e-ISSN : 2597-6052

MPPKI MEDIA PUBLIKASI PROMOSI KESEHATAN INDONESIA

Research Articles Open Access

# Predicting Smoking Intentions Among Indonesian Youth Using Structural Equation Modeling and the Theory of Planned Behavior

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**ARTICLE INFO**

**Manuscript Received:** 30 Jun, 2025
**Revised:** 06 Sep 2025
**Accepted:** 18 Sep, 2025
**Date of Publication:** 02 Nov, 2025
**Volume:** 8
**Issue:** 11
**DOI:** 10.56338/mppki.v8i11.8229

**KEYWORDS**

Indonesia;
Structural Equation Modeling;
Theory of Planned Behavior;
Tobacco Control;
Youth Smoking

**ABSTRACT**

**Introduction:** In this study, we aimed to predict smoking intentions among Indonesian youth using the Theory of Planned Behavior (TPB) within the context of global tobacco use. Our objective was to examine how attitude toward smoking, subjective norms, and perceived behavioral control shape youth smoking intentions, addressing gaps in prior Indonesian studies by leveraging nationally representative data and enhanced analytical methods.

**Methods:** This cross-sectional study involved a secondary data analysis of the 2019 Global Youth Tobacco Survey (GYTS) conducted across Indonesia. A total of 9,992 youth participants were enrolled, and data were collected through structured questionnaires.

**Results:** The primary outcome of the study was cigarette smoking intention, and the structural equation modelling revealed a good model fit (SRMR = 0.018, RMSEA = 0.028, TLI = 0.986, and CFI = 0.994). All of the predictors were statistically significant in predicting youth smoking intentions. When compared to other TPB constructs, perceived behavioral control emerged as the strongest predictor ($\beta = 0.223$, $p < .001$), followed by attitude ($\beta = –0.202$, $p < .001$) and subjective norms ($\beta = 0.091$, $p < .001$). Past smoking behavior was also the strongest predictor ($\beta = 0.241$, $p < .001$). The model explained 29.7% of the variance in smoking intention. Individuals who had a positive attitude towards smoking, were exposed to smoking in both public and private spaces, and thought quitting was difficult were more likely to intend to smoke.

**Conclusion:** In conclusion, our study contributes to the understanding of youth smoking behavior by applying the TPB in the Indonesian context. These findings highlight the importance of behaviorally informed tobacco control interventions that address young people's perceptions of control and attitudes towards smoking, as well as the value of school-based programs, media literacy campaigns, and peer education strategies tailored to Indonesian culture.

**Publisher:** Fakultas Kesehatan Masyarakat Universitas Muhammadiyah Palu

## INTRODUCTION

Tobacco consumption represents a critical public health issue in Indonesia, accounting for an estimated 225,700 premature deaths annually, nearly 15% of total national mortality (1). Smoking-related illnesses such as lung cancer, cardiovascular disease, and chronic respiratory conditions impose a significant burden on the healthcare system and result in substantial economic losses. Despite ongoing public health campaigns, many Indonesians continue to underestimate the risks associated with tobacco use (2).

People aged 13–17 are particularly vulnerable to smoking initiation, and this age group is increasingly targeted either directly or indirectly by permissive policies, aggressive marketing, and peer influence (3). National surveys and research have shown that the smoking prevalence among Indonesian youth is high and continues to rise. Among adolescents aged 13–15, smoking prevalence reached 38.3% in 2019, one of the highest rates in the Southeast Asia (4). Contributing factors include the widespread availability of single-stick cigarettes, proximity of tobacco retailers to schools, weak regulatory enforcement, and cultural normalization of smoking (5,6).

Efforts to reduce youth smoking in Indonesia face significant challenges, particularly given the influence of the tobacco industry. The sector remains a major contributor to national revenue and employment, complicating policy implementation (7–9). Although health warnings on cigarette packaging have been introduced, their impact remains limited due to small graphic sizes that fall short of global standards (10). More comprehensive strategies, including taxation, education, clinical interventions, and psychosocial approaches, are needed to curb the youth smoking epidemic (11).

Understanding the psychological determinants of adolescent smoking is critical for developing effective interventions. The Theory of Planned Behavior (TPB), proposed by Ajzen (12), offers a robust framework for predicting health-related behaviors such as smoking. According to TPB, behavioral intention is the primary determinant of behavior, which is influenced by attitude towards the behavior, subjective norms, and perceived behavioral control. Meta-analyses support these relationships, showing that smoking intention is positively correlated with smoking behavior ($r$ = 0.30), attitude ($r$ = 0.16), and subjective norms ($r$ = 0.20), while PBC is negatively associated with both intention ($r$ = –0.24) and behavior ($r$ = –0.20) (13).

Despite the relevance of TPB, empirical studies focusing on adolescent smoking intentions in Indonesia remain limited. A recent study by Nurseha and A'yunin (14) explored smoking intentions among 276 junior high school students aged 13–15 in urban Tangerang. The study found that 56.5% of respondents, despite being non-smokers, already held strong intentions to smoke. Moreover, 52.2% had positive attitudes toward smoking, 54.7% experienced negative subjective norms, and 55.8% exhibited low perceived behavioral control. Logistic regression analysis showed that subjective norm was the strongest predictor of smoking intention (PR = 3.338), followed by PBC (PR = 2.739) and attitude (PR = 2.658).

