

A model of student smoking cessation behavior based on pictorial health warnings as an intervening variable

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Abstract

Purpose: This research examines smoking cessation among students at seven universities following pictorial health warnings under Government Regulation No. 28 of 2024 on Tobacco Control. Using the Theory of Planned Behavior, it analyzes how attitudes toward smoking's health impacts and perceived behavioral control influence smoking cessation through pictorial warnings as an intervening variable, aiming to foster a healthier Indonesian society.

Research Methodology: This quantitative study used purposive sampling with 200 student respondents who quit smoking at seven universities in Soloraya. Data were collected through surveys and interviews, analyzed using item validity, reliability, goodness-of-fit, and Structural Equation Modeling (SEM) to test variable influences, with moderating analysis conducted via AMOS 21.

Results: The results of quantitative research showed that two independent variables directly influenced students' smoking cessation behavior, with attitude having a dominant influence. Pictorial health warnings acted as an intervening variable.

Conclusions: The research concludes that attitude values and perceived behavioral control significantly influence students' smoking cessation behavior. It highlights the need for government regulation, increased tobacco excise, and family support, with recommendations for further research on broader smoking cessation models.

Limitations: The study's subjects were limited to students who quit smoking at seven universities in Soloraya. Future research should include students across Central Java or nationwide and enhance the model by adding moderating variable tests for broader applicability and deeper analysis.

Contribution: This study reinforces the Theory of Planned Behavior by introducing pictorial health warnings as an intervening variable and urges the Indonesian Ministry of Health to expand warning displays to enhance fear and awareness of smoking's negative health impacts.

Keywords: *Behavior, Horrific Health Images, Intervening, Students Quit Smoking*

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1. Introduction

Indonesia is currently entering the final stages of the 2022-2024 National Medium-Term Development Plan. Efforts to reduce the number of teenage smokers in Indonesia face significant challenges. The 2021 Global Youth Tobacco Survey (GYTS) reported that the prevalence of teenage smokers in Indonesia reached 19.2%, significantly higher than the global prevalence of smoking in the same age group, which is 6%, according to the World Health Organization. Several factors contribute to the challenges in reducing the number of teenage smokers in Indonesia. The relatively low price of cigarettes in Indonesia facilitates easy access and availability through retail purchases when new government regulations increase prices. The ease of purchasing cigarettes among teenagers has been shown to increase the trend of buying cigarettes among students, resulting in an increase in cigarette consumption from 11% in 2014 to 13% in 2019 (Melinda, 2024). The numerous challenges of reducing the prevalence of young smokers in Indonesia, as well as the increasing burden of health insurance costs imposed by the Indonesian National Health Insurance Agency (*BPJS Kesehatan*) due to the negative impacts of smoking, create a research gap for further elaboration on the topic of community behavior in quitting smoking

A study by researchers Ardelia and Dewi (2016) found that cigarette smoke contains 4,000 types of chemicals, 40% of which are toxic substances such as nicotine, tar, carbon monoxide, nitrogen oxide, and hydrogen cyanide. There are many other hazardous and toxic substances in cigarette smoke that can adversely affect human health. Various pictorial warnings of negative health aspects have been studied by various researchers. The dangerous aspects of pictures include the direct effects of cigarette smoke on smokers, both active and passive smokers. Given the negative impacts of the hazardous ingredients in cigarettes, awareness has arisen that smoking behavior must be avoided, and if an individual is already addicted, it must be stopped as soon as possible through various treatment methods (Ardelia & Dewi, 2016). In an effort to quit smoking, active smokers must have sufficient knowledge and be aware of the emergence of new experiences, all of which stem from the negative health impacts of smoking (Andriani, Fahdi, Ligita, Fujiana, & Fauzan, 2023; Lü et al., 2022). One example of a warning about the dire health impacts of damage to the body's organs, the lungs, on social media is outlined in Figure 1.



Figure 1. Warning of the Negative Impacts of Smoking

A common problem among smokers is the difficulty in quitting, which erodes their motivation and behavior. Quitting smoking is challenging because cigarettes contain addictive substances that attack the brain, making smoking habitual. A survey by LM3, a non-governmental organization that addresses socioeconomic issues, found that 67% of respondents reported difficulties quitting. The study revealed that the treatment methods for smokers are not yet effective in achieving optimal smoking cessation behavior (Kemenkes, 2022).

