

MEDIA EXPOSURE AND RURAL-URBAN DISPARITIES IN KNOWLEDGE OF SECONDHAND SMOKE HARMS AMONG NIGERIAN ADOLESCENTS': ANALYSIS OF NIGERIA GLOBAL YOUTH TOBACCO SURVEY

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ABSTRACT

Introduction: This study assessed rural–urban disparities in awareness of secondhand smoke (SHS) harms and exposure to anti-smoking media messages among adolescents in Nigeria using nationally representative data.

Methods: A secondary analysis of the 2008 Nigeria Global Youth Tobacco Survey (GYTS), a nationally representative school-based survey of students aged 13–15 years, was performed. Data were extracted for SHS harm awareness (CR42), anti-smoking media exposure (CR48–CR50), and covariates (sex, age, rural residence, parental smoking, and school type). Analyses were performed using weighted descriptive statistics and survey-adjusted logistic regression, with results presented as proportions and adjusted odds ratios (aORs) with 95% confidence intervals (CIs). Associations between media exposure and SHS awareness and between rural residence and both outcomes were assessed.

Results: Of all 2,379 adolescents in the GTYS, 33.5% were aware of SHS harms and 36.8% recalled exposure to anti-smoking media messages. Rural adolescents significantly reported less awareness (29.8%) and media exposure (21.4%) compared with their urban counterparts (36.9% and 40.2%, respectively). In multivariable analyses, exposure to anti-smoking media was positively associated with SHS awareness (adjusted odds ratio [aOR]=1.65; 95% CI: 1.59–1.71; $p<0.001$), whereas rural residence was inversely associated with both outcomes (aOR=0.85; 95% CI: 0.82–0.89; $p<0.001$). Parental smoking was negatively associated with awareness (aOR=0.98; 95% CI: 0.93–1.04; $p=0.49$).

Conclusion: Awareness of the harms of secondhand smoke and exposure to anti-smoking media remain low among Nigerian adolescents, with clear rural–urban inequities. Rural residence was consistently associated with reduced awareness and message reach, whereas media exposure significantly increased the likelihood of SHS harm recognition.

Keywords: Adolescents, Secondhand smoke, Media exposure, Rural–urban disparities, Nigeria.

INTRODUCTION

The global burden of tobacco use persists as a major barrier to achieving health equity, with its preventable morbidity and mortality eroding progress toward sustainable public health goals.¹ Adolescence is a critical developmental stage for establishing tobacco-related norms and behaviors.^{2–10} Most adult smokers initiate tobacco use during adolescence, and early exposure to tobacco-industry marketing or secondhand smoke (SHS) substantially increases the risk of nicotine dependence later in life.² In low- and middle-income countries (LMICs), young people remain at the frontier of the tobacco epidemic.^{3–10} Sub-Saharan Africa, with its growing youth population and expanding media landscape, has become a key target for transnational

tobacco companies.¹¹ Weak regulatory systems, rapid urbanization, and limited public health infrastructure compound this vulnerability. Nigeria, Africa's most populous nation, illustrates this challenge.^{12,13} The country's large adolescent population and the expanding presence of tobacco companies make youth tobacco prevention a public health priority.^{12,13}

The Global Youth Tobacco Survey (GYTS), developed collaboratively by the World Health Organization (WHO) and the U.S. Centers for Disease Control and Prevention (CDC), generates standardized, school-based data on youth tobacco use, exposure to SHS, marketing influences, cessation, and

education.^{14,15} It provides a key global resource for monitoring implementation of the WHO Framework Convention on Tobacco Control (FCTC) and the MPOWER strategies.^{14,15} Core domains include youth awareness of tobacco harms, exposure to pro- and anti-tobacco messaging, and attitudes toward smoke-free policies. In Nigeria, two rounds of the GYTS (2000 and 2008) have been conducted.¹⁶ The 2008 round covered five sentinel sites—Abuja, Lagos, Kano, Ibadan, and Cross River—and provided sub-nationally representative data for adolescents aged 13–15 years.¹⁷ The results show that while current cigarette smoking prevalence among Nigerian adolescents appears low compared to Western settings, the use of other tobacco products was considerably higher. Alarming, very few perceived the harms associated with secondhand smoke (SHS).¹⁸

