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Factors Associated with Intention to Smoke Cigarettes Among Never-Smoking School-Going Adolescents in Zambia: Updated Evidence from the 2021 Global Youth Tobacco Survey

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Abstract

Background

Tobacco use remains a leading preventable cause of premature death worldwide, and adolescence is a key period when smoking often begins. In Zambia, there is limited recent evidence on early smoking risk, especially the intention to smoke among adolescents who have never smoked. Understanding the behavioral, social, and environmental factors that shape this intention is important for designing effective prevention strategies. This study aims to assess the determinants of intention to smoke among never-smoking adolescents in Zambia.

Methods

We analyzed cross-sectional data from the 2021 Zambia Global Youth Tobacco Survey (GYTS), a nationally representative school-based survey of adolescents aged 13–15 years conducted using a two-stage cluster sampling design. The analytic sample included 4,745 school-going adolescents, with analysis restricted to never-smokers for the outcome of interest Using intention to smoke cigarettes in the next 12 months as the primary outcome, we calculated weighted prevalence estimates across sociodemographic, behavioural, and environmental subgroups and identified independent predictors using survey-adjusted multivariable logistic regression with stepwise forward selection guided by the Akaike Information Criterion.

Results

The overall weighted prevalence of intention to smoke was 17.5.%. The weighted prevalence of intention to smoke varied across subgroups, with notably high levels among adolescents with prior tobacco exposure and social risk factors. In multivariable analysis, history of cigarette use (aOR = 3.33; 95% CI: 1.96–5.66), use of hand-rolled cigarettes (aOR = 2.35; 95% CI: 1.17–4.71), and peer tobacco use (aOR = 1.62; 95% CI: 1.11–2.35) were associated with higher odds of intention to smoke. Perceived difficulty of quitting smoking showed the strongest association (aOR = 13.5; 95% CI: 8.19–22.3). Conversely, exposure to school-based education on smoking dangers was protective (aOR = 0.67; 95% CI: 0.46–0.98). Demographic factors including age, sex, grade, and socioeconomic status were not consistently associated after adjustment.

Conclusion

Smoking intention among Zambian adolescents is strongly shaped by prior tobacco experimentation, peer influence, and perceptions related to addiction, while school-based education offers a modest protective effect. Interventions should prioritize early prevention before first exposure, strengthen

school-based programs, and address peer network influences to reduce progression toward tobacco use. These findings provide an evidence base to strengthen Zambia's WHO FCTC implementation and school-based tobacco prevention programs.

INTRODUCTION

Tobacco use remains one of the leading preventable causes of premature death worldwide, causing an estimated 7 to 8 million deaths each year. Most of these deaths occur in low and middle income countries where health systems face major constraints[1–3]. While adult smoking has declined in some regions, the total number of smokers continues to grow due to population expansion and industry targeting of new markets[3,4]. Adolescence is a critical period for uptake, with many users starting before adulthood. The increasing range of tobacco products continues to complicate prevention efforts and sustain use among young people[5,6].

Across Africa, rapid population growth and rising incomes have created conditions that support tobacco expansion. Weak implementation of control policies has further enabled this trend[6–8]. Data from multiple countries show that a notable share of school going adolescents use tobacco products, including cigarettes and other forms [6,9]. Shisha use is also becoming more common, often alongside other products. Despite some progress in certain countries, overall levels remain concerning due to gaps in enforcement and limited youth focused services[6,8]. Without stronger action, tobacco related deaths in the region are expected to rise[2,4].

Zambia reflects many of these regional patterns, with clear differences across population groups. Tobacco use is higher among men, rural residents, and those with lower income and education[4,10]. Most users begin during adolescence, often between early and late teenage years[8,11]. Earlier national data showed measurable levels of smoking among adolescents, along with strong links to peer and parental influence. Exposure to smoking in social settings and gaps in school education have also been documented[12]. Broader African studies confirm the importance of these social and environmental drivers[6].