Kuijpers, Wintels, and Yamakawa (2020) revealed that Indonesian consumers are increasingly concerned about the cleanliness and health of consumer products due to the Covid-19 outbreak. Research data show that 42% of respondents consider health to be the most important factor in product selection, and this will become a new habit. During the Covid-19 pandemic in Indonesia, consumers have increased their interest in consuming healthy and safe products to boost immunity. Cigarette smoking can lower immunity during the pandemic. These research findings could provide a window into the phenomenon that Indonesian consumers are increasingly aware that unsafe consumer products, processed products, or those containing hazardous ingredients such as nicotine, have the potential to cause disease.

In general, Muslim consumers have a positive attitude towards products and services that use the halal concept approach in the marketing process (Salehudin & Mukhlis, 2012). Halal in Arabic means "permitted" or "allowed." Law No. 33 of 2014 stipulates that goods are halal if they are free from carrion, blood, pork, and/or animals whose slaughtering process does not comply with Islamic law. The Islamic legal ruling (*fatwa*) of the Council of Indonesian Ulama (MUI) states that cigarettes in Indonesia are forbidden goods.

As far as observed, consumers are becoming increasingly critical of purchasing allowed (*halal*) products. In the future, a halal lifestyle will play an increasingly important role in individual and social outreach. Producers who can innovate by producing a variety of halal products related to future lifestyles are entrepreneurs with a competitive advantage. One potential halal lifestyle that is expected to grow rapidly in the future is food and cosmetics. Research has shown that cosmetics with halal labels partially have a positive influence on purchase intention (Baca, 2021). The above observations provide a gap in the phenomenon to develop and empirically test a model of the concept of purchase intention for halal brands by integrating halal attributes and various components related to marketing. This is ironic because cigarettes are considered haram products, yet their sales volume is currently growing rapidly.

Crabtree (2010) stated that Indonesia is included in the list of the most religious countries, where 99% of Indonesians consider religion to be important in their daily lives, and this paradox is evident. This phenomenon explains that, in general, when a country experiences an increase in per capita income, its society becomes more religious. In Indonesia, the opposite occurs: as per capita income increases, the population becomes more religious. Research findings show that increasing crises and disasters significantly influence the increase in religiosity and spirituality in society (Fardin, 2020). The researcher's findings above also create a contradiction: cigarettes are a forbidden product that is increasingly being consumed by Indonesian people in religious environments.

As far as observations go, consumers are currently becoming more critical in purchasing halal and haram products. In the future, a halal lifestyle will play an increasingly important role in individual and social outreach. Manufacturers who can innovate by producing a variety of halal products related to future lifestyles are entrepreneurs with a competitive advantage. One lifestyle with the potential for rapid growth in the future is the use of e-cigarettes, as they are considered a way to divert nicotine addiction (Handayani, Prabamurti, & Handayani, 2023). The above problem observation is a gap in the phenomenon to develop and empirically test the model of the concept of student consumption behavior to stop smoking by integrating the component attributes related to marketing science in the theory of Planned Behavior.

For Indonesian society, the harms of smoking outweigh its benefits. However, smoking is deeply ingrained in society and can lead to addiction. The MUI and Muhammadiyah organization have issued fatwas declaring smoking haram for Muslims. The Indonesian government has published graphic images depicting the devastating health impacts of smoking on most cigarette packs (Andriani et al., 2023). Cigarettes are the cause of numerous public health problems experienced by the majority of the world's population. Cigarettes are products with a relatively high consumption rate (Kemenkes, 2022). The negative impacts of smoking are an urgent national issue that requires priority intervention because they affect various aspects of life, including economic, socio-political, and cultural aspects, most

notably health. Smoking-related illnesses have eroded the financial burden of the Indonesian National Health Insurance (*BPJS Kesehatan*) (Taufick et al., 2023).

Indonesia has the third-highest number of smokers in the world, after China and India. The number of smokers continues to increase annually, especially among beginners and young people, potentially causing a tsunami of problems in the future (Kemenkes, 2022). One of the biggest problems is the negative impact on public health, which results in a decline in the quality of Indonesia's human resources. The National Socioeconomic Survey (*Susenas*) showed that people with low economic strata have higher cigarette consumption rates than those with other commodities (BPS, 2022). Reducing cigarette consumption in Indonesia is a challenging task. This phenomenon is caused by smoking, an addictive behavior that is considered normal in Indonesia. The 2018 Basic Health Research Survey (*Riskesdas*) showed alarming data in Indonesia, with a significant increase in the number of smokers of all ages (Andriani et al., 2023).