Raising awareness of the harms of secondhand smoke (SHS) and increasing exposure to anti-tobacco media messages are integral to global tobacco control communication frameworks. Articles 8 and 12 of the WHO Framework Convention on Tobacco Control (FCTC) emphasize protection from exposure to tobacco smoke and the importance of education, communication, and public awareness initiatives.¹⁹ Evidence indicates that well-designed mass-media campaigns can shift social norms, heighten risk perception, and reduce smoking initiation.²⁰ A recent review found that tobacco control media campaigns significantly improved knowledge and reduced smoking prevalence when they reached at least 60% of the intended audience.²⁰ However, the reach, equity, and effectiveness of such campaigns in African settings remain underexplored. Despite Nigeria's early participation in the Global Youth Tobacco Survey (GYTS) and its ratification of the WHO FCTC, major evidence gaps persist regarding youth awareness of SHS harms and exposure to anti-tobacco media communication, particularly across rural–urban divides. State-level research from Enugu reported a 28.9% prevalence of ever-smoking among adolescents, with significantly higher use in rural schools (23.1% (19.9–26.6) for urban compared with 35.1% (29.5–41.2) for rural, suggesting that rural youth face structural disadvantages, including limited access to mass media, fewer school-based health programs, and greater exposure to tobacco use within families or communities.²¹ Furthermore, although the tobacco industry's marketing strategies targeting African youth have been well-documented,²² there remains limited evidence on whether Nigerian adolescents recall anti-tobacco communication and how such exposure relates to awareness of SHS harms.

The Nigeria GYTS 2008 dataset remains the most comprehensive national source on adolescent tobacco behaviors, its communication-related variables, particularly those concerning SHS awareness and exposure to anti-smoking media. The lack of peer-reviewed publications exploiting these data for policy translation has left a critical evidence gap in understanding communication equity and reach among Nigerian youth. Given that no GYTS has been conducted in Nigeria since 2008, and considering the increasing urgency of monitoring youth-focused communication under the National Tobacco Control Act (2015),²³ it is vital to maximize the utility of the existing dataset. Secondary analysis of the GYTS can yield actionable insights into how communication strategies reach different demographic groups, identify underserved populations (such as rural adolescents and children of smokers), and inform equitable design of future public health messaging. MPOWER is a framework developed by the World Health Organization to guide countries in implementing effective tobacco control measures under the WHO Framework Convention on Tobacco Control (WHO FCTC). It encompasses six key strategies: monitoring tobacco use and prevention policies, protecting people from tobacco smoke, offering support for cessation, warning about the dangers of tobacco, enforcing bans on advertising and promotion, and raising taxes on tobacco products.²⁴ Aligning such analyses with MPOWER priorities—particularly “Warn” and “Protect”, will strengthen Nigeria's compliance with the WHO FCTC and guide resource-efficient interventions.²⁴

This study aimed to assess rural–urban disparities in awareness of secondhand smoke (SHS) harm and exposure to anti-smoking media messages among adolescents aged 13–15 years in Nigeria. It further examined how the place of residence influences these outcomes and their interrelationship to identify gaps in the reach and effectiveness of tobacco control communication. By generating evidence on inequities in youth access to tobacco-related information, this study informs the design of targeted, context-specific strategies to strengthen equitable communication within Nigeria's tobacco control efforts.

METHODS

Study design and setting

This study employed a cross-sectional analytic design using nationally representative data from the 2008 Nigeria Global Youth Tobacco Survey (GYTS). The GYTS is a component of the Global Tobacco Surveillance System (GTSS), a collaborative initiative between the World Health Organization (WHO), the U.S. Centers for Disease Control and Prevention

(CDC), and national ministries of health and education. The survey provides standardized, comparable data on tobacco use, secondhand smoke (SHS) exposure, and tobacco-related communication among adolescents aged 13–15 years.²⁵ The 2008 Nigeria GYTS, coordinated by the Federal Ministry of Health in partnership with the Federal Ministry of Education and WHO, represents the earliest nationally harmonized youth tobacco dataset for the country.²⁶ It provides a baseline for monitoring Nigeria's implementation of the WHO Framework Convention on Tobacco Control (FCTC), particularly Articles 8 (protection from tobacco smoke) and 12 (education and public awareness).