Similarly, a study by Sutha et al. (15) involving 174 junior and senior high school students aged 13–17 in Sampang, Madura, confirmed the applicability of TPB in explaining smoking behavior among Indonesian youth. The study found that attitude (OR = 5.27), subjective norms (OR = 1.78), and PBC (OR = 2.05) were all significantly associated with smoking behavior. Furthermore, intention to smoke was strongly associated with actual smoking behavior (OR = 4.16), highlighting the central role of intention in adolescent smoking initiation. While Sutha et al.'s study offers valuable regional insight, our research builds on this by using a nationally representative sample of 9,992 adolescents across 30 provinces, enhancing generalizability. We also employ structural equation modeling to test latent constructs and model fit, providing a more rigorous analytical approach than prior logistic regression studies. These methodological advances support deeper theoretical interpretation and greater policy relevance in understanding TPB constructs within Indonesia's diverse sociocultural context.

These findings are further supported by cross-cultural evidence. Hosking et al. (16), analyzing data from the International Tobacco Control Project, found that in collectivist societies like Malaysia and Thailand, subjective norms had greater influence on smoking behavior than personal attitudes, contrasting with Western countries where personal attitudes were more predictive. This suggests that in Indonesia, a similarly collectivist culture, normative influences such as peer approval and family attitudes may play a dominant role in shaping smoking intentions.

Despite an expanding body of international research, studies that comprehensively apply the TPB to understand smoking behavior among Indonesian adolescents are rare. Given the unique cultural, social, and regulatory contexts that shape youth behavior in Indonesia, the lack of localized applications is concerning. Without

context-sensitive TPB-based investigations, interventions may fail to address the underlying cognitive and normative factors that contribute to smoking initiation. As a result, this gap represents a missed opportunity to develop theoretically sound and culturally relevant strategies to reduce adolescent smoking during its most formative stage.

Given this context, more empirical research is needed to better understand the psychological mechanisms that drive smoking intentions among Indonesian youth. While previous studies using local or regional samples have provided valuable insights, their scope and generalizability remain limited. To fill this gap, this study will use the TPB to examine smoking intentions among Indonesian adolescents using nationally representative data from the Global Youth Tobacco Survey (GYTS), with a focus on the roles of attitude towards smoking, subjective norms, and perceived behavioral control. By identifying the psychological factors that have the greatest influence on smoking intention, the study hopes to provide evidence-based recommendations for youth-centered public health interventions and more culturally sensitive tobacco control policies in Indonesia.

## METHOD

### Research Type

This study used a quantitative approach with a cross-sectional survey design. The data came from the 2019 Indonesian Global Youth Tobacco Survey (GYTS), which was conducted in both public and private schools throughout Indonesia to assess tobacco use among youth (17). The World Health Organization (WHO) and the United States Centers for Disease Control and Prevention (CDC) both support the GYTS.

### Population and Sample

The study population included junior and senior high school students aged 13 to 17 from across Indonesia (18). The sample was drawn using a two-stage cluster sampling procedure. The first stage involved selecting schools based on probability proportional to size (PPS), stratified by region (Java, Sumatra, and other provinces) and school type (junior and senior high). Each region contributed 25 junior high schools and 25 senior high schools, totaling 150 schools across 30 provinces. In the second stage, one class was randomly selected from each chosen school, and all students in those classes were invited to participate. The survey was completed by a total of 9,992 eligible students from grades 7 to 12. Complex sample weights were applied to adjust for nonresponse and post-stratification, ensuring national representativeness in the analysis. The overall response rate was 91.0%.

### Research Location

The 2019 Indonesia GYTS was administered in both public and private schools throughout Indonesia. The sample was distributed across three major regions: Sumatra, Java, and the other islands.

### Instrumentation or Tools

To investigate the psychological determinants of smoking intention behavior, selected items from the 2019 GYTS were systematically mapped onto constructs from the Theory of Planned Behavior (TPB), as conceptualized by Ajzen (12). This theoretical alignment was further supported by prior empirical studies examining smoking behavior through the TPB lens (19–21). The primary outcome variable was smoking intention, defined as the respondent's stated likelihood of smoking in the future. Predictor variables included attitude toward smoking (beliefs about smoking and its health consequences), subjective norms (perceived social pressure to smoke, such as smoking within the household or indoors and outdoors), and perceived behavioral control (confidence in resisting or quitting smoking). The control variable is past smoking behavior (how many in a day the participant smoked). Each TPB construct was modeled as a latent variable and operationalized using multiple observed indicators derived from the GYTS 2019 items. The alignment between these indicators and their respective theoretical constructs is illustrated in Figure 1.

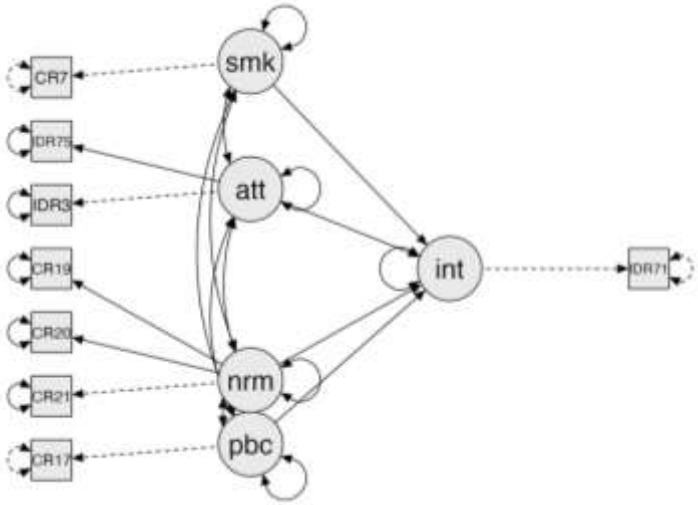


**Figure 1.** The SEM Model

**Data Collection Procedures**

Before implementing the survey, trained enumerators collected data in collaboration with school administrators and teachers. Enumerators informed both staff and students about the study's purpose and procedures. Questionnaires were distributed during school hours, and students had about 45 minutes to complete the survey. Participation was entirely voluntary, with each respondent providing written informed consent.

