ADDIS ABABA UNIVERSITY COLLEGE OF HEALTH SCIENCES

SCHOOL OF MEDICINE

DEPARTMENT OF INTERNAL MEDICINE

EVALUATING THE IMPACT OF GRAPHIC HEALTH WARNING LABELS INTENSITY ON ANTI-SMOKING INTENTIONS AMONG NON-SMOKING ADOLESCENTS ATTENDING HIGH SCHOOL IN ADDIS ABABA, ETHIOPIA: A Multi Center Quasi Experimental Study

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The full title of the research project	Evaluating the impact of Graphic health warning intensity and individual predispositions on Anti- smoking intentions among non smoking Adolescents attending high school in Addis Ababa, Ethiopia: A MultiCenteric Quasiexperimental Study
Study Area	The study will be conducted at randomly selected high schools in Addis Ababa.
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First of all, glory to God who gives me strength in everything I do. I would like to express my sincerest gratitude to Dr. Aschalew Worku and dr Hanan Yusuf for always giving me his advice and providing me guidance throughout the process of developing and writing this proposal.

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List of Abbreviations and Acronyms

Abbreviation	Meaning
GHWLs	Graphic Health Warning Labels
GYTS	Global Youth Tobacco Survey
FCTC	Framework Convention on Tobacco Control
WHO	World Health Organization
SUDS	Subjective Units of Distress Scale
ITC	International Tobacco Control
CI	Confidence Interval
GATS	Global Adult Tobacco Survey
CDC	Centers for Disease Control and Prevention

1)Abstract

Background:

Cigarette smoking poses a significant public health threat, and its detrimental effects are particularly concerning among adolescents. Graphic Health Warnings (GHWLs) on cigarette packs have emerged as a low-cost yet effective tool to deter tobacco use and reduce mortality. While Ethiopia adopted the Framework Convention on Tobacco Control (FCTC) recommendations and implemented GHWLs, their effectiveness in influencing adolescents' emotional responses, risk perception, and smoking intentions remains locally unevaluated.

Objective:

To asses effectiveness of GHWLs in influencing perceptions of smoking and anti-smoking intentions in adolescent non-smokers attending high school in Addis Ababa Ethiopia

Methods:

This is a Quasi experimental study which utilized structured interviews to investigate the impact of GHWLs on late adolescents' perceived message and Impact related effectiveness. A sample of 525 non-smoking high school students in Addis Ababa were exposed to either mild or strong GHWLs and assessed based on their emotional responses, perceived risk, and intentions to smoke. The extracted data was entered to SPSS version 26, frequencies, proportions, and summary statistics is used to describe the study population in relation to relevant variables. Variables with p value of <0.2 on the bivariate analysis will be included in the multivariate one. Analysis is carried out to see the effect of independent variable on the dependent variable and P- value <0.05 is considered significant.

Result

A total of 525 Adolescents attending in Four high schools in Addis Ababa were included in the study. There were 54.5% female participants. The age of participants ranges from 13-20yrs, majority(52.6%) were in the 16-17 age range. Students attending governmental schools were 51.4% and 48.6% were attending in private schools. The Multivariate

regression analysis showed that exposure to strong warnings increased odds ofthe impact related dimension(intention to avoid smoking and emotional response) and by 20.5x (Adjusted Odds Ratio (AOR) = 20.5, 95% Confidence Interval (CI) = (9.47-44.7).

Conclusion

This study investigated the effectiveness of anti-smoking graphic warnings on students in Addis Ababa high schools. The findings suggest that strong warning images are more impactful than weak warning images. Students exposed to strong warnings showed higher agreement with the effectiveness of the Strong GHWL to Convey anti smoking messages, to elicit stronger negative emotions and impact on their anti-smoking intentions. These results support the use of graphic health warnings as a tool to deter smoking initiation among youth

2) Introduction

2.1 Background of the study

Cigarette smoke harbors a staggering array of over 7,000 chemicals, encompassing a multitude of toxins derived from both native tobacco constituents and the byproducts of pyrolysis. The ultimate health detriment inflicted by these pernicious agents hinges critically on the degree of exposure, with chronic and heavy smoking patterns, characterized by daily consumption of multiple cigarettes over extended periods, demonstrably amplifying the associated risks.[(1)]

Persistent, high-dose inhalation of the diverse and toxic chemicals found in cigarette smoke over extended periods (often years) induces a multitude of adverse health consequences, impacting both immediate and long-term well-being across numerous organ systems.[(1)]