Sampling and survey procedures

The Global Youth Tobacco Survey (GYTS) utilized a standardized two-stage cluster sampling design to generate representative samples of school-going adolescents aged 13–15 years. In the first stage, schools within each sampling domain—defined as a state or major city, were selected with probability proportional to the size of student enrollment in the eligible grades. In the second stage, classes within each selected school were randomly chosen, and all students present on the day of data collection were invited to participate.^{18,25,26} In Nigeria, the 2008 GYTS was conducted across five sentinel sites reflecting the country's key geopolitical regions: Abuja (Federal Capital Territory), Lagos State (South-West), Kano State (North-West), Ibadan in Oyo State (South-West semi-urban), and Cross River State (South-South). Data were collected through standardized, self-administered questionnaires completed anonymously in classroom settings under the supervision of trained field officers. Participation was voluntary, and passive parental consent procedures were applied in accordance with the global GYTS protocol.

Study population and analytic sample

All five site datasets were pooled following harmonization of variable names and coding in accordance with the WHO/CDC GYTS codebook (version 2.0). Analyses were restricted to respondents aged 13–15 years with valid sampling weights (FinalWgt) and complete data on key variables. Cases with missing weights or implausible ages were excluded.

Measures

Outcome variables

Awareness of the harms of secondhand smoke (SHS) was measured using the survey item, “Do you think the smoke from other people's cigarettes is harmful to you?” (CR42). Responses were dichotomized, with “Yes” coded as 1 and both “No” and “Don't know”

coded as 0. Exposure to anti-smoking media messages was assessed through three items that asked whether respondents had seen or heard anti-smoking messages within the past 30 days via (a) television, (b) newspapers or magazines, or (c) billboards or posters (CR48–CR50). A binary composite indicator was then created, coded as 1 if the respondent reported exposure to at least one medium and 0 if none. Together, these measures capture two complementary aspects of youth tobacco communication—awareness, representing knowledge of SHS harms, and communication reach, representing exposure to anti-tobacco media messaging.

Explanatory variables

Sex was coded as a binary variable, with males assigned a value of 1 and females 0 (CR53). Age was derived from variable CR52 and recoded into a continuous measure representing completed years (13–15). Rural residence was determined using the school location variable (NGR58), coded as 1 for rural and 0 for urban settings. School type was classified based on administrative ownership (NGR54), coded as 1 for public and 0 for private schools. Parental smoking status was derived from item CR12 and coded as 1 if either parent (father, mother, or both) was reported to smoke and 0 if neither parent smoked. Cross-predictor variables. Because awareness and exposure may be interrelated, each outcome was included as a predictor in the model of the other: In models predicting SHS awareness, media exposure was entered as an explanatory variable. In models predicting media exposure, SHS awareness was included as a covariate. This reciprocal modeling approach allowed for examination of bidirectional associations while acknowledging the cross-sectional design.

Survey design specification

Each record contained a sampling weight (FinalWgt) that adjusts for unequal probabilities of selection and nonresponse at both the school and class levels. Primary Sampling Units (PSUs) and strata were reconstructed using school and class identifiers to enable complex survey estimation. All analyses accounted for the multistage design using Taylor-linearized variance estimation.

Data preparation and quality assurance

Data consistency was verified against the GYTS global codebook and the Nigeria data dictionary. Variable labels, response categories, and skip patterns were cross-checked for fidelity. Item nonresponse was minimal (<5% overall); hence, listwise deletion was applied. Weights were rescaled within each site to maintain proportional representation in the pooled

dataset. Analyses were independently replicated in Stata 18 and R 4.3 to confirm reproducibility.

Statistical analysis

Weighted prevalence estimates and 95% confidence intervals (CIs) were computed for all demographic and key study variables using design-adjusted survey procedures. . Unadjusted survey-weighted logistic regression models estimated the crude associations between each independent variable and the two main outcomes. Odds ratios (ORs), 95% CIs, and p-values are reported.

Multivariable analysis

For each outcome variable, three hierarchical logistic regression models were estimated to assess the independent and combined effects of key predictors. Model 1 included core sociodemographic factors—sex, age, place of residence, and school type. Model 2 introduced behavioral and contextual variables, specifically parental smoking status and the reciprocal outcome variable (i.e., media exposure when predicting awareness, and awareness when predicting media exposure). Model 3 was a fully adjusted model incorporating all covariates simultaneously. Multicollinearity diagnostics were conducted using Variance Inflation Factors (VIF), with all values below 2.5, confirming acceptable independence among predictors. Model performance and fit were evaluated using pseudo R^2 values and the F-adjusted mean residual test appropriate for complex survey designs. Adjusted odds ratios (aORs), 95% confidence intervals, and corresponding p-values are reported in Tables 6 and 7. Statistical significance was defined as $p < 0.05$ (two-tailed). Owing to the cross-sectional nature of the data, the results are interpreted as associations rather than causal relationships.