**Data Analysis**

Descriptive statistics were initially presented to characterize the study participants and to summarize indicators related to the TPB, as shown in Table 1 and Table 2. To explore the structural relationships among these constructs and their influence on smoking intention, Structural Equation Modeling (SEM) was employed. Each latent variable was operationalized using its corresponding observed indicators from the GYTS dataset, based on the theoretical assumption that variations in latent constructs manifest as changes in measurable responses. Model fit was evaluated using established criteria: Root Mean Squared Error of Approximation (RMSEA) below 0.05, Standardized Root Mean Squared Residual (SRMR) below 0.08, and both the Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) exceeding 0.90 (22).

Additionally, the coefficient of determination ($R^2$) was reported to quantify the proportion of variance in smoking intention explained by the TPB constructs, serving as an indicator of model validity. The structural relationships among latent and observed variables, including covariate pathways, are illustrated in Figure 1. All SEM analyses were conducted using JASP Version 0.18.1.0 (23), with statistical significance set at alpha ($\alpha$) level 0.05.

**Ethical Approval**

The 2019 Indonesian GYTS was granted ethical approval by the Health Research Ethics Commission of the National Institute of Health Research and Development, Ministry of Health, Indonesia (Letter Number: LB.02.01/2/KE.315/2019). All participants provided written informed consent prior to participation. Identifiable information was removed from the dataset to maintain confidentiality, and all procedures followed ethical research standards and regulations.

## RESULTS

Table 1 displays the participant distribution by age, gender, grade, and amount of money to be spent. Most of the respondents were 14 years old ($n$ = 1,788; 17.9%), followed closely by those aged 13 ($n$ = 1,732; 17.3%) and 15 ($n$ = 1,605; 16.1%). Only 3.0% ($n$ = 300) of participants were 11 years old or younger, while those aged 17 or older accounted for 16.4% ($n$ = 1,635). A small proportion of participants ($n$ = 14; 0.1%) did not report their age. Overall, the age of respondents ranged from 11 years or younger to 17 years or older.

**Table 1.** Demographic Characteristics

| Variables | Frequency | Percentage |
|---|---|---|
| **Age** | | |
| CR1. "How old are you?" | | |
| "11 years old or younger" | 300 | 3.002 |
| "12 years old" | 1,365 | 13.661 |
| "13 years old" | 1,732 | 17.334 |
| "14 years old" | 1,788 | 17.894 |
| "15 years old" | 1,605 | 16.063 |
| "16 years old" | 1,553 | 15.542 |
| "17 years old or older" | 1,635 | 16.363 |
| Missing | 14 | 0.140 |
| **Sex** | | |
| CR2. "Are you a boy or a girl?" | | |
| "Male" | 4,419 | 44.225 |
| "Female" | 5,564 | 55.685 |
| Missing | 9 | 0.090 |
| **Grade** | | |
| CR3. "In what grade/form are you?" | | |
| "7" | 2,115 | 21.167 |
| "8" | 1,841 | 18.425 |
| "9" | 1,888 | 18.895 |
| "10" | 1,277 | 12.780 |
| "11" | 1,415 | 14.161 |
| "12" | 1,444 | 14.452 |
| Missing | 12 | 0.120 |
| **Money to spend** | | |
| CR4. "During an average week, how much money do you have that you can spend on yourself, however you want?" | | |
| "I usually don't have any spending money" | 515 | 5.154 |
| "Less than Rp. 11,000" | 2,079 | 20.807 |
| "Rp. 11,000 - Rp. 20,000" | 2,065 | 20.667 |
| "Rp. 21,000 - Rp. 30,000" | 1,130 | 11.309 |
| "Rp. 31,000 - Rp. 40,000" | 741 | 7.416 |
| "Rp. 41,000 - Rp. 50,000" | 1,081 | 10.819 |
| "More than Rp. 50,000" | 2,359 | 23.609 |
| Missing | 22 | 0.220 |

Out of the 9,992 respondents, 9,983 (99.8%) indicated their gender. Of these, 55.7% were female ($n$ = 5,564) and 44.2% were male ($n$ = 4,419). Gender information was missing for 9 respondents (0.1%).

Grade levels of respondents are also presented in Table 1. The largest group of students were in grade 7 ($n$ = 2,115; 21.2%), followed by grade 9 ($n$ = 1,888; 18.9%) and grade 8 ($n$ = 1,841; 18.4%). Students in grades 10 through 12 were fairly evenly distributed, each comprising around 12–14% of the sample. Grade information was missing for 12 respondents (0.1%).