The behavior of quitting smoking is closely related to intention, which is a very strong motivation that leads to behavior. When an individual is about to engage in an activity, there is a strong motivation to do so. The intention to quit smoking is a strong motivation caused by various driving factors, such as psychological and health factors (Brown et al., 2014). There is a psychological drive for an individual's intention to quit smoking because of physical problems that require special therapy through new activities to stop smoking. Strong motivation due to psychological and health factors drives an individual's intention and behavior to quit smoking as soon as possible. Various studies in contemporary international journals have found that the Theory of Planned Behavior is relevant to predicting the behavior of individuals to stop consuming addictive substances, creating a phenomenon and research gap for this research activity through model development (Tapera et al., 2020).

This research is urgently needed considering that the government has issued various regulations on the dangers of smoking, one of which is the Regulation of the Minister of Health of the Republic of Indonesia No. 56 of 2017 concerning Amendments to the Regulation of the Minister of Health No. 28 of 2013 concerning the Inclusion of Health Warnings and Health Information on Tobacco Product Packaging (Andriani et al., 2023). Currently, it is necessary to continue research on the topic of students quitting smoking because this theme is still relatively limited by several researchers (Tapera et al., 2020). Based on these findings, there is an opportunity to conduct further research by proposing a behavioral model for students quitting smoking through the proposal of independent variables of attitude and perceived behavioral control with graphic warnings of the negative health impacts of smoking as an intervening variable.

There are various contradictory findings on whether pictorial health warnings influence students' smoking cessation behavior (Syaputra & Coralia, 2022). Therefore, these contradictory findings indicate a research gap. The findings of Andriani et al. (2023) and Hamdan (2015) show that pictorial warnings of the dangers of cigarettes on packaging strongly influence consumers' decision to quit smoking. Research by Baharuddin, Puspitasari, and Islamiah (2024) shows the opposite finding, namely that pictorial warnings are unable to increase the intention to quit smoking. Based on these findings, there is an opportunity to conduct research through model development. The proposed problem formulation is as follows.

1. Are the health impact attitudes and perceived behavioral control factors able to directly influence students' smoking cessation behavior?
2. Can pictorial health warnings function as an intervening variable between the direct influence of the two independent variables on students' smoking cessation behavior?

2. Literature review

The theory of Planned Behavior is a well-established theory in behavioral science research. This theory explains that the behavior of individuals with high involvement requires beliefs and evaluations to foster attitudes, subjective norms, and perceived behavioral control, with intentions as mediators. This activity is influenced by various co-factors, such as intentions, which impact behavior (Ajzen, 2020). The decision to quit smoking is a new behavior undertaken by students with high involvement in smoking.

The decision to quit smoking involves various internal factors, such as personality, perception, intentions, attitudes, and learning factors. Strong external factors influence intentions and behavior, such as peers, parents, neighbors, reference groups, and role models. These factors are known as subjective norms in behavioral science research. The next step toward intention is to measure the perceived behavioral control. This is the condition in which an individual believes that an action is easy or difficult to perform. Individuals must understand the various risks, challenges, obstacles, and problems that arise when making decisions. This phenomenon is known as whether the individual has the will but is unable or the individual is willing and able (Ajzen, 2020).

Cheng et al. (2019) defined attitude as an individual's learned tendency to respond to an object. This object can influence a person directly or simultaneously. This response can be felt by individuals through feelings of like or dislike under various observation conditions over a specific period. This response is relevant to the study of student behavior as they go through the process of smoking cessation. Liu, Lee, and Hwang (2021) explained that attitude is an affection or feeling that arises in an individual due to the emergence of stimuli related to intentions and behavior. Based on the two definitions above, attitude is concluded as an individual's tendency. This attitude can be learned when an individual responds to or receives stimuli related to an object. Attitudes consistently emerge in individuals, resulting in feelings of like or dislike. Attitudes are formed in individuals through a continuous, gradual process that takes both short and long periods.