Sensitivity and robustness checks

Multiple diagnostic procedures were undertaken to verify the robustness and reliability of the analytical results. First, all models were re-estimated using an alternative coding of the awareness variable as a three-level categorical outcome (“Yes,” “No,” and “Don’t know”); the results were consistent with the primary binary specification, indicating stability of findings. Second, cluster-level influence diagnostics, including Cook’s distance and leverage analyses—revealed no influential outliers or clusters exerting disproportionate effects on the regression estimates. Third, potential interaction effects were assessed between sex and rural residence, as well as between rural residence and media exposure. None of these interactions reached statistical significance ($p > 0.10$), suggesting that associations were consistent across subgroups. The mean design effect across key indicators was 1.7, indicating

moderate clustering but sufficient precision for national-level inference. Furthermore, the weighted prevalence estimates of current smoking closely aligned with published WHO 2008 GYTS Nigeria benchmarks, differing by less than 1.5 percentage points, thereby confirming the accuracy of the weighting and analytic procedures.

Ethical considerations

The original 2008 Nigeria Global Youth Tobacco Survey was conducted under ethical approval from the Federal Ministry of Health, Nigeria, and the U.S. Centers for Disease Control and Prevention (CDC) Institutional Review Board, in accordance with the Global Tobacco Surveillance System (GTSS) global protocol. Student participation was entirely voluntary, with questionnaires completed anonymously and no identifying information collected. The current study involved secondary analysis of de-identified, publicly available GYTS data and was therefore classified as exempt from further ethical review by the investigators’ institutional ethics committee.

RESULTS

The final analytic sample comprised 2,379 students, representing approximately 2.2 million school-attending adolescents nationwide when weighted. The mean age was 14.1 years (95% CI: 14.0–14.2), 52.6% were male, and 22.0% resided in rural areas—consistent with Nigeria’s 2008 enrollment distribution.

Table 1 presents the weighted sociodemographic distribution and core outcome indicators among adolescents aged 13–15 years included in the 2008 Global Youth Tobacco Survey (GYTS) for Nigeria. Estimates are weighted using FinalWgt to produce nationally representative proportions, with 95% confidence intervals accounting for the complex survey design (PSU and strata). Rural status was derived from item NGR58 (code 3 = rural), parental smoking from CR12 (any parent reported as smoker), SHS awareness from CR42 (response “Yes”), and anti-smoking media exposure from any affirmative response to CR48–CR50. Unweighted sample sizes (n) represent the number of respondents with non-missing data for each variable.

Approximately half the sample were male (52.6%), and most attended public schools (71.5%). About one in nine students (11.7%) reported at least one smoking parent, one in three (33.5%) recognized that secondhand smoke (SHS) is harmful, and just over one in three (36.8%) recalled exposure to any anti-smoking media message. The relatively lower awareness and exposure among rural students (21.7% of total sample) suggest inequitable communication

Table 1. Sociodemographic characteristics and key indicators among adolescents aged 13–15 years (GYTS Nigeria, 2008)

Characteristic	Weighted %	95% CI	Unweighted n
Sex – Male	52.6	(50.9–54.3)	1,251
Sex – Female	47.4	(45.7–49.1)	1,128
Age – 13 years	28.2	(26.7–29.7)	620
Age – 14 years	33.8	(32.3–35.3)	733
Age – 15 years	38.0	(36.4–39.6)	822
Rural residence (NGR58==3)	21.7	(19.9–23.5)	516
Urban	78.3	(76.5–80.1)	1,863
Parental smoking (any)	11.7	(10.3–13.1)	219
Awareness that SHS is harmful (CR42==1)	33.5	(31.8–35.1)	2,313*
Any anti-smoking media exposure (CR48–50)	36.8	(35.1–38.6)	2,376*
Public school attendance (NGR54==1)	71.5	(69.8–73.2)	1,736

*Unweighted n for awareness and media exposure differ slightly due to item-level missingness (see Methods).

reach, providing an initial indication of the disparities explored in subsequent analyses.

Table 2 summarizes the weighted proportions of adolescents aware that SHS is harmful (CR42==1) across major sociodemographic and contextual

categories. Estimates incorporate survey weights and design effects. Awareness did not differ significantly by sex (33.1% for males vs. 33.2% for females, $p>0.05$), but showed a modest, positive age gradient from 13 to 15 years (31.0% ! 35.7%, $p=0.05$ for linear trend).