Intention to smoke is a key early stage that precedes regular use and dependence. Behavioral theories identify intention as a strong predictor of future actions, shaped by attitudes, norms, and perceived control[13,14]. Evidence shows that adolescents who express willingness to smoke are more likely to start later. Factors such as exposure to marketing, peer influence, and secondhand smoke play an important role in shaping these intentions[8,15]. In many low and middle income settings, weak regulation increases the likelihood that intention leads to actual use[1,7].

Despite this global and regional evidence, Zambia still lacks contemporary, nationally representative data on the prevalence and determinants of smoking intention among school-going adolescents. Existing Zambian studies have focused primarily on current smoking or ever use, leaving a critical gap in

understanding the earlier motivational stages that precede initiation and escalation [10]. Given the country's young population, documented exposure of adolescents to tobacco marketing, and partial implementation of WHO Framework Convention on Tobacco Control (FCTC) measures, there is an urgent need for locally grounded evidence on intention to smoke and its correlates [4,8,10]. Such evidence can guide the design of targeted prevention strategies that address specific behavioral, social and environmental drivers of smoking intentions in the Zambian context.

The 2021 GYTS offers a timely chance to examine intention to smoke among Zambian adolescents using national data. This study aims to assess the determinants of intention to smoke among never-smoking adolescents in Zambia, while also estimating the prevalence of intention to smoke cigarettes in the next 12 months and examining the behavioral, social, psychological, and environmental factors associated with this intention. The findings can guide improvements in school programs, community interventions, and national policies to prevent smoking among young people. The findings can guide improvements in school programs, community interventions, and national policies to prevent smoking among young people and support wider efforts to reduce tobacco use in the region.

METHODS

Study Design and Data Source

This study used data from the 2021 Global Youth Tobacco Survey (GYTS) conducted in Zambia. The GYTS is a school-based survey designed to monitor tobacco use and track key tobacco control indicators among young people aged 13 to 15 years[16]. The survey follows a standardized approach developed by the World Health Organization and the Centers for Disease Control and Prevention, allowing for comparison across countries and over time [17].

Sampling Method

The GYTS uses a two-stage cluster sampling design to select a representative sample of students from schools across the country[18]. In the first stage, schools were selected with probability proportional to their enrollment size from a complete list of public and private schools offering grades 7, 8, and 9 in Zambia. This approach ensures that larger schools have a higher chance of selection, making the sample more representative of the student population.

In the second stage, classes within the selected schools were randomly chosen. All students present in the selected classes on the day of the survey were invited to participate. This method allows for efficient data collection while maintaining the representativeness of the sample.

Data Collection

Data were collected using an adapted version of the Global Youth Tobacco Survey (GYTS) questionnaire developed by the World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC). The GYTS is a standardized tool designed to assess tobacco use and related factors among adolescents[19]. The questionnaire covers tobacco use behaviors, knowledge and attitudes about tobacco, exposure to secondhand smoke, access to tobacco products, exposure to tobacco advertising, and school curriculum on tobacco. Students completed the anonymous, self-administered questionnaire during a regular class period. Trained survey administrators were present to provide instructions and answer questions, but they did not collect names or other identifying information to protect student privacy.

Study Variables

Outcome Variable

The primary outcome for this analysis was intention to smoke cigarettes in the next 12 months. This was measured using two survey questions. First, students were asked: "At any time during the next 12 months, do you think you will smoke a cigarette?" Response options were: definitely not, probably not, probably yes, and definitely yes. Second, to identify never-smokers, students were asked: "How long ago did you stop smoking?" Students who responded "probably yes" or "definitely yes" to the intention question AND who had never smoked cigarettes were classified as having intention to smoke. All other students were classified as having no intention to smoke. This definition follows the approach used in previous GYTS analyses and focuses on students who are at risk of smoking initiation[20].

Independent Variables

Based on the Theory of Planned Behavior, which suggests that intentions are influenced by attitudes, subjective norms, and perceived behavioral control [14,21], we selected independent variables in three categories: demographic characteristics, Theory of Planned Behavior components, and environmental factors.

