	—	1.68 (1.17–2.42)**	1.49 (1.04–2.13)*
Peer smoking	—	2.84 (2.10–3.84)***	2.30 (1.66–3.19)***
Awareness of youth-sales law	—	—	0.89 (0.65–1.22)
Exposure to anti-tobacco media	—	—	0.77 (0.59–0.99)*

*p < 0.05; **p < 0.01; **p < 0.001.
aOR = adjusted odds ratio; CI = confidence interval.
Model 3: Hosmer–Lemeshow $\chi^2(8) = 6.21$, p = 0.21; VIF < 2.5.

Refusal of cigarette sale was significantly less likely among older adolescents (aOR = 0.81, 95% CI: 0.72–0.91; Wald $\chi^2 = 10.8$, p = 0.001) and rural residents (aOR = 0.64, 95% CI: 0.51–0.81; p < 0.001). Peer smokers were also 45% less likely to be refused (aOR = 0.55, 95% CI: 0.41–0.74; p < 0.001), suggesting social facilitation in illegal retail transactions. Parental smoking and sex were not significant predictors (p > 0.10). Overall refusal prevalence was 12.4% (95% CI: 11.0–13.8), indicating that nearly nine in ten minors who attempt purchase succeed—evidencing widespread non-compliance with the National Tobacco Control Act (2015) and FCTC Article 16 enforcement benchmarks. (Table 7)

Table 7. Predictors of refusal of cigarette sales due to age (proxy indicator of retailer compliance)

Variable	aOR (95% CI)	Wald χ^2	p-value
Age (per year)	0.81 (0.72–0.91)	10.8	0.001
Male sex	0.94 (0.70–1.26)	0.28	0.60
Rural residence	0.64 (0.51–0.81)	12.4	<0.001
Public school	0.89 (0.68–1.18)	0.73	0.39
Parental smoking	0.83 (0.61–1.13)	1.37	0.24
Peer smoking	0.55 (0.41–0.74)	15.2	<0.001

Interpretation: Retailer compliance with youth-sales prohibitions was markedly low; older, rural, and socially exposed adolescents were least likely to be refused purchase, reflecting critical enforcement gaps under FCTC Article 16.

Table 8 presents adjusted associations from multivariable logistic regression models examining determinants of underage cigarette purchase and refusal of sale due to age. Increasing age (aOR = 1.25, 95% CI: 1.12–1.40), rural residence (aOR = 1.38, 95% CI: 1.03–1.84), parental smoking (aOR = 1.49, 95% CI: 1.04–2.13), and particularly peer smoking (aOR = 2.30, 95% CI: 1.66–3.19) were associated with higher odds of successful underage cigarette purchase, whereas anti-tobacco media exposure was protective (aOR = 0.77, 95% CI: 0.59–0.99). Conversely, older age (aOR = 0.81, 95% CI: 0.72–0.91), rural residence (aOR = 0.64, 95% CI: 0.51–0.81), and peer smoking (aOR = 0.55, 95% CI: 0.41–0.74) were associated with lower odds of being refused sale due to age. Peer smoking demonstrated the strongest magnitude of association across both outcomes. All estimates were derived from fully adjusted models controlling for sex, age, residence, school type, parental smoking, and peer smoking, with application of survey weights. (Table 8)

Table 8. Summary of key adjusted associations from multivariable models

Outcome	Predictor	aOR (95% CI)	Direction of effect
Underage cigarette purchase	Age (per year)	1.25 (1.12–1.40)	Increased odds
	Rural residence	1.38 (1.03–1.84)	Increased odds
	Parental smoking	1.49 (1.04–2.13)	Increased odds
	Peer smoking	2.30 (1.66–3.19)	Strongly increased odds
	Anti-tobacco media exposure	0.77 (0.59–0.99)	Reduced odds
Refusal of sale due to age	Age (per year)	0.81 (0.72–0.91)	Reduced odds
	Rural residence	0.64 (0.51–0.81)	Reduced odds
	Peer smoking	0.55 (0.41–0.74)	Strongly reduced odds

All models adjusted for sex, age, residence, school type, parental smoking, and peer smoking, with survey weights applied

DISCUSSION

Findings: This analysis of the 2008 Global Youth Tobacco Survey (GYTS) data from Nigeria presents compelling evidence that despite existing legal prohibitions, a substantial proportion of adolescents still obtain cigarettes. Among in-school youths aged 13–15 years, 6.8% reported purchasing cigarettes in the previous 30 days, yet only 12.4% reported ever being refused a sale because of their age. The prevalence of purchase increased markedly with age and was significantly higher among adolescents who reported smoking peers or parents. In multivariable models, peer smoking emerged as the strongest independent predictor of illicit access (adjusted OR ≈ 2.30), while parental smoking and rural residence also contributed significant independent effects. These findings expose persistent and multifaceted gaps in retail compliance and highlight entrenched social and contextual drivers of youth access, with immediate relevance for enforcement, education and community-level tobacco control in Nigeria. Our prevalence estimates and the pattern of correlates align closely with prior research on adolescent tobacco access and initiation.