Regarding weekly spending money, 23.6% of respondents ($n$ = 2,359) reported having more than Rp. 50,000 to spend, making this the most frequently reported category. Another 20.8% ($n$ = 2,079) had less than Rp. 11,000, and 20.7% ($n$ = 2,065) reported having between Rp. 11,000 and Rp. 20,000. A small proportion of participants ($n$ = 515; 5.2%) stated that they usually did not have any spending money. Only 0.2% of responses ($n$ = 22) were missing for this question.

Table 2 shows descriptive statistics of the Theory of Planned Behavior (TPB) construct indicators. Regarding recent smoking experience, 76.9% of respondents ($n$ = 7,684) reported not smoking at all in the past 30 days.

Meanwhile, 7.4% (*n* = 743) smoked on 1–2 days, and only 2.6% (*n* = 261) reported smoking every day in the past month. A small number (*n* = 594; 5.9%) did not provide a response to this question.

In terms of attitudes toward smoking, a strong majority (75.3%, *n* = 7,528) agreed that secondhand smoke is definitely harmful, while 19.1% (*n* = 1,907) believed it is probably harmful. Only a small proportion (5.4%) expressed doubt, with 3.3% responding "definitely not" and 2.1% "probably not." For the perception of smoking's harm to personal health, 84.1% (*n* = 8,401) responded "definitely yes," with another 7.9% (*n* = 789) choosing "probably yes." Only 2.2% (*n* = 224) said "probably not," and 5.1% (*n* = 505) answered "definitely not." Missing responses for both attitude items were minimal (under 1%).

The subjective norms data indicated that exposure to secondhand smoke was fairly common. When asked about exposure inside their own home in the past 7 days, 44.1% (*n* = 4,410) said they were not exposed at all. However, 22.7% (*n* = 2,267) reported being exposed every day, and 20.4% (*n* = 2,035) reported exposure on 1–2 days. Exposure in indoor public places was also notable: only 33.3% (*n* = 3,328) reported no exposure, while 21.3% (*n* = 2,126) reported daily exposure. Similarly, for outdoor public places, 32.6% (*n* = 3,256) reported no exposure, while 21.6% (*n* = 2,161) experienced daily exposure. Missing responses were low across all items (less than 0.2%).

As for perceived behavioral control, 66.5% of respondents (*n* = 6,640) indicated they had never smoked, while 10.7% (*n* = 1,074) stated they do not smoke anymore. Among those who have smoked, 20.1% (*n* = 2,004) believed they could stop if they wanted, while 2.7% (*n* = 265) believed they could not. This suggests that the majority of respondents either had no smoking history or were confident in their ability to quit. There were only nine responses missing.

Finally, regarding intention to smoke in the next 12 months, most respondents (81.7%, *n* = 8,165) stated they definitely would not, and 11.6% (*n* = 1,161) said they probably would not. A smaller group (5.4%, *n* = 540) indicated a probability of smoking, while 1.2% (*n* = 117) said they definitely would smoke. As with the other items, missing responses were negligible (*n* = 9; 0.09%).

**Table 2.** Descriptive Statistics of TPB Construct Indicators

| Indicators | Frequency | Percentage |
|---|---|---|
| **Smoking Experience** | | |
| CR7. "During the past 30 days (one month), on how many days did you smoke cigarettes?" | | |
| "0 day" | 7,684 | 76.902 |
| "1-2 days" | 743 | 7.436 |
| "3-5 days" | 289 | 2.892 |
| "6-9 days" | 180 | 1.801 |
| "10-19 days" | 169 | 1.691 |
| "19-20 days" | 72 | 0.721 |
| "All 30 days" | 261 | 2.612 |
| Missing | 594 | 5.945 |
| **Attitude** | | |
| IDR38. "Do you think the smoke from other people's cigarettes smoking is harmful to you?" | | |
| "Definitely not" | 328 | 3.283 |
| "Probably not" | 208 | 2.082 |
| "Probably yes" | 1,907 | 19.085 |
| "Definitely yes" | 7,528 | 75.340 |
| Missing | 21 | 0.210 |
| IDR75. "Do you think smoking cigarettes is harmful to your health?" | | |
| "Definitely not" | 505 | 5.054 |
| "Probably not" | 224 | 2.242 |
| "Probably yes" | 789 | 7.896 |
| "Definitely yes" | 8,401 | 84.077 |
| Missing | 73 | 0.731 |
| **Subjective Norms** | | |
| CR19. "During the past 7 days, on how many days has anyone smoked inside your home, in your presence?" | | |

| | | |
|---|---|---|
| "0 day" | 4,410 | 44.135 |
| "1-2 days" | 2,035 | 20.366 |
| "3-4 days" | 894 | 8.947 |
| "5-6 days" | 381 | 3.813 |
| "7 days" | 2,267 | 22.688 |
| Missing | 5 | 0.050 |
| CR20. "During the past 7 days, on how many days has anyone smoked in your presence, inside any enclosed public place, other than your home (such as school, shops, cafes, restaurants, shopping malls, etc.)?" | | |
| "0 day" | 3,328 | 33.307 |
| "1-2 days" | 2,636 | 26.381 |
| "3-4 days" | 1,289 | 12.900 |
| "5-6 days" | 604 | 6.045 |
| "7 days" | 2,126 | 21.277 |
| Missing | 9 | 0.090 |
| CR21. "During the past 7 days, on how many days has anyone smoked in your presence, at any outdoor public place (such as playgrounds, sidewalks, entrances to buildings, parks, swimming pools, etc.)?" | | |
| "0 day" | 3,256 | 32.586 |
| "1-2 days" | 2,706 | 27.082 |
| "3-4 days" | 1,243 | 12.440 |
| "5-6 days" | 615 | 6.155 |
| "7 days" | 2,161 | 21.627 |
| Missing | 11 | 0.110 |
| **Perceived Behavioral Control** | | |
| CR17. "Do you think you would be able to stop smoking if you wanted to?" | | |
| "I have never smoked cigarettes" | 6,640 | 66.453 |
| "I do not smoke now" | 1,074 | 10.749 |
| "Yes" | 2,004 | 20.056 |
| "No" | 265 | 2.652 |
| Missing | 9 | 0.090 |
| **Intention** | | |
| IDR71. "At any time during the next 12 months do you think you will consume cigarette in any form?" | | |
| "Definitely not" | 8,165 | 81.715 |
| "Probably not" | 1,161 | 11.619 |
| "Probably yes" | 540 | 5.404 |
| "Definitely yes" | 117 | 1.171 |
| Missing | 9 | 0.090 |