Health awareness is a consumer's concern and is essential for achieving better health. Individuals are generally motivated to improve and maintain their health and enhance their quality of life by adopting various healthy lifestyle habits (Michaelidou & Hassan, 2008). Consumers are increasingly considering health factors in the products they consume. This concern stems from changing individual activity patterns toward healthier lifestyles. Modern consumers are increasingly considering the nutritional content listed on the labels of various products (Reskiaddin & Supriyati, 2021). For the majority of cigarette consumers in Indonesia, the public has sufficient understanding and knowledge of the dangers of smoking through the negative health impacts it causes. Ironically, this adequate public knowledge is a factor in the significant increase in cigarette production by cigarette manufacturers in Indonesia. The neglect of the negative health impacts of smoking on young consumers and students due to smoking behavior in Indonesia makes the influence of pictorial health warnings an interesting intervening variable to examine as a research gap (Hamdan, 2015).

Ajzen (2020) explained that the The Theory of Planned Behavior, which he proposed two decades ago, is not an exclusive model for predicting behavioral intentions. This model is flexible enough to be expanded, modified, or to add various predictors that can significantly explain various variations in the intentions. Contemporary researchers have expanded the Theory of Planned Behavior (Taylor & Todd, 1995). These researchers explained that the TPB does not include several other variables. Construct variables such as moral obligation, religiosity, self-identity, and habits can be added to the model. These additional variables can more accurately predict intentions and behaviors. Various research findings that still identify limitations in the model can become research or theoretical gaps in future contemporary research models (Taylor & Todd, 1995). The findings of the various studies above indicate that several indicators from various variables can be developed and are therefore relevant for application to various observational objects. The relevance of the model's use in various observational situations further strengthens the TPB model.

For the majority of cigarette consumers in Indonesia, the public has sufficient understanding and knowledge of the dangers of smoking through its negative health impacts; however, cigarette production by cigarette manufacturers continues to increase significantly. The neglect of smoking behavior in Indonesia, especially among young people and students, makes the moderating influence of health warnings an interesting research opportunity (Hamdan, 2015).

Ha: Attitudes and perceived behavioral control can directly influence students' behavior in quitting smoking through pictorial health warnings, which can act as intervening variables

3. Methodology

This study aimed to test whether the dependent variable, student smoking cessation behavior, is directly influenced by two independent variables: perceived health attitudes regarding the negative impacts of smoking and perceived behavioral control, with pictorial health warnings as an intervening variable. The next stage of the research activity is to examine the impact of the model's significance on student smoking cessation behavior.

The questionnaire attribute design includes two independent variables of attitude: the tendency to react affectively in response to the health risks of smoking and smoking cessation behavior, perceived behavior control: beliefs from oneself and from outside (self-efficacy) through smoking cessation activities (Wang, Loftus, Pang, & Kirkpatrick, 2021), student smoking cessation behavior: strong behavior of individuals to quit smoking (Tapera et al., 2020), intervening variables of pictorial health warnings: knowledge of scary images due to smoking, experience of compatibility with images, psychological encouragement due to health factors, and images being able to strengthen smoking cessation behavior (Reskiaddin & Supriyati, 2021).

Survey research activities were conducted on student respondents at seven universities in the Soloraya region: UNS, UMS, Uniba, Unisri, UTP, Univet, and Unwidha, totaling 200 respondents by purposive sampling. The basis for taking the number of respondents as a sample based on the Multivariate SEM test of 200 to 400 respondents was considered fit (Sekaran & Bougie, 2016). Initial model testing was carried out through the validity and reliability test of instrument items, confirmatory factor testing through goodness of fit, multivariate correlation regression analysis, and at the final stage, a Structural Equation Model (SEM) test was carried out using the AMOS 21 statistical program (Hair, Babin, Anderson, & Black, 2019).

4. Results and discussion

4.1. Respondent Description

4.1.1. Respondent' Age

Table 1. Respondent' Age

Age	Total	Percentage
18 – 21	90	30%
22 –25	210	70%
Total	300	100%

Source: Primary data processed in 2025

The distribution of research respondents was between 18 and 21 years old (30%) and 22 and 25 years old (70%). The research findings indicate that the student respondents were mature. They are in a stable student position, and their families are currently financially stable.