Demographic Variables

Age (measured in years and categorized as 11–12, 13–14, 15–16, and 17 or older), sex (male or female), grade level (grades 7, 8, or 9), and socio-economic status (wealth index categorized as low, middle, or high). These variables were included in all statistical models regardless of their association with the outcome, as they are fundamental characteristics that may influence smoking intentions.

Theory of Planned Behavior Components

Positive attitude toward smoking was measured by asking whether students think smoking makes young people look more or less attractive and whether it makes them have more or fewer friends, with positive responses indicating a favourable attitude. The subjective norm component was assessed using

peer tobacco use and whether close friends smoke cigarettes. Perceived behavioral control was measured by asking how difficult students think it would be to quit smoking if they wanted to (very easy, easy, difficult, or very difficult/impossible).

Environmental and Social Factors

Variables included ever tried cigarette smoking, use of hand-rolled cigarettes, history of cigarette use, ever tried shisha or waterpipe, parental tobacco use, exposure to tobacco on television or media, exposure to tobacco advertisements, ownership of tobacco-branded items, school-based education on smoking dangers, observing teachers smoking at school, and observing others smoking at school.

Data Analysis

All statistical analyses were performed using appropriate software that accounts for the complex survey design. The GYTS uses a clustered sampling design where students are nested within classes and classes are nested within schools. To produce accurate estimates and correct standard errors, we applied survey weights and accounted for the primary sampling units (schools) and strata (geographic regions) in all analyses.

We first calculated weighted prevalence estimates with 95% confidence intervals for the intention to smoke across all demographic and independent variables. These estimates show the proportion of students with smoking intentions in different subgroups of the population.

Next, we conducted bivariate logistic regression analyses to examine the relationship between each independent variable and the intention to smoke. These crude (unadjusted) analyses provide initial insights into which factors are associated with smoking intentions before accounting for potential confounding variables [22].

For the multivariable analysis, we used stepwise logistic regression with forward selection based on the Akaike Information Criterion (AIC). This approach starts with the demographic variables (age, sex, grade, and region) that were forced into the model regardless of statistical significance. Additional variables were then added one at a time based on their ability to improve the model fit. Variables that improved the AIC by at least 2 points were retained in the final model. This method helps identify the most important predictors while avoiding overfitting the model with too many variables.

Results are presented as crude and adjusted odds ratios with 95% confidence intervals and p-values. An odds ratio greater than 1 indicates increased odds of having smoking intentions, while an odds ratio less than 1 indicates decreased odds. Statistical significance was set at p-value less than 0.05 for all tests.

Missing Data

Students with missing data on the outcome variable (intention to smoke) were excluded from the analysis. For independent variables, we used listwise deletion, meaning that observations with missing values on any variable in a given model were excluded from that analysis. This approach ensures that all models are based on the same set of observations for valid comparison[23].

Ethical Considerations

The GYTS was approved by the relevant ethical review bodies in Zambia. The survey was voluntary, and students could choose not to participate without any consequences. Students completed anonymous questionnaires, and no personally identifying information was collected. Parental consent and student assent were obtained following local requirements. Clinical trial number: not applicable

RESULTS

Sample characteristics

The sample included 4,745 Zambian school-going adolescents from the 2021 Global Youth Tobacco Survey as shown in Table 1. Most participants were aged 14 years (26%), followed by 15 years (21%) and 13 years (17%), while 11-year-olds were the fewest (3.0%). The sample was nearly evenly split by sex, with females at 51% and males at 49%. Grade 7 was most common (44%), with Grades 8 and 9 each at 28%. Over half of participants were in the low socioeconomic group (55%), with fewer in the middle (18%) and higher groups (27%). Ever trying cigarettes (9.2%), hand-rolled cigarette use (14%), and lifetime cigarette use (7.7%) were reported by a minority, while most had tried shisha or waterpipe (88%). Peer (21%) and parental (15%) tobacco use were less common. About half received school-based education on smoking risks (50%), while fewer perceived quitting as difficult (17%), and many reported positive attitudes toward smoking (70%) and having friends who smoke (59%).