Studies in diverse settings have shown that peer smoking and parental smoking are strong predictors of youth tobacco uptake and access.[26,27] For example, a longitudinal study found that association with peers who smoke was linked with 2 to 6 times higher odds of smoking initiation in 11–15 year-olds, and that parental connectedness and monitoring were protective.[26] Research on retailer compliance and youth access laws has also found that laws restricting sales to minors are only effective when actively enforced.[28,29] In our Nigerian sample, the fact that only ~12% of adolescents reported being refused a sale implies that the legislative framework embodied in the National Tobacco Control Act (2015) and its implementing regulations may need to be translated into effective normative or operational deterrence of underage tobacco access.

The dominant role of peer influence in our study resonates with the broader literature that describes adolescents' social networks as critical vectors for tobacco initiation, procurement and consumption.[30,31] In our sample, adolescents with smoking peers were more than twice as likely to report illicit purchase, suggesting that supply and demand are both influenced by peer behaviour: peers may provide access conduits (for example, pooling money, proxy buying, group purchasing) as well as social validation. Similarly, the independent association with parental smoking (aOR ~1.5) aligns with intergenerational transmission models: parents who smoke may normalise tobacco use, reduce perceived barriers to access and provide both supply and modelling for children.[32]The rural–urban disparity we documented, with higher purchase prevalence and lower refusal rates among rural youth, reflects findings from other enforcement-context studies that show weaker regulatory coverage, lower retailer density oversight and differential social norms in non-urban markets.[33] Specifically, in settings with less frequent inspection, informal retail networks and a more relaxed social environment around youth access, regulatory measures may have diminished effect.[34]

The observed pattern of youth access to cigarettes in Nigeria can be explained by three closely interrelated mechanisms. First, retail non-compliance and informal supply channels play a central role. Evidence from compliance check studies consistently shows that when regulatory oversight, licensing systems, and inspection mechanisms are weak, tobacco retailers continue to sell to minors with little fear of reprisal.[29,35,36] In the Nigerian context, although a minimum legal age for tobacco sales exists, our data reveal that enforcement is severely inadequate. The remarkably low rate of refusal of sale (only 12.4%) suggests that most adolescents who attempt to buy cigarettes are successful, often purchasing through unregulated vendors or informal market outlets that operate beyond the reach of routine inspection. This structural weakness creates an enabling environment in which legal restrictions exist in form but not in function. Second, social facilitation through peer and familial networks substantially amplifies adolescents' access to tobacco products. The combined exposure analysis in this study demonstrates a clear dose–response relationship: adolescents who were exposed to both smoking parents and smoking peers reported a cigarette purchase prevalence of 18.9%, compared with just 4.9% among those with no such exposure. This pattern underscores how social networks serve as both normative and logistical pathways to tobacco acquisition. The closer and more pervasive the network of smokers within an adolescent's environment are, the fewer the barriers to obtaining cigarettes.

Peer smokers may directly model smoking behaviour, pool resources, or share information about where to purchase tobacco without scrutiny, while smoking parents may normalize cigarette use, reduce perceived risks, or even provide direct access. These social mechanisms reinforce one another, sustaining an ecosystem in which tobacco use and procurement are socially sanctioned and practically facilitated.[37,38] Finally, low awareness and weak deterrence of age restrictions further erode the effectiveness of youth access laws. When both adolescents and retailers perceive minimal risk of detection or penalty, legal prohibitions lose their deterrent power. Our findings also reveal that older adolescents (aOR = 0.81 per additional year) and were significantly less likely to be refused sale, indicating that compliance among vendors declines as youth appear more mature or as regulatory oversight diminishes outside urban centres. This trend suggests that many vendors either lack awareness of the law or perceive enforcement as negligible. Over time, this normalizes the expectation that underage cigarette purchase is routine and easily achievable. Consequently, the law's symbolic authority weakens, and youth access becomes embedded in everyday retail practice. Together,

these mechanisms—structural laxity in retail enforcement, social reinforcement through peers and family, and low perceived deterrence—operate synergistically to perpetuate adolescent access to cigarettes in Nigeria despite the existence of legal restrictions.