4.1.2. Monthly Income

Table 2. Income per Month

Income	Total	Percentage
< 3.000,000 Rp	30	10%
3.000.000- 8.000.000 Rp	240	80%
>8.000.000 Rp	30	10%
Total	300	100%

Source: Primary data processed in 2025

The distribution of student respondents based on monthly income shows that the majority (90%) are above Rp 3,000,000, a figure that is above the minimum wage in the Soloraya region. These student respondent data findings indicate that the Soloraya region is a developed and developing economic area. The Soloraya region is part of the region encompassing the cities of Yogyakarta (Jogja), Surakarta

(Solo), and Semarang in Central Java, Indonesia (*Joglosemar*) economic growth center. The final stages of the Solo-Jogja toll road construction further demonstrate that the more advanced the Soloraya creative economy, the more rapid the growth of the Soloraya creative economy region is.

4.2. Validity Test

Validity testing is the ability of the questionnaire to measure what it should measure through a variance test extracted from the latent variables or constructs developed. The extracted variance value agreed upon by the expert panel was 0.5, a value at which the questionnaire instrument passed the validity test. In this research, the initial pre-research test on 33 respondents was measured through a validity test of the questionnaire instrument, as presented in Table 3 below:

Table 3. Validity Test

Indicator	R result	R required	Status
Attitudes towards health risks due to smoking			
P1	0.757	0.500	Valid
P2	0.630	0.500	Valid
P3	0.784	0.500	Valid
P4	0.516	0.500	Valid
Perceived Behavior Control			
P1	0.744	0.500	Valid
P2	0.667	0.500	Valid
P3	0.571	0.500	Valid
P4	0.755	0.500	Valid
Health images of the negative impacts of smoking			
P1	0.690	0.500	Valid
P2	0.759	0.500	Valid
P3	0.759	0.500	Valid
P4	0.654	0.500	Valid
Smoking cessation behavior			
P1	0.670	0.500	Valid
P2	0.749	0.500	Valid
P3	0.749	0.500	Valid
P4	0.664	0.500	Valid

Source: Primary data processed in 2025

The results of the item indicator validity test, presented in Table 3, indicate that the instrument is valid. This means that the questionnaire items can measure what they are intended to measure.

4.3. Reliability Test

The reliability test is the ability of a questionnaire to maintain the consistency of an instrument's ability to measure a different object when repeated at different time points. The extract variance value, according to the expert panel's agreement of 0.70, was agreed upon as a questionnaire instrument value capable of passing the reliability test. The pre-research test in the initial stage of 35 respondents was carried out on the reliability measurement of the questionnaire instrument, which is presented in Table 4 as follows:

Table 4. Reliability Test

Indicator	R result	R required	Status
Attitudes towards health risks due to smoking	0.775	0.700	Reliable
Perceived behavior Control	0.751	0.700	Reliable
Image of negative health impacts merokok	0.745	0.700	Reliable
Smoking Cessation Behavior	0.735	0.700	Reliable

Source: Primary data processed in 2025

The results of the item indicator validity test, presented in Table 4, indicate that all instruments were deemed reliable. This means that the questionnaire items are instruments that have been tested for consistency, indicating that the questionnaire can produce the same results when tested at different times.

4.4. Data Analysis

The framework of the research model and feasibility test based on mediating variables through multivariate tests is shown in Figure 2.