Table 1
Weighted distribution of sample characteristics among Zambian school adolescents, GYTS 2021 (N = 4,745).

Characteristics	Overall (Unweighted N = 4,745)
Age (Years)	
11	134 (3.0%)
12	358 (7.8%)
13	837 (17%)
14	1,199 (26%)
15	1,001 (21%)
16	728 (16%)
17	455 (9.6%)
Gender	
Female	2,732 (51%)
Male	1,961 (49%)
School Grade	
Grade 7	1,665 (44%)
Grade 8	1,458 (28%)
Grade 9	1,561 (28%)
Socioeconomic Status (Wealth)	
Low	2,490 (55%)
Middle	869 (18%)
Rich	1,386 (27%)
Ever Tried Cigarette Smoking	444 (9.2%)
Ever Used Hand-rolled Cigarettes	588 (14%)
History of Cigarette Use	299 (7.7%)
Ever Tried Shisha/Waterpipe	4,115 (88%)
Awareness of E-Cigarettes	1,099 (21%)
Parental Tobacco Use	638 (15%)
Peer Tobacco Use	984 (21%)

Characteristics	Overall (Unweighted N = 4,745)□
Age (Years)	
School Education on Smoking Dangers	2,413 (50%)
Observed Teachers Smoking at School	477 (10%)
Observed Others Smoking at School	1,102 (23%)
Exposure to Tobacco on TV/Media	2,270 (46%)
Exposure to Tobacco Advertisements	916 (20%)
Ownership of Tobacco-branded Items	442 (9.6%)
Belief: Tobacco Causes Cancer	2,952 (63%)
Belief: Tobacco is a Gateway to Other Drugs	1,981 (41%)
Future Intention to Smoke (5 Years)	453 (9.9%)
Positive Attitude Toward Smoking	3,249 (70%)
Close Friends Who Smoke Cigarettes	2,717 (59%)
Perceived Difficulty of Quitting	776 (17%)

□ *n (%) represents unweighted counts and weighted percentages to account for the complex survey design.*

Prevalence of Intention to Smoke

The overall weighted prevalence of intention to smoke in the next 12 months varied across participant subgroups as presented in Table 2. Prevalence was higher at younger ages, at 39% among 11-year-olds and 23% among 17-year-olds, with the lowest levels at ages 12–14 (14–15%). There was no clear difference by gender ($p = 0.3$), school grade ($p = 0.5$), or socioeconomic group ($p = 0.086$). All tobacco-related behaviours were associated with intention to smoke (all $p < 0.001$ unless stated otherwise). The highest prevalence was seen among those with a history of cigarette use (58%), those who had used hand-rolled cigarettes (51%), those who reported difficulty quitting (60%), and those with future smoking intentions (42%). Higher prevalence was also observed among those exposed to teacher smoking at school (41%), those who owned tobacco-branded items (35%), those reporting peer tobacco use (31%), those aware of e-cigarettes (29%), and those with parental tobacco use (28%), while school-based education on smoking risks was linked to lower prevalence (12%). Belief that tobacco leads to other drug use was not associated with intention ($p = 0.3$), and neither were positive attitudes toward smoking or having close friends who smoke (both $p = 0.12$).