Table 2 summarizes descriptive statistics for the TPB construct indicators, all measured using ordinal scales. Due to the ordinal nature of the data and the non-normality assumption, the study uses the Diagonally Weighted Least Squares (DWLS) estimation method with robust standard errors, which is well-suited for ordinal data. DWLS is specifically designed for models with ordinal or categorical variables because it does not rely on the multivariate normality assumption required by standard maximum likelihood estimation methods (24). DWLS uses a diagonal weight matrix, simplifying computations while still producing reliable parameter estimates for ordinal data. Robust standard errors further ensure that statistical inference remains valid even when assumptions such as homoscedasticity (equal variances) are violated. The table also shows the presence of missing data, which is handled using pairwise deletion to retain more data for analysis. While this approach can lead to varying sample sizes and potential inconsistencies, it is considered a practical choice when missing data are minimal.

**Table 3.** Model Fit Indices

| Model | *N* | $\chi^2$ | *DF* | *P* | RMSEA | SRMR | CFI | TLI | $R^2$ |
|---|---|---|---|---|---|---|---|---|---|
| TPB | 9,992 | 115.801 | 13 | < .001 | 0.028 | 0.018 | 0.994 | 0.986 | 0.297 |

*Note.* Estimation method DWLS. The pairwise deletion method is used to handle missing values.

Table 3 displays the structural equation modelling fit indices derived from the model shown in Figure 1. The chi-square test ($\chi^2$ (13) = 115.801) indicated statistical significance, with an RMSEA of 0.028 and an SRMR of 0.018. Furthermore, the CFI and TLI indicated values of 0.994 and 0.986, respectively, as shown in Table 3. These indicators suggest a reasonable model-data fit. Specifically, the RMSEA value remains under the accepted cutoff of 0.08, indicating an acceptable approximation error in the population. The SRMR value, significantly lower than the conventional 0.08 cutoff, reflects minimal discrepancies between observed and predicted data. Additionally, the high CFI and TLI values, both surpassing the 0.90 cut-off, confirm a strong comparative fit of the hypothesized model against the baseline model. The significant chi-square statistic, while often interpreted as a sign of misfit, should be considered cautiously in large samples, where even minor deviations can produce significant values. Integrating both incremental fit indices (such as CFI and TLI) alongside absolute fit indices (such as SRMR and RMSEA) provides a more thorough assessment of the model's suitability. In total, the model accounted for 30% of the variation in smoking intention, demonstrating a moderate level of explanatory power. This result suggests that while the included variables significantly contribute to predicting smoking intention, other influential factors remain unexplained and may need to be incorporated in future model iterations. The results underscore the utility of SEM in testing complex behavioral models and provide a foundation for identifying key psychological drivers that influence smoking behavior.

**Table 4.** Regression Coefficients

| | | | | | | 95% Confidence Interval | | Standardized | |
|---|---|---|---|---|---|---|---|---|---|
| **Outcome** | **Predictor** | **Estimate** | **Std. Error** | ***Z*-value** | ***P*** | **Lower** | **Upper** | **All** | **LV** |
| Intent | PBC | 0.151 | 0.011 | 13.907 | < .001 | 0.130 | 0.173 | 0.223 | 0.223 |
| | Norm | 0.045 | 0.006 | 0.006 | < .001 | 0.006 | 0.056 | 0.091 | 0.091 |
| | Attitude | -0.394 | 0.042 | -9.394 | < .001 | -9.394 | 0.312 | -0.202 | -0.202 |
| | Smoking | 0.115 | 0.009 | 0.009 | < .001 | 0.098 | 0.132 | 0.241 | 0.241 |

Note. Intent = intention to smoke. Attitude = attitude toward smoking. Norm = subjective norms. PBC = perceived behavioral control. Smoking = Past smoking behavior.