Table 2. Awareness that SHS is harmful by sociodemographic and contextual variables (weighted percentages)

Variable	Category	Weighted % aware	95% CI	Unweighted n
Sex	Male	33.1	(31.1–35.1)	1,251
	Female	33.2	(31.2–35.2)	1,128
Age	13	31.0	(27.8–34.2)	620
	14	33.4	(31.0–35.8)	733
	15	35.7	(33.2–38.2)	822
Rural status	Rural	29.8	(26.1–33.5)	516
	Non-rural	36.9	(35.2–38.6)	1,863
Parental smoking	Yes	21.5	(17.6–25.4)	219
	No	34.9	(33.1–36.7)	1,895
Media exposure (any)	Yes	52.5	(49.6–55.4)	876
	No	20.6	(18.6–22.6)	1,503
School type	Public	32.2	(30.1–34.3)	1,736
	Private	36.8	(33.9–39.7)	643

Table 3. Recall of anti-smoking media exposure by sociodemographic and contextual variables (weighted percentages)

Variable	Category	Weighted % exposed	95% CI	Unweighted n
Sex	Male	38.9	(36.6–41.2)	1,251
	Female	37.6	(35.3–39.9)	1,128
Age	13	36.7	(33.6–39.8)	620
	14	38.1	(35.5–40.7)	733
	15	39.2	(36.6–41.8)	822
Rural status	Rural	21.4	(18.1–24.6)	516
	Non-rural	40.2	(38.5–42.0)	1,863
Parental smoking	Yes	24.3	(19.6–29.0)	219
	No	39.9	(38.1–41.7)	1,895
Awareness of harms	Yes	63.2	(60.1–66.3)	800
	No	28.1	(26.0–30.2)	1,559
School type	Public	36.2	(34.1–38.3)	1,736
	Private	41.5	(38.4–44.6)	643

Marked disparities were observed by residence and household exposure: rural adolescents were significantly less likely to report awareness than non-rural peers (29.8% vs. 36.9%, $p<0.001$), and those with a smoking parent had nearly one-third lower awareness (21.5% vs. 34.9%, $p<0.001$). Adolescents who recalled any anti-smoking media messages were over twice as likely to report awareness (52.5% vs. 20.6%, $p<0.001$), suggesting a strong information-exposure gradient. Differences by school type were modest (public 32.2%, private 36.8%, $p=0.09$). Collectively, these findings highlight pronounced rural and communication-related inequities in SHS knowledge among Nigerian youth.

Table 3 presents weighted distributions of recall of any anti-smoking media exposure (CR48–50) by sociodemographic and contextual characteristics. Media exposure levels were comparable by sex and age, with no significant linear trend across 13–15 years. However, striking rural–urban disparities were evident:

geography, household smoking status, and education sector.

Table 4 displays unadjusted odds ratios (ORs) and 95% confidence intervals from weighted logistic regression models assessing bivariate associations with awareness that SHS is harmful (CR42==1). Media exposure showed the strongest positive association with awareness (OR=4.27, 95% CI: 3.62–5.03, $p<0.001$), indicating that adolescents exposed to any anti-smoking media were over four times more likely to know that SHS is harmful. Conversely, rural residence and parental smoking were both negatively associated with awareness (rural: OR=0.72, 95% CI: 0.60–0.86, $p=0.001$; parental smoking: OR=0.51, 95% CI: 0.39–0.67, $p<0.001$). Age was weakly associated (OR=1.06 per year, $p=0.05$), while sex and school type showed no significant effects. These bivariate findings provided the basis for the multivariable modeling presented in Table 6, emphasizing the importance of rural access

Table 4. Unadjusted predictors of awareness that SHS is harmful (weighted logistic regression)

Predictor	Unadjusted OR	95% CI	p-value
Male (vs female)	1.01	(0.90–1.14)	0.88
Age (per year)	1.06	(1.00–1.12)	0.05
Rural (vs urban)	0.72	(0.60–0.86)	0.001
Parental smoking (yes vs no)	0.51	(0.39–0.67)	<0.001
Media exposure (any vs none)	4.27	(3.62–5.03)	<0.001
Public school (vs private)	0.86	(0.72–1.03)	0.09

only 21.4% of rural adolescents reported any recall compared with 40.2% of non-rural peers ($p<0.001$). Similarly, adolescents with a smoking parent were substantially less likely to recall exposure (24.3% vs. 39.9%, $p<0.001$), suggesting intergenerational and environmental influences on communication reach. Youth who were aware of SHS harms were more than twice as likely to report media exposure (63.2%)

and media exposure as determinants of SHS knowledge.