Table 2
Weighted prevalence of intention to smoke in the next 12 months by participant characteristics, GYTS Zambia 2021

Characteristics	No, n (%)	Yes (Prevalence), n (%)	p-value
Age (Years)			< 0.001
11	194 (61%)	40 (39%)	
12	310 (85%)	48 (15%)	
13	733 (86%)	104 (14%)	
14	1,057 (86%)	142 (14%)	
15	838 (81%)	163 (19%)	
16	601 (79%)	127 (21%)	
17	367 (77%)	88 (23%)	
Gender			0.3
Female	2,345 (84%)	387 (16%)	
Male	1,644 (81%)	317 (19%)	
School Grade			0.5
Grade 7	1,375 (80%)	290 (20%)	
Grade 8	1,246 (83%)	212 (17%)	
Grade 9	1,357 (84%)	204 (16%)	
Socioeconomic Status (Wealth)			0.086
Low	2,123 (83%)	367 (17%)	
Middle	755 (84%)	114 (16%)	
Rich	1,149 (79%)	237 (21%)	
Ever Tried Cigarette Smoking	323 (67%)	121 (33%)	< 0.001
Ever Used Hand-rolled Cigarettes	289 (49%)	299 (51%)	< 0.001
History of Cigarette Use	131 (42%)	168 (58%)	< 0.001
Ever Tried Shisha/Waterpipe	3,600 (85%)	515 (15%)	< 0.001
Awareness of E-Cigarettes	846 (71%)	253 (29%)	< 0.001
Parental Tobacco Use	457 (72%)	181 (28%)	< 0.001
Peer Tobacco Use	704 (69%)	280 (31%)	< 0.001

Characteristics	No, n (%)	Yes (Prevalence), n (%)	p-value
School Education on Smoking Dangers	2,159 (88%)	254 (12%)	< 0.001
Observed Teachers Smoking at School	294 (59%)	183 (41%)	< 0.001
Observed Others Smoking at School	897 (78%)	205 (22%)	0.004
Exposure to Tobacco on TV/Media	1,993 (85%)	277 (15%)	< 0.001
Exposure to Tobacco Advertisements	718 (76%)	198 (24%)	< 0.001
Ownership of Tobacco-branded Items	301 (65%)	141 (35%)	< 0.001
Belief: Tobacco Causes Cancer	2,615 (86%)	337 (14%)	< 0.001
Belief: Tobacco is a Gateway to Other Drugs	1,723 (84%)	258 (16%)	0.3
Future Intention to Smoke (5 Years)	272 (58%)	181 (42%)	< 0.001
Positive Attitude Toward Smoking	2,783 (83%)	466 (17%)	0.12
Close Friends Who Smoke Cigarettes	2,311 (84%)	406 (16%)	0.12
Perceived Difficulty of Quitting	351 (40%)	425 (60%)	< 0.001

 n (%) represents unweighted counts and weighted row percentages (prevalence). *Pearson's χ^2 with Rao–Scott adjustment for complex survey design.*

Factors associated with Intention to Smoke

The survey-adjusted multivariable logistic regression identified several independent predictors of intention to smoke in the next 12 months as shown in Table 3. Among demographic factors, 14-year-olds had lower odds of intention compared with 11-year-olds (aOR = 0.23, 95% CI: 0.07–0.78, p = 0.023), while other age groups, gender, school grade, and socioeconomic status showed no significant associations. A history of cigarette use was strongly associated with higher odds of intention (aOR = 3.33, 95% CI: 1.96–5.66, p < 0.001), as was use of hand-rolled cigarettes (aOR = 2.35, 95% CI: 1.17–4.71, p = 0.021) and peer tobacco use (aOR = 1.62, 95% CI: 1.11–2.35, p = 0.017). School-based education on smoking dangers was associated with lower odds of intention (aOR = 0.67, 95% CI: 0.46–0.98, p = 0.039). Perceived difficulty of quitting showed the strongest association in the model (aOR = 13.5, 95% CI: 8.19–22.3, p < 0.001). Other variables, including parental tobacco use, attitudes, media exposure, and beliefs, were not statistically significant.

Table 3
Adjusted odds ratios (aOR) from survey-adjusted multivariable logistic regression for intention to smoke in the next 12 months, GYTS Zambia 2021.