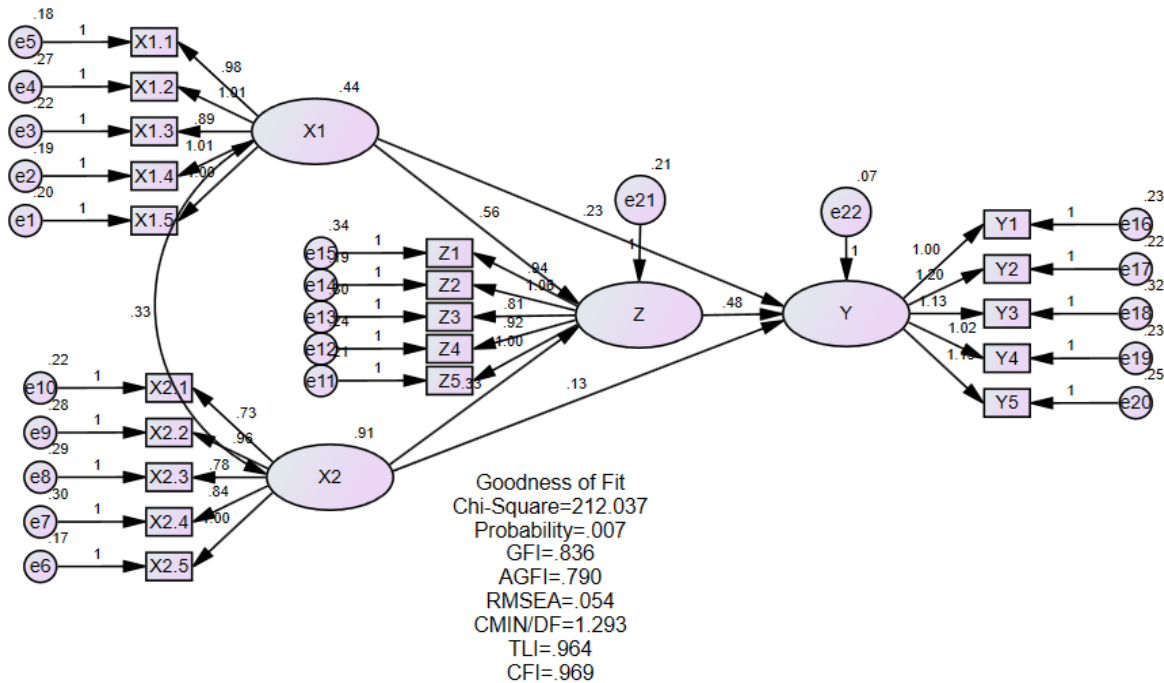


Figure 2. Model framework

The results of the SEM model feasibility test are presented in Table 5.

Table 5. Full Model Feasibility Test Results

No	Good of Fit Index	Cut off values	Result	Model Evaluation
1.	Chi square	little < 385.058	212.037	Good
2.	Probability	>0.05	0.007	Good
3.	RMSEA	<0.08	0.054	Good
4.	GFI	>0.90	0.836	Less Good
5.	AGFI	>0.90	0.790	Less Good
6.	CMIN/DF	<2.00	1.293	Good
7.	TLI	>0.95	0.964	Good
8.	CFI	>0.95	0.969	Good

Source: Primary data processed in 2025

Based on the feasibility test of the research model, the causal relationship between the dependent variable and students' smoking cessation behavior was directly influenced by two independent variables: attitudes about the negative impacts of smoking and perceived behavioral control. The intervening variable, horrific images of the health impacts of smoking, has been shown to play a positive role. It is concluded that the model's suitability for this research activity is appropriate. The model's suitability for this research activity was proven by the test findings through the significance of the chi-square value.

4.5. Hypothesis Testing

Hypothesis testing in this study was conducted based on the Critical Ratio (CR) value, which is a causal relationship. The complete results of the hypothesis testing are presented in Table 6.

Table 6. Hypothesis Testing

No	Variables	Estimate	SE	CR	P	Result
1.	Attitude -> Health image	0.389	0.182	5.029	<0.012	Significant
2.	PBC-> Health image	0.436	0.088	4.387	<0.021	Significant
3.	Attitude -> Smoking cessation behavior	0.357	0.057	4.297	<0.005	Significant
4.	PBC-> Smoking cessation behavior	0.394	0.347	3.775	<0.028	Significant
5.	Image -> Smoking cessation behavior	0.437	0.553	3.530	<0.036	Significant

Source: Primary data processed in 2025

Hypothesis testing from Table 6 shows that two independent variables can significantly influence the health image and behavior of students to quit smoking, with the attitude of the health impact of smoking being more dominant through the CR value of 5.029. Attitude can directly influence students' smoking cessation behavior because it has a positive direction in the critical ratio value and probability <0.05. This can be interpreted from research findings indicating that the influence of attitude variables is more significant than that of perceived behavior control. This greater influence could be due to the influence of motives, family support, and coping mechanisms, as found by (Reskiaddin & Supriyati, 2021).

Respondents' experiences of extreme pain due to the negative impacts of smoking were deeply embedded in their past. This painful experience made attitude variables a more dominant influence on students' smoking cessation than the perceived behavior control variable and images of the negative health impacts of smoking. The research findings conclude that increasing awareness of the negative impact of smoking and efficacy beliefs can increase awareness of the horrific health image due to smoking and the behavior of students to quit smoking. Increased awareness due to the horrific health image of smoking can increase students' behavior to quit smoking at seven universities in the Soloraya region.