Table 4 shows regression coefficients for all predictors. All predictors were found to be statistically significant. Specifically, perceived behavioral control was a significant predictor ($b$ = 0.151, $SE$ = 0.011, $z$ = 13.907, $p$ < .001, 95% CI [0.130, 0.173]), with a standardized beta coefficient of 0.223. Subjective norm also significantly predicted intention ($b$ = 0.045, $SE$ = 0.006, $z$ = 0.006, $p$ < .001, 95% CI [0.006, 0.056]) with a standardized beta coefficient of 0.091. Attitude significantly predicted intention ($b$ = -0.394, $SE$ = 0.042, $z$ = -9.394, $p$ < .001, 95% CI [-9.394, -0.312]), with a standardized coefficient of -0.202. Past smoking behavior significantly predicted intention ($b$ = 0.115, $SE$ = 0.009, $z$ = 0.009, $p$ < .001, 95% CI [0.098, 0.132]), with a standardized coefficient of 0.241. This finding implies that participants with lower perceived behavioral control, more smoking exposure at home and in indoor or outdoor facilities, and a positive attitude towards the health effects of smoking were more likely to smoke in the next year. Among the predictors, subjective norm demonstrated the low substantial standardized effect (β = 0.091), indicating that social influences play a low significant role in shaping behavioral intentions within this context. Figure 2 presents the conceptual path diagram, illustrating the directional relationships among the latent TPB constructs and past smoking behavior. It also shows their influence on smoking intention, with standardized coefficients included to enhance interpretability.

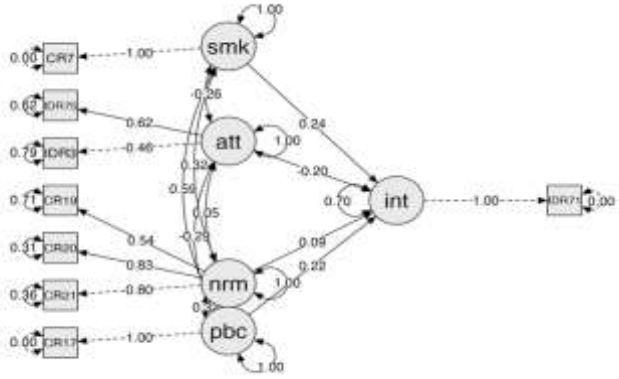


**Figure 2.** The SEM Model Coefficient

## DISCUSSION

This study applied the Theory of Planned Behavior (TPB) to examine the psychological determinants of smoking intentions among Indonesian youth using nationally representative data from the 2019 Global Youth Tobacco Survey (GYTS). The findings confirm the applicability of TPB constructs, attitude toward smoking, subjective norms, and perceived behavioral control (PBC) in predicting adolescent intentions to smoke. PBC emerged as the most influential predictor, followed by attitude and subjective norms.

The significant role of PBC in predicting smoking intentions is consistent with prior research showing that adolescents who perceive greater control over their behavior are less likely to form intentions to smoke (13,25). In the present study, adolescents with lower self-efficacy in resisting peer pressure or avoiding smoking opportunities were more likely to express an intention to smoke in the future. This aligns with the notion that perceived control can serve as both a direct and indirect determinant of behavior by influencing behavioral intentions (12,26). In the Indonesian context, culturally specific norms such as strong familial expectations and peer conformity may intensify or moderate the salience of perceived behavioral control. Prior studies have shown that collectivist cultures often emphasize social harmony and deference to group norms, which can influence adolescents' perceived agency in resisting smoking (e.g. 18). These dynamics suggest that perceived behavioral control may be shaped not only by individual beliefs but also by relational pressures, adding nuance to its role in predicting smoking intention. Therefore, interventions that strengthen adolescents' confidence in their ability to refuse cigarettes through skill-building, refusal strategies, and social reinforcement may be particularly effective in reducing smoking uptake.

Attitudes toward smoking were also significantly associated with intention, indicating that adolescents who view smoking less negatively are more inclined to consider smoking in the near future. This finding reflects previous research conducted in various cultural settings, where positive beliefs about smoking (e.g., smoking makes one look cool or is not harmful) were linked to higher smoking intentions (27). In Indonesia, where smoking is often socially normalized and even valorized in certain communities, counter-marketing efforts that challenge favorable smoking beliefs are critical.

Subjective norms were found to have a smaller yet statistically significant effect on smoking intention. While previous Indonesian studies (e.g. 14) identified subjective norms as the strongest predictor of intention, the current national-level data suggest that normative pressure may be less dominant than individual beliefs and perceived control. Consistent with previous studies, this study found that subjective norms had less of an effect on adolescents' smoking intentions (15,20). This discrepancy may be explained by differences in sampling (local vs. national), urban-rural dynamics, and measurement approaches. Furthermore, regional, socioeconomic, and educational disparities may moderate the effect on smoking intentions (28,29). For instance, adolescents in urban or higher-income settings may be more exposed to anti-smoking campaigns and health education, potentially diminishing the weight of normative pressures. Conversely, youth in rural or lower-resource environments may rely more heavily on social cues from peers, family, and community figures, amplifying the role of perceived approval. Nevertheless, the influence of

perceived social approval, particularly from peers, family members, and teachers, remains a relevant factor. In collectivist cultures like Indonesia, where conformity and relational harmony are emphasized, adolescents may be especially susceptible to perceived social expectations (16).

Notably, past smoking behavior was also a strong predictor of future intention, suggesting that previous experimentation may lower cognitive barriers and normalize smoking. This finding reinforces the argument for early prevention strategies, particularly among never-smokers, as initial experimentation may set a behavioral trajectory that culminates in regular smoking (30).