Characteristics	aOR	95% CI	p-value
Age (Years)			
11 (Ref)	1.00	—	—
12	0.22	0.03, 1.50	0.11
13	0.28	0.06, 1.26	0.088
14	0.23	0.07, 0.78	0.023
15	0.36	0.08, 1.71	0.2
16	0.40	0.10, 1.67	0.2
17	0.44	0.18, 1.09	0.071
Gender			
Female (Ref)	1.00	—	—
Male	1.05	0.64, 1.71	0.8
School Grade			
Grade 7 (Ref)	1.00	—	—
Grade 8	1.00	0.52, 1.92	> 0.9
Grade 9	0.56	0.29, 1.10	0.084
Socioeconomic Status (Wealth)			
Low (Ref)	1.00	—	—
Middle	0.95	0.57, 1.57	0.8
Rich	0.98	0.61, 1.58	> 0.9
Ever Tried Cigarette Smoking			
No (Ref)	1.00	—	—
Yes	1.75	0.74, 4.15	0.2
Ever Used Hand-rolled Cigarettes			
No (Ref)	1.00	—	—

aOR = Adjusted Odds Ratio; CI = Confidence Interval. Model is fully survey-adjusted using svyglm (R survey package). A priori variables (age, sex, grade) were retained in the model irrespective of statistical significance. — denotes reference category

Characteristics	aOR	95% CI	p-value
Age (Years)			
Yes	2.35	1.17, 4.71	0.021
History of Cigarette Use			
No (Ref)	1.00	—	—
Yes	3.33	1.96, 5.66	< 0.001
Ever Tried Shisha/Waterpipe			
No (Ref)	1.00	—	—
Yes	0.83	0.51, 1.35	0.4
Awareness of E-Cigarettes			
No (Ref)	1.00	—	—
Yes	1.16	0.72, 1.88	0.5
Parental Tobacco Use			
No (Ref)	1.00	—	—
Yes	1.13	0.64, 1.99	0.7
Peer Tobacco Use			
No (Ref)	1.00	—	—
Yes	1.62	1.11, 2.35	0.017
School Education on Smoking Dangers			
No (Ref)	1.00	—	—
Yes	0.67	0.46, 0.98	0.039
Observed Teachers Smoking at School			
No (Ref)	1.00	—	—
Yes	1.55	0.72, 3.34	0.2
Observed Others Smoking at School			
No (Ref)	1.00	—	—
Yes	0.98	0.61, 1.57	> 0.9

aOR = Adjusted Odds Ratio; CI = Confidence Interval. Model is fully survey-adjusted using svyglm (R survey package). A priori variables (age, sex, grade) were retained in the model irrespective of statistical significance. — denotes reference category

Characteristics	aOR	95% CI	p-value
Age (Years)			
Exposure to Tobacco on TV/Media			
No (Ref)	1.00	—	—
Yes	0.77	0.57, 1.03	0.075
Exposure to Tobacco Advertisements			
No (Ref)	1.00	—	—
Yes	1.15	0.66, 1.99	0.6
Ownership of Tobacco-branded Items			
No (Ref)	1.00	—	—
Yes	1.36	0.81, 2.28	0.2
Belief: Tobacco Causes Cancer			
No (Ref)	1.00	—	—
Yes	0.88	0.55, 1.42	0.6
Belief: Tobacco is a Gateway to Other Drugs			
No (Ref)	1.00	—	—
Yes	0.91	0.67, 1.23	0.5
Future Intention to Smoke (5 Years)			
No (Ref)	1.00	—	—
Yes	1.63	0.92, 2.90	0.088
Positive Attitude Toward Smoking			
No (Ref)	1.00	—	—
Yes	0.89	0.54, 1.48	0.6
Close Friends Who Smoke Cigarettes			
No (Ref)	1.00	—	—
Yes	0.67	0.41, 1.10	0.10
Perceived Difficulty of Quitting			

aOR = Adjusted Odds Ratio; CI = Confidence Interval. Model is fully survey-adjusted using svyglm (R survey package). A priori variables (age, sex, grade) were retained in the model irrespective of statistical significance. — denotes reference category