4.6. Mediator Hypothesis Test (Sobel Test)

Sobel Ferdinand's (2019) mediation hypothesis test is described in table 7 as follows.

Table 7. Sobel Test

No	Mediator	t-table	t-count	Sig (df/p=59../0.05)
1.	Attitudes towards student behavior of quitting smoking through pictures	1.761	1.742	0.044
2.	PBC on student behavior to stop smoking through images	1.761	1.706	0.025

Source: Primary data processed in 2025

The primary data of this study conclude that the horrific health images resulting from smoking can act as an intervening variable between attitudes and perceived behavioral control towards increasing students' behavior in quitting smoking. Intervening variable significantly mediate the relationship between the independent and dependent variable consistent with (Fahrizal, Budiono, Khalid, & Santoso, 2025; Riswanda & Millanyani, 2025).

4.7. Discussion

The 2021 Global Adult Tobacco Survey (GATS) in Indonesia by Kemenkes (2022) examined the role of cigarettes in the early stages of adolescent smoking initiation. Among the younger population, cigarette consumption was dominant and showed a downward trend with age. This can be explained by the fact that as individuals age, they become more economically established, thus reducing their retail cigarette purchases. Another finding was that cigarette consumption tended to increase among

older smokers. Most adolescents in the study chose cigarettes because they are easily available due to their accessibility. This easy access encourages young smokers to buy cigarettes repeatedly, spending between IDR 30,000 and IDR 200,000 per week in their pocket money. This amount is equivalent to half the average weekly per-capita expenditure of Indonesians in March 2023, according to data from the Central Statistics Agency (BPS, 2022).

These findings align with data from student smokers in the Soloraya region. The research respondents had middle- to upper-class purchasing power above the monthly minimum wage. Ironically, their relatively high monthly income is spent on toxic nicotine products, namely cigarettes. The Indonesian government must take more decisive, straightforward, and comprehensive steps to prevent the increase in the number of young smokers. Tobacco consumption among teenagers and college students has long-term negative consequences, including the emergence of various dangerous non-communicable diseases caused by smoking and increasing economic and social disparities. Therefore, more proactive and targeted measures are needed to reduce cigarette consumption among teenagers and college students in China.

The results of the regression test in this study indicate that two independent variable predictors can influence students' smoking cessation behavior. This research finding can be interpreted as every increase in the two independent variables increasing the influence of students' smoking cessation behavior. This research finding is in line with the findings of the Planned Behavior Theory, which states that intention can be influenced by three independent variables as predictors. The regression test findings show that the independent variable, attitude toward the health impacts of smoking, had the greatest influence on students' smoking cessation behavior. Among student smokers in the Solo Raya area, the perception of this variable has a dominant influence on the dependent variable, according to the research findings (Syaputra & Coralia, 2022; Tapera et al., 2020).

Attitude reflects an individual's belief in understanding the negative health impacts of smoking, which is experienced over a long process. This belief in awareness of this attitude is in line with various factors that inhibit and encourage important behaviors experienced by individuals experiencing severe harm from smoking, which leads to smoking cessation. The attitude of the negative impacts of smoking among students in the Solo Raya area is very strong, meaning that smokers have a very strong attitude belief that encourages them to continue quitting smoking despite various obstacles and social and emotional environmental challenges that tempt them to return to smoking. Smoking students in the Soloraya area had a very good attitude toward continuing smoking cessation activities.

In behavioral research, there is another term for perceived behavioral control: self-efficacy. Self-efficacy is an individual's belief in their abilities. Several factors influence self-efficacy, including mastery experience, vicarious experience, verbal persuasion, and various physiological and emotional states. This study found that self-efficacy was a significant predictor of students' smoking cessation, with the second-highest CR score, indicating that this predictor also had a dominant influence. This finding aligns with research on smoking cessation respondents in the United States and Western Europe. Individuals with high self-efficacy strive to train themselves consistently to quit smoking. This activity begins with an attempt to quit smoking for one day and continues on subsequent days, thus becoming more accustomed to not smoking.

This can be interpreted as meaning that the higher the self-confidence of an individual smoker in reaching the final stage of their smoking cessation efforts, the more likely they are to achieve complete freedom from their smoking addiction (Wang et al., 2021). Self-efficacy was significantly related to the dependent variable, consistent with (Komakech, Obici, & Mwesigwa, 2021; Pujiati, Feani, & Cahaya, 2025; Sjarifudin, Widyastuti, Renwarin, & Suroso, 2025).