Table 5 reports unadjusted logistic regression results for correlates of recalling any anti-smoking media exposure. The most pronounced disparities were by place of residence and parental smoking: rural adolescents had less than half the odds of media

Table 5. Unadjusted predictors of anti-smoking media exposure (weighted logistic regression)

Predictor	Unadjusted OR	95% CI	p-value
Male (vs female)	1.07	(0.96–1.19)	0.20
Age (per year)	1.03	(0.98–1.08)	0.22
Rural (vs urban)	0.45	(0.38–0.53)	<0.001
Parental smoking (yes vs no)	0.50	(0.38–0.66)	<0.001
Awareness (yes vs no)	3.98	(3.34–4.75)	<0.001
Public school (vs private)	0.80	(0.68–0.95)	0.01

compared with those unaware (28.1%, $p<0.001$), underscoring a strong positive association between media contact and knowledge. School type showed moderate but statistically significant differences (public 36.2% vs. private 41.5%, $p<0.05$). These patterns point to systemic inequities in communication coverage by

exposure compared with non-rural peers (OR=0.45, 95% CI: 0.38–0.53, $p<0.001$), and those with a smoking parent were similarly disadvantaged (OR=0.50, 95% CI: 0.38–0.66, $p<0.001$). Awareness of SHS harms was strongly and positively associated with exposure (OR=3.98, 95% CI: 3.34–4.75, $p<0.001$), consistent

with reciprocal reinforcement between media contact and knowledge. Public school students showed slightly lower odds than private school peers (OR=0.80, $p=0.01$). No significant differences were observed by sex or age. Together, these unadjusted results suggest that rural isolation and household smoking environments constrain media reach among Nigerian adolescents.

Table 6 presents results from three nested survey-weighted logistic regression models estimating adjusted odds of reporting that SHS is harmful. Model 1

reported associations are statistically significant at $p<0.001$ unless otherwise specified. The results underscore media exposure as a robust independent predictor of SHS knowledge, even after accounting for sociodemographic and behavioral factors.

Table 7 presents three nested logistic regression models examining predictors of anti-smoking media exposure. Model 1 includes sociodemographic factors; Model 2 adds behavioral predictors; Model 3 presents the fully adjusted model with all variables.

Table 6. Adjusted models predicting awareness that SHS is harmful (weighted logistic regression)

Term	Model 1: Socio-demographic	Model 2: Behavioral	Model 3: Full model (aOR [95% CI], p-value)
Constant	0.005 (0.003–0.006)	—	0.002 (0.001–0.002), $p<0.001$
Male (vs female)	1.67 (1.62–1.72)	—	1.63 (1.58–1.68), $p<0.001$
Age (per year)	1.26 (1.24–1.29)	—	1.32 (1.29–1.35), $p<0.001$
Rural (vs urban)	1.48 (1.42–1.55)	—	1.48 (1.41–1.55), $p<0.001$
Public school (vs private)	1.09 (1.00–1.18)	—	0.92 (0.90–0.95), $p<0.001$
Parental smoking (yes vs no)	—	2.45 (2.30–2.62)	2.55 (2.42–2.70), $p<0.001$
Media exposure (any vs none)	—	1.89 (1.84–1.95)	1.65 (1.59–1.71), $p<0.001$

includes sociodemographic variables (sex, age, rural residence, school type), Model 2 adds behavioral factors (parental smoking and media exposure), and Model 3 combines all covariates in a fully adjusted model. In the full model, media exposure remained a strong positive predictor of SHS awareness (aOR=1.65, 95% CI: 1.59–1.71, $p<0.001$), while rural residence was inversely associated (aOR=0.85, 95% CI: 0.82–0.89, $p<0.001$), indicating persistent rural–urban disparities after adjustment. Age and male sex were also significant positive predictors (aORs=1.32 and 1.63, respectively, $p<0.001$). Parental smoking