Characteristics	aOR	95% CI	p-value
Age (Years)			
No (Ref)	1.00	—	—
Yes	13.5	8.19, 22.3	< 0.001

aOR = Adjusted Odds Ratio; CI = Confidence Interval. Model is fully survey-adjusted using svyglm (R survey package). A priori variables (age, sex, grade) were retained in the model irrespective of statistical significance. — denotes reference category

DISCUSSION

In our analysis of never-smoking school-going adolescents in Zambia, key findings emerged. First, the prevalence of intention to smoke was found to be substantial, indicating that a notable proportion of adolescents are at risk for future tobacco use[9,24,25]. Secondly, prior experimentation with tobacco products, including both manufactured and hand-rolled cigarettes, was identified as a strong independent predictor of intention to smoke [24,26,27]. Thirdly, the presence of peers who use tobacco significantly increased the likelihood of smoking intention, highlighting the powerful influence of social networks[24,28–30]. Furthermore, perceived difficulty in quitting smoking stood out as the most potent predictor among all variables examined[31–34]. Lastly, exposure to school-based education on the dangers of smoking was associated with lower odds of intending to smoke, underscoring the protective effect of structured educational interventions[12,35–37] .

The prevalence of intention to smoke among Zambian adolescents aligns with or exceeds estimates from other African countries. Studies across sub-Saharan Africa report susceptibility rates ranging from 12% to 25% among never-users[9,25]. In Zambia specifically, previous surveys have documented similar or slightly lower rates, suggesting a persistent challenge over time [12,24]. The higher prevalence observed may reflect unique exposure patterns in Zambia, such as widespread experimentation with alternative tobacco products and moderate levels of peer tobacco use [26,38]. Comparative research from Nigeria and South Africa confirms that peer influence and access to cigarettes are dominant drivers of both tobacco use and susceptibility among adolescents[39,40]. These findings point toward a shared ecology of adolescent tobacco risk across the region.

While male sex is often associated with higher tobacco use in Africa[25], our findings indicate that after adjusting for other factors, sex did not independently predict intention to smoke among Zambian adolescents[24]. This suggests that girls may be exposed to similar social and environmental cues as boys at the stage where intentions are formed. Such results call for gender-inclusive prevention strategies rather than those targeting only boys.

Prior experimentation with cigarettes or hand-rolled tobacco products strongly predicted future intentions to smoke. This pattern is consistent with evidence from both Zambian and international

studies showing that early contact with tobacco reshapes attitudes and increases susceptibility even before regular use begins[24,26,27,38]. The implication is clear: prevention efforts must reach students before their first exposure to any form of tobacco. Interventions delivered during upper primary school may be most effective in altering trajectories before intentions become entrenched through experience.

Peer networks exert a profound influence on adolescent smoking intentions. Adolescents surrounded by friends who smoke are significantly more likely to express an intention to try cigarettes themselves[24,28–30]. Systematic reviews confirm that peer substance use is one of the strongest predictors for adolescent tobacco uptake globally [41]. Notably, perceptions about how many peers smoke can be just as influential as actual behavior within one's network [29]. As adolescents progress through school years, peer influence tends to overshadow parental influence in shaping attitudes toward smoking[26,42].

Perceived difficulty in quitting emerged as the strongest single predictor for intention to smoke. Rather than deterring initiation, this perception may enhance the *allure* of smoking by signaling its potency or social significance among youth navigating identity formation [43]. Health education messages focusing solely on addiction risk may inadvertently reinforce these perceptions if not carefully framed. Messaging that emphasizes loss of autonomy rather than distant health threats could prove more effective for this age group.

Structured school-based education on the dangers of smoking demonstrated a protective effect against intention formation. However, coverage remains incomplete; only about half of surveyed students reported receiving such education recently [44]. Evidence from multiple countries supports the value of comprehensive school curricula but also highlights gaps in implementation and effectiveness when programs do not address broader social influences or lack cultural adaptation[45,46].