The current findings extend previous research by demonstrating the utility of TPB in a nationally representative adolescent sample, thus providing stronger external validity than prior localized studies. Moreover, the use of structural equation modeling (SEM) enabled simultaneous testing of direct and indirect relationships among TPB constructs, offering a more nuanced understanding of the behavioral pathways involved. Notably, the relatively weaker influence of subjective norms, despite Indonesia's collectivist orientation, suggests that normative pressures may be underrepresented in current tobacco control messaging. This interpretation is reinforced by findings from Megatsari et al. (18) which show that exposure to anti-smoking messages in media and schools was either ineffective or paradoxically associated with increased odds of smoking among adolescents. These findings point to specific gaps in national tobacco control strategies and underscore the need for culturally responsive interventions that enhance perceived behavioral control and self-regulatory capacity.

Despite these contributions, several limitations must be acknowledged. First, the cross-sectional nature of the GYTS data precludes causal inferences. Longitudinal studies are needed to examine how intentions translate into behavior over time. Second, the TPB constructs in the GYTS are measured using single or limited items, potentially reducing the reliability and comprehensiveness of each variable. Third, unmeasured contextual factors such as tobacco marketing exposure, religiosity, school climate, and enforcement of tobacco laws may also influence smoking intentions but were not captured in the model.

Future research should consider integrating TPB with other behavioral theories, such as Social Cognitive Theory or the Health Belief Model, to explore additional predictors and mediating mechanisms. Experimental or quasi-experimental studies evaluating the effectiveness of TPB-based interventions such as self-regulation training or peer-led programs would also be valuable in testing the theory's applicability in real-world prevention settings.

Finally, the study emphasizes the importance of targeting perceived behavioral control and smoking-related attitudes in efforts to reduce youth smoking in Indonesia. Public health campaigns, school-based programs, and policy interventions should prioritize strengthening adolescents' refusal skills, reshaping normative beliefs, and promoting negative attitudes toward smoking. Tobacco control efforts for young populations can be made more behaviorally informed and developmentally appropriate by addressing these psychological determinants.

## CONCLUSION

This study used nationally representative data from the Global Youth Tobacco Survey (GYTS) to investigate the psychological determinants of smoking intention among Indonesian adolescents aged 13-17. The Theory of Planned Behavior (TPB) was applied. The study found that perceived behavioral control, attitude towards smoking, and subjective norms all significantly predicted adolescents' intention to smoke, emphasizing the importance of self-efficacy and personal beliefs in shaping tobacco-related decisions. Notably, the study makes a unique contribution by validating the TPB framework at the national level in Indonesia, where collectivist values and widespread tobacco normalization influence youth behavior.

These findings highlight the significance of behaviorally informed tobacco control interventions that address adolescents' perceived control and attitudes towards smoking, as well as the value of school-based programs, media literacy campaigns, and peer education strategies tailored to the Indonesian cultural context.

While this study provides useful insights into adolescent smoking intentions, some limitations should be noted, such as the use of cross-sectional data, which prevents causal interpretation, the reliance on self-reported measures, and the GYTS questionnaire's limited TPB item depth. Future studies should use longitudinal designs, expanded psychometric instruments, and integration with other behavioral theories to capture broader sociocultural influences, potentially improving our understanding of adolescent smoking initiation and informing more effective prevention policies and practices.

## AUTHOR'S CONTRIBUTION STATEMENT

**SP** was responsible for the conception and design of the study, conducted the analysis and interpretation of results, and led the preparation of the manuscript. **AHR** contributed to data acquisition and the development of the analytical model. **BS** and **LN** provided critical review and refinement of the final manuscript.

## CONFLICTS OF INTEREST

The authors declare no conflict of interest.

## DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

We acknowledge the use of QuillBot to support language refinement during the manuscript preparation stage. All suggestions generated were carefully reviewed and evaluated to ensure accuracy and clarity.

## SOURCE OF FUNDING STATEMENTS

Lembaga Riset dan Inovasi (LRI) Universitas Muhammadiyah Surakarta granted publication funding for this study.

## ACKNOWLEDGMENTS

The author thanks the Health Research and Development Agency, the World Health Organization, and the US Centers for Disease Control and Prevention for providing the open-access data.

## BIBLIOGRAPHY

1. Martini S, Artanti KD, Hargono A, Widati S, Ahsan A, Prabandari YS. Association between percentage of smokers and prevalence of smoking attributable morbidity in Indonesia: one decade after implementation of smoke-free area regulation. BMC Public Health. 2022 Nov 28;22(1):2202.
2. Ichsan B, Nuredis YA, Priscillah W. Reasons for quitting, reasons for relapse, and knowledge toward the danger of smoking in active smokers. Journal of Health Promotion and Behavior. 2021 Oct 16;5(4):232–9.
3. Rosilawati Y, Rafique Z, Sudiwijaya E. Tobacco use among in-school young adolescents in Indonesia: Exploring availability, affordability, and accessibility. PLOS ONE. 2024 Mar 28;19(3):e0301291.
4. Megatsari H, Astutik E, Gandeswari K, Sebayang SK, Nadhiroh SR, Martini S. Tobacco advertising, promotion, sponsorship and youth smoking behavior: The Indonesian 2019 Global Youth Tobacco Survey (GYTS). Tob Induc Dis. 2023;21:163.
5. Effendi DE, Nugroho AP, Handayani S, Novita R, Purwoko S, Agustina ZA. Tobacco Consumption Among Young Population in Rural Indonesia: Prevalence and Associated Factors. Open Access Macedonian Journal of Medical Sciences. 2022 Jan 1;10(E):1178–83.
6. Reqyrizendri D, Prihartanti N, Asyanti S. Smoking among muslim students behavior case study in Surakarta. Indigenous. 2020 Dec 31;5(2):218–30.
7. Astuti PAS, Assunta M, Freeman B. Why is tobacco control progress in Indonesia stalled? - a qualitative analysis of interviews with tobacco control experts. BMC Public Health. 2020 Dec;20(1):527.
8. Cahyadin M, Sari VK, Szulc AI. Does health contribute to economic growth? An evidence from regional levels in Indonesia. Jurnal Ekonomi Pembangunan: Kajian Masalah Ekonomi dan Pembangunan. 2022 Dec 17;283–94.
9. Marjohan M, Supratikta H. Financial management helps financial ratio analysis to share price in the largest cigarette company in Indonesia. Benefit: Jurnal Manajemen dan Bisnis. 2024;9(2):184–204.
10. Canadian Cancer Society. Cigarette package health warnings: international status report [Internet]. Canadian Cancer Society Ontario, Canada; 2023 Oct. (Eighth Edition). Available from: https://cancer.ca/en/about-us/media-releases/2024/international-warnings-report
11. West R. Tobacco smoking: Health impact, prevalence, correlates and interventions. Psychology & Health. 2017 Aug 3;32(8):1018–36.
12. Ajzen I. The theory of planned behavior. Organizational Behavior and Human Decision Processes. 1991