Implications: The findings of this study highlight a critical reality: the mere existence of legal prohibitions is insufficient to prevent Nigerian adolescents from accessing cigarettes. Reducing youth access therefore requires a coordinated, multi-layered strategy that addresses not only the retail environment but also the social and structural systems that perpetuate availability. International evidence provides clear direction for such an approach. Studies have repeatedly shown that routine compliance checks linked to active enforcement—including fines, license suspensions, and publicized sanctions, significantly reduce sales to minors and shift retailer behaviour over time.[39,40] When vendors are aware that inspections are likely and that violations will lead to tangible penalties, compliance improves substantially. Similarly, retailer education programmes combined with visible point-of-sale signage (e.g., "No sales to persons under 18") and structured age-verification protocols have been found to increase refusal rates, particularly when they are supported by credible enforcement mechanisms.[41]Beyond enforcement, multi-component community-based strategies—integrating school education, peer leadership, parental engagement, and retailer monitoring—produce more durable reductions in youth tobacco access than single interventions alone.[42]

Trade-Offs (Limitations): Several limitations of our study warrant discussion. First, the GYTS is a school-based survey and therefore excludes out-of-school adolescents, who may have higher rates of tobacco use and access, so findings only apply to school-attending youth aged 13–15 years. Second, the measures of purchase, refusal, parental, and peer smoking are based on self-report and may be subject to recall bias or social-desirability bias; however, the anonymous, self-administered nature of the instrument likely reduces such bias. Third, the cross-sectional design prevents definitive causal inference; for example, peer smoking may both influence and be influenced by shared tobacco-access behaviors. Fourth, the data come from the 2008 survey; while this remains the most recent nationally representative youth dataset for Nigeria, the tobacco market, retail supply chain, and regulatory environment may have changed since then. Nonetheless, the socio-behavioral mechanisms we identified—peer influence, parental modeling, and weak enforcement—are still highly relevant to current policy design. Finally, we lacked data on some potentially important confounders, such as household income or detailed vendor types, which future studies on freshly collected data should examine.

Take-Home (Conclusion): In Nigeria in 2008, substantial numbers of adolescents procured cigarettes in violation of legal age-sales restrictions. Peer smoking, parental smoking and rural residence were the strongest risk factors of illicit access. Legal prohibition alone has not eliminated under-age access; effective control requires robust enforcement systems, targeted community and retail interventions, and comprehensive prevention strategies addressing peer and family networks. By implementing evidence-based enforcement, sustained surveillance and community-engaged prevention, Nigeria has the opportunity to reduce youth access to tobacco and avert a generation of avoidable tobacco-related harm.

Expectations for future research: A targeted research and evaluation agenda is vital to translate these findings into action. Updated national surveillance, such as a new Global Youth Tobacco Survey (GYTS), should measure current youth access, retailer compliance, and progress since the National Tobacco Control Act (2015). Randomized or quasi-experimental trials are needed to test and scale cost-effective enforcement strategies like random inspections and publicized sanctions. Longitudinal studies can clarify how early access, peer, and parental influences shape smoking trajectories. Qualitative research in rural and informal markets should explore vendor behaviour and social norms to guide culturally appropriate interventions. Collectively, these efforts will strengthen Nigeria's evidence base and ensure sustainable youth tobacco control.

Recommendations:

- Applying these lessons to Nigeria highlights several priorities for action. First, retail compliance systems must be strengthened by operationalizing the National Tobacco Control Act (2015) 43 through retailer licensing, trained enforcement officers, and random compliance inspections.
- Public documentation of sanctions and proxy youth purchase checks can enhance transparency and deterrence.
- Rural and peri-urban enforcement should be prioritized using mobile inspection teams, community reporting, and local leader engagement to close visibility gaps.
- Interventions must address the social supply chain, as peer smoking remains the strongest predictor of youth access.44 Peer-led and family-based programmes that promote refusal skills, parental cessation, and communication can disrupt intergenerational tobacco normalization.45
- Stronger licensing, signage, and penalty systems—including escalating sanctions and license suspension—should replace weak fines. Continuous monitoring and accountability via the GYTS and a public compliance dashboard would

- Collaboration with civil society and youth networks can sustain enforcement momentum. In sum, Nigeria's challenge is not legislative absence but implementation weakness; combining enforcement, community engagement, and transparency can align national practice with WHO FCTC Article 16 commitments.

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