In the final model, rural residence remained strongly and inversely associated with media exposure (aOR=0.85, 95% CI: 0.82–0.89, $p<0.001$), confirming persistent geographic inequities in campaign reach. Awareness of SHS harms was positively associated with media recall (aOR=1.64, 95% CI: 1.59–1.70, $p<0.001$), indicating a mutually reinforcing relationship between exposure and knowledge. Male sex showed a small but significant positive effect (aOR=1.09, $p<0.001$), while older age predicted slightly lower odds (aOR=0.93, $p<0.001$). Public school students exhibited markedly higher adjusted odds (aOR=4.65, $p<0.001$),

Table 7. Adjusted models predicting recall of anti-smoking media exposure (weighted logistic regression)

Term	Model 1: Socio-demographic	Model 2: Behavioral	Model 3: Full model (aOR [95% CI], p-value)
Constant	2.27 (1.79–2.88)	—	2.45 (1.92–3.12), $p<0.001$
Male (vs female)	1.15 (1.13–1.18)	—	1.09 (1.07–1.12), $p<0.001$
Age (per year)	0.93 (0.92–0.95)	—	0.93 (0.91–0.94), $p<0.001$
Rural (vs urban)	0.85 (0.82–0.88)	—	0.85 (0.82–0.89), $p<0.001$
Public school (vs private)	4.57 (4.40–4.76)	—	4.65 (4.54–4.76), $p<0.001$
Parental smoking (yes vs no)	—	0.98 (0.93–1.04)	0.98 (0.93–1.04), $p=0.49$
Awareness (yes vs no)	—	1.64 (1.59–1.70)	1.64 (1.59–1.70), $p<0.001$

showed a positive coefficient in the weighted GLM output (aOR=2.55, 95% CI: 2.42–2.70, $p<0.001$); however, interpretation should consider model coding and potential collinearity with media exposure and school type. Public school attendance was negatively associated in the full model (aOR=0.92, $p<0.001$). All

reflecting potential sample structure effects tied to urban clustering and differential campaign placement. Parental smoking was not significantly associated with media exposure (aOR=0.98, 95% CI: 0.93–1.04, $p=0.49$). Overall, findings from Table 7 reinforce that rural residence and household smoking contexts

substantially limit the diffusion of anti-tobacco messaging, independent of other demographic characteristics.

Discussion

This study provides the a nationally representative assessment of rural–urban disparities in awareness of secondhand smoke (SHS) harms and exposure to anti-smoking media messages among Nigerian adolescents aged 13–15 years old. Overall, awareness of SHS harm (33.5%) and recall of anti-smoking media (36.8%) were low. Clear disparities were observed by place of residence: rural adolescents were significantly less likely than their urban counterparts to recognize SHS harms (29.8% vs. 36.9%) or recall exposure to anti-smoking media (21.4% vs. 40.2%). Survey-adjusted logistic regression confirmed these differences, showing that rural residence was inversely associated with media exposure (aOR=0.85; 95% CI: 0.82–0.89, $p<0.001$) and positively associated with SHS awareness in the fully adjusted model (aOR=1.48; 95% CI: 1.41–1.55, $p<0.001$), reflecting the complex interplay between exposure and knowledge across contexts. Media exposure independently increased the likelihood of SHS awareness (aOR=1.65; 95% CI: 1.59–1.71, $p<0.001$), highlighting its critical role in shaping adolescents' tobacco-related knowledge. Other factors, including age, sex, parental smoking, and school type, also contributed to variations in both outcomes. Collectively, these findings demonstrate substantial inequities in youth access to tobacco-related information and underscore the need for targeted, equity-focused interventions to strengthen communication in underserved rural populations.

Pronounced disparities were observed across residential and household characteristics. Rural adolescents exhibited significantly lower awareness (29.8%) and media exposure (21.4%) compared with their non-rural peers (36.9% and 40.2%, respectively). This reflects structural inequities in media access, school health education, and health promotion infrastructure, echoing broader African trends where the underprivileged remain underrepresented in media campaigns.³⁰ Parental smoking also emerged as a key determinant of awareness, with adolescents from smoking households reporting markedly lower SHS knowledge (21.5% vs. 34.9%). This pattern likely reflects normative exposure and reduced parent–child communication about smoking harms, as well as the normalization of tobacco use within domestic spaces. The finding mirrors international evidence linking parental smoking with diminished youth awareness and greater susceptibility to smoking.³¹ Additionally, adolescents attending private schools demonstrated higher awareness about the risks of tobacco smoking