Warnings of negative health impacts through frightening and disgusting images on cigarette packs, coupled with personal experiences of pain due to smoking, influence respondents' fear. Research respondents felt fear and disgust at the warning images of the negative health impacts of smoking on packaging, various broadcast media, and other social media, so they wanted to reduce smoking

consumption after seeing the disgusting images on the packaging. The fear of horrific images of the negative health impacts for smokers makes this intervening variable function as an intermediary between the two predictor variables for the dependent variable. This finding is consistent with those of previous studies (Andriani et al., 2023; Mayasari et al., 2018).

Attitudes had no influence on smoking cessation intentions. Research findings indicate that pictorial health warnings on cigarette packaging have no effect on public attitudes toward quitting (Baharuddin et al., 2024). Although pictorial health warnings on cigarette packaging can increase awareness of health risks, they are ineffective in stifling smoking behavior. Several other studies have shown that graphic health warnings have no effect on smoking behavior. However, this study argues that graphic images depicting the health impacts of smoking make cigarette packaging less attractive from a marketing perspective (Shrestha et al., 2022).

The research findings theoretically explain the function of intervening variables that can mediate the influence of independent variables on dependent variables; therefore, including this variable in the model is important and relevant. Practical contributions according to the research findings of Andriani et al. (2023); Hamdan (2015); Indrawani, Mailani, and Nilawati (2014), health images have an influence on increasing consumer behavior to quit smoking. The government, as a policy maker, needs to create regulations to further increase the proportion of horrific health images due to smoking on packaging displays, even to a portion of 70-90 percent of all packaging displays. In other countries, such as Vietnam, Laos, and developed countries, regulations implementing a larger proportion of images have been implemented along with the plain cigarette packaging model. Indonesia is currently lagging behind in regulating the proportion of horrific health images due to the negative impact of smoking.

5. Conclusions

The research results based on the description above conclude that students' behavior to stop smoking can be directly influenced by two predictors: attitude values and perceived behavioral control. The intervening variable test can play a role in the influence of two independent variables on the behavior of students to stop smoking. Theoretical and managerial contributions of research findings: For stakeholders of higher-education institutions, the Health Service, independent variable indicators must continue to be observed, and their activities must continue to be increased because they can directly influence the variable of student behavior to stop smoking. The government needs to increase tobacco excise significantly by 25–70 percent so as to reduce the purchasing power of teenage smokers. The government also needs to prohibit the sale of cigarettes in retail, as well as illegal cigarettes without excise. Prohibiting the sale of cigarettes in retail and small stalls can reduce the prevalence of teenage smoking. From a health regulatory perspective, the government needs to ensure strong and comprehensive tobacco product control regulations, such as a ban on cigarette advertising in open spaces and cigarette promotional banners near school areas and locations where children and teenagers are active.

The future government needs to broadly incorporate provisions for controlling tobacco products and various tobacco derivatives into the Health Law. The government needs to demonstrate its commitment to protecting the younger generation from the harmful effects of smoking to improve health and enhance the quality of a healthy generation of Indonesians in the future. Family and social support are essential for encouraging smokers to quit. Education on providing healthy and nutritious food in the future, through the allocation of cigarette spending, can be redirected to meet the food and clothing needs of the lower-middle class. The findings of the model related to the variable of images of the negative health impacts of smoking can act as an intervening variable for students who want to quit smoking. Stakeholders must increase activities to enlarge the horrific images of the negative health impacts of smoking on cigarette packaging. The findings of the research show that the category of student smokers in the Soloraya region is in the middle-up income economy category, so that high purchasing power will increase the ability to buy cigarettes if the price of cigarettes is relatively cheap.

This study has limitations in that the dependent variable studied is limited to the behavior of college students quitting smoking in the Solo Raya region. Future research should expand the scope of research objects related to the theme and target respondents not limited to the Soloraya region alone but also encompassing the wider province of Central Java and all provinces in Indonesia, which have diverse cultures and social behavior. Future research should develop broader model testing on actual smoking cessation behavior by adding model construction through the influence of moderating variables or developing through the influence of moderating variables and intervening variables.

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