Other factors such as family members' smoking status, exposure to pro-tobacco advertising, academic performance, mental health status, and socioeconomic context also play roles in shaping susceptibility and intentions among adolescents[47]. For example, exposure to secondhand smoke at home or seeing actors smoke on television has been linked with increased risk for both experimentation and future intentions.

Policy and research implications

Effective prevention requires multi-level strategies. School-based programs should be expanded and culturally tailored while integrating peer-led components that empower non-smoking students as role models within their networks [46]. Family-focused interventions remain important but may need reinforcement through community engagement given the declining influence of parents during adolescence. Policy measures such as restricting access to cigarettes near schools and enforcing age verification can further reduce opportunities for initiation.

For researchers, this study highlights important gaps. Longitudinal studies are needed to trace whether the predictors identified here actually drive smoking initiation over time. Qualitative research is needed to understand the cognitive processes through which perceived difficulty of quitting translates into intention among never-smokers, a relationship that is theoretically important and practically underexplored. Research on out-of-school adolescents, invisible in GYTS data, is a priority given that they may face even greater tobacco risk.

Strengths and Limitations

This study draws on a nationally representative, school-based sample from the 2021 GYTS, providing current and generalisable data. Complex survey-adjusted multivariable regression with AIC-guided variable selection strengthens the validity of the predictive model. Restricting the sample to never-smokers and applying a stringent 12-month intention criterion provides a clean and actionable measure of proximate susceptibility.

Several limitations apply. The cross-sectional design prevents causal inference. Self-reported tobacco behaviours may underestimate true exposure due to social desirability bias. The school-based sampling frame excludes out-of-school adolescents, who may be at higher tobacco risk. Important variables such as financial expenditure on tobacco, detailed supply-side access, and quality-of-care indicators were not available in the dataset.

Conclusion

Smoking intention among never-smoking Zambian adolescents is a measurable, concentrated, and preventable public health concern. The 17.5% prevalence signals that a substantial share of school-going adolescents are on a trajectory toward tobacco initiation unless effective interventions intercept them early. Prior experimentation, peer tobacco networks, and a paradoxical association between perceived addiction difficulty and higher intention form a coherent risk profile that prevention programmes can target. School-based education stands as the one structural protective factor identified, yet it reaches only half the students who need it. Zambia has the policy architecture through its FCTC commitments and school health infrastructure to mount an effective response. What is needed is the commitment to act on that architecture comprehensively, equitably, and urgently.

Abbreviations

SSA	Sub-Saharan Africa
ITS	Intention to Smoke
GYTS	Global Youth Tobacco Survey
WHO	World Health Organization

FCTC	Framework Convention on Tobacco Control
LMICs	Low- and Middle-Income Countries
OR	Odds Ratio
CI	Confidence Interval

Declarations

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Author Contributions

WN led the conceptualisation of the study, conducted the statistical analysis, and drafted the manuscript. SM contributed to the study conceptualisation and critically reviewed both the analysis and manuscript. CZ provided policy-relevant insights and reviewed the manuscript. All authors read and approved the final version of the manuscript.

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Data Availability

The data analysed in this study are from the 2021 Zambia Global Youth Tobacco Survey (GYTS) and are publicly available through the World Health Organization NCD Microdata Repository. Access to the dataset is subject to World Health Organization data access procedures.

Ethics approval and consent to participate

The 2021 Zambia Global Youth Tobacco Survey (GYTS) was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. Ethical approval was obtained from relevant national ethics authorities in Zambia, with technical oversight from the World Health Organization. Written informed consent was obtained from all participating students prior to data collection.

This study is a secondary analysis of de-identified, publicly available GYTS data accessed through an approved World Health Organization data request. The analysis involved no direct participant contact and did not require additional ethical approval.

Consent For Publication

Not applicable. This manuscript does not contain any individual-level identifiable data.

Competing Interests

The authors declare no competing interests.

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