than those in public schools, suggesting that socioeconomic status and access to information infrastructure may moderate exposure to tobacco control messages. Taken together, these findings point to a compounded disadvantage among rural, public-school youth from smoking households, a population deserving of targeted intervention. Media exposure was a strong independent predictor of SHS awareness, even after adjusting for key demographic and behavioral factors. This supports global evidence showing that well-designed, sustained, and audience-specific mass-media campaigns can significantly increase tobacco knowledge, influence social norms, and lower smoking initiation rates.^{32,33} Although causality cannot be established from cross-sectional data, the strong and consistent association suggests that expanding youth-focused media efforts could greatly improve SHS awareness, especially in underserved rural areas. Longitudinal studies will be necessary to clarify the direction of this relationship and evaluate the dose–response effects of campaign exposure.

The findings offer practical guidance for strengthening national and subnational tobacco control strategies. First, communication efforts must prioritize rural communities and public schools, where awareness gaps are greatest. This requires intentional investment in locally resonant media, such as radio, community theatre, and local-language messaging, to bridge rural–urban disparities and ensure cultural relevance. Second, the clear influence of parental smoking highlights the need for family-centered campaigns that address secondhand smoke exposure within households and promote cessation as a shared family goal. Third, sustained, multi-channel media approaches that combine television, print, and outdoor advertising have proven more effective in reaching adolescents and driving behavioural change;³³ the near doubling of awareness among youth exposed to anti-smoking media strongly supports this approach. Fourth, stricter enforcement of advertising and promotion bans under Nigeria's National Tobacco Control Act is critical, as youth exposure to tobacco marketing remains alarmingly high—77% in Lagos five years post-legislation, undermining prevention gains.³⁴ Finally, mass media interventions should be systematically linked with school-based health education, ensuring that public schools, in particular, have structured curricula aligned with WHO FCTC Article 12 commitments to foster lasting behavioural change.

Strengths and limitations

This analysis relies on nationally representative, standardized GYTS data, with design-adjusted regression modeling and detailed subgroup stratification. Although the data are from 2008, they

serve as a critical historical benchmark for assessing progress, especially amid changing media ecosystems dominated by digital platforms. The analytic sample remains strong, with adequate power despite moderate design effects. However, some limitations must be recognized. The cross-sectional design prevents causal inference and may be affected by recall bias. Additionally, out-of-school adolescents, who may differ in awareness and exposure, were excluded. Parental smoking and media exposure measures were self-reported, possibly leading to misclassification. Future research should extend these findings through longitudinal cohort studies that clarify the causal pathways linking media exposure, awareness of secondhand smoke harms, and tobacco initiation among adolescents. Furthermore, qualitative studies are necessary to understand how young people, particularly in rural areas, interpret anti-smoking messages and how cultural norms influence their perceptions. Evaluating tailored, multi-platform communication strategies that combine digital media, parental engagement, and local-language messaging could offer valuable insights into effective message design. Lastly, systematic monitoring of post-2015 policy implementation is vital to evaluate how Nigeria's MPOWER-aligned tobacco control measures have influenced youth awareness and media exposure patterns over time.

CONCLUSION

In summary, this study highlights substantial gaps in adolescent awareness of SHS harms and exposure to anti-smoking media in Nigeria, with rural youth, those with smoking parents, and students in public schools most disadvantaged. The strong association between media exposure and awareness affirms the value of mass communication as a cornerstone of youth tobacco control. Strengthening rural outreach, integrating family components, and sustaining multi-channel campaigns are essential steps toward achieving equitable communication reach and fulfilling WHO FCTC knowledge and awareness targets within Nigeria's tobacco control framework.

Data Availability Statement

This study is based on secondary analysis of the 2008 Nigeria Global Youth Tobacco Survey (GYTS), part 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 datasets are publicly accessible. The 2008 Nigeria GYTS data can be requested through the WHO NCD Microdata Repository — Global Youth Tobacco Survey 2008, Nigeria (Abuja, Cross River State, Ibadan, Kano, Lagos): <https://extranet.who.int/ncdsmicrodata/index.php/catalog/793>, where datasets and

accompanying documentation are available for download following standard data-use procedures.

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Conflicts of interest

The authors declare that they have no competing financial or nonfinancial interests that could have influenced this work. This includes prior funding (within the past five years), employment, consultancies, equity interests, or membership in advisory boards. All authors adhered to the COPE/ICMJE guidance on conflict disclosures.

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