Dec;50(2):179–211.
13. Topa G, Moriano JA. Theory of planned behavior and smoking: meta-analysis and SEM model. SAR. 2010 Dec;23.
14. Nurseha NL, Elia Nur A'yunin. Adapting the Theory of Planned Behavior to analyze smoking intentions among adolescents in urban school. Media Publ Promosi Kesehat Indones. 2024 Nov 14;7(11):2768–73.
15. Sutha DW, Prabandari YS, Padmawati RS. Smoking behavior among junior high school students based on the theory of planned behavior in Madura, Indonesia. International Journal of Adolescent Medicine and Health. 2023 Feb 1;35(1):61–8.
16. Hosking W, Borland R, Yong HH, Fong G, Zanna M, Laux F, et al. The effects of smoking norms and attitudes on quitting intentions in Malaysia, Thailand and four Western nations: A cross-cultural comparison. Psychology & Health. 2009 Jan 1;24(1):95–107.
17. Indonesia National Health Research and Development (NHRD), World Health Organization (WHO), US Centers for Disease Control and Prevention (CDC). NCD Microdata Repository. 2022 [cited 2025 July 29]. Indonesia Global Youth Tobacco Survey 2019. Available from: https://extranet.who.int/ncdsmicrodata/index.php/catalog/926
18. Megatsari H, Damayanti R, Kusuma D, Warouw TS, Nadhiroh SR, Astutik E, et al. The influence of anti-smoking messages to Indonesian youth smoking behavior: the Indonesian 2019 Global Youth Tobacco Survey (GYTS). BMC Public Health. 2023;23(1):907.
19. Ajzen I. Perceived behavioral control, self-efficacy, locus of control, and the theory of planned behavior. J Applied Social Pyschol. 2002 Apr;32(4):665–83.
20. Shubayr MA, Alhazmi AS, Dalatony MME, Desouky EDE, Al-Zalabani AH, Monshi SS, et al. Factors associated with tobacco use among Saudi Arabian youth: Application of the Theory of Planned Behavior. Tob Induc Dis. 2024 Dec 18;22(December):1–12.
21. Tapera R, Mbongwe B, Mhaka-Mutepfa M, Lord A, Phaladze NA, Zetola NM. The theory of planned behavior as a behavior change model for tobacco control strategies among adolescents in Botswana. Pakpour AH, editor. PLoS ONE. 2020 June 5;15(6):e0233462.
22. Hu L, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. Structural Equation Modeling: A Multidisciplinary Journal. 1999 Jan;6(1):1–55.
23. JASP Team. JASP [Internet]. 2023. Available from: https://jasp-stats.org/
24. Li CH. Confirmatory factor analysis with ordinal data: Comparing robust maximum likelihood and diagonally weighted least squares. Behav Res. 2016 Sept;48(3):936–49.
25. Armitage CJ, Conner M. Efficacy of the theory of planned behaviour: A meta-analytic review. Br J Soc Psychol. 2001 Dec;40(Pt 4):471–99.
26. Ajzen I. The theory of planned behaviour: Reactions and reflections. Psychology & Health. 2011 Sept;26(9):1113–27.
27. Lu Y, Shin Y, Gitau MW, Njoroge MW, Gitau P, Temple JR. Application of the theory of planned behavior to predict smoking intentions: cross-cultural comparison of Kenyan and American young adults. Health Education Research. 2021 Feb 1;36(1):140–50.
28. Vionalita G, Ismail Z. Comparative study: Health risk behaviour in urban and rural Indonesian adolescents. The Indonesian Journal of Public Health. 2025 Mar 30;20(1):15–28.
29. Kusumawardani N, Tarigan I, Suparmi, Schlotheuber A. Socio-economic, demographic and geographic correlates of cigarette smoking among Indonesian adolescents: results from the 2013 Indonesian Basic Health Research (RISKESDAS) survey. Global Health Action. 2018 Dec 3;11(sup1):54–62.
30. Cai Y, Li R, Zhu J, Na L, He Y, Redmon P, et al. Personality, perceived environment, and behavior systems related to future smoking Intentions among youths: An application of problem-behavior theory in Shanghai, China. PLOS ONE. 2015 Mar 31;10(3):e0122276.