Acutely, cigarette smoking triggers a decline in overall health, measurable through various indicators. These include physiological disadvantage markers, reduced self-reported health status, increased susceptibility to acute illnesses and respiratory symptoms, and higher absenteeism from school and work.Chronically, smoking leads to the development of prominent, often fatal, diseases in developed nations: coronary heart disease, cancer, and chronic obstructive pulmonary disease (COPD).[(1)]

Tobacco use remains a global public health crisis, claiming over 5.4 million lives annually . Projected trends anticipate this figure to rise to 8.3 million by 2030, with a staggering 80% of deaths concentrated in developing countries (World Health Organization, 2011).[2] In response to this escalating epidemic, health warning labels (HWLs) on cigarette packs have emerged as a low-cost, yet demonstrably effective, policy tool for deterring tobacco consumption and reducing mortality (Hammond, 2011).[3]

Tobacco use among youth is a global concern. The Global Youth Tobacco Survey (GYTS) conducted in 43 countries among 13–15 year olds indicated that 20% of them had used some kind of tobacco product, and among those who smoked cigarettes 25% started before the age of 10years.[4] GYTS conducted in Ethiopia, Addis Ababa among school children from grade 8-12 in 2003 showed that 7.6% of students had ever smoked cigarettes and 6.6% were active smokers. It also showed that 12% of the never smokers were likely to initiate smoking next year. [5]

Numerous studies have demonstrated the effectiveness of graphic health warnings in achieving various public health goals. Firstly, graphic warnings consistently outperform text-only warnings in capturing attention and raising awareness of the detrimental health consequences of smoking. This is particularly true for populations with limited literacy or those exposed to multiple languages. Vivid imagery can significantly increase smokers' risk perceptions, prompting them to reconsider their continued tobacco use. Studies have shown that smokers exposed to graphic warnings are more likely to acknowledge the dangers of smoking and report feeling more concerned about their health.

Furthermore, graphic warnings can act as a catalyst for quitting by prompting smokers to contemplate cessation and even take concrete steps towards it. Research suggests that exposure to graphic warnings can lead to increased quit attempts and higher quit success rates. The impact extends beyond smokers themselves, as graphic warnings can deter young people from taking up smoking in the first place. The stark imagery can serve as a powerful deterrent, highlighting the negative consequences of smoking before they become ingrained in a habit.

2.2 Statement of the problem

While Ethiopia adopted the Framework Convention on Tobacco Control (FCTC) recommendations in 2018 and implemented graphic health warnings (GHWs) on cigarette packs, the effectiveness of these specific images has not been locally evaluated. Existing research emphasizes the importance of rotating GHWs to maintain their impact.

2.3 Significance of the study

This research addresses this knowledge gap by investigating the influence of GHWLs on late adolescents' emotional responses (e.g., disgust, fear), cognitive processing of health risks, and ultimately, smoking decision-making. Utilizing a combination of experimental designs and structured interviews, the study aims to elucidate how GHWLs shape adolescents' emotional engagement with health warnings, comprehension of risk information, and smoking intentions.

Identifying potential differences in responses across subgroups will inform the development of tailored interventions targeting this vulnerable population. Ultimately, this study seeks to optimize GHW design and public health strategies to minimize smoking initiation and enhance health outcomes among late adolescents.

The study's findings will also contribute to a repository of empirically validated GHW images, informing future GHW design and implementation in Ethiopia.

3) Literature Review

3.1 Effectiveness of Graphic Health Warning Labels (GHWLs)

Theories in social and health psychology, bolstered by empirical evidence, have established the superior efficacy of pictorial elements and imagery over text-only messaging in the realm of health communication. This aligns with research conducted since the 1950s, which consistently demonstrates the effectiveness of "fear appeals" in prompting health behavior modifications, particularly cessation, when paired with readily accessible information about available cessation resource.[6]

Comprehensive and tailored warnings have the potential to significantly enhance risk perception and inform smokers about the full spectrum of dangers associated with their habit. Utilizing data from the International Tobacco Control Four Country Survey (ITC-4), Hammond et al. (2006) investigate variations in tobacco risk knowledge and the influence of package warnings among smokers in the USA, UK, Canada, and Australia. Their findings reveal significant knowledge gaps across all four countries, highlighting the persistent need for effective health communication. Importantly, the study demonstrates a positive correlation between noticing warnings and acknowledging various health risks. Smokers residing in countries with mandated warning labels, such as Canada with its inclusion of impotence risks, exhibited greater awareness of specific health consequences. [7]

A study by Thrasher et al. (2007) compared the reactions of smokers in Canada and Mexico to cigarette package warnings. Canadian smokers exposed to GHWLs demonstrated greater warning label salience, actively noticing and processing the message content, compared to their Mexican counterparts exposed to text-only warnings. Notably, this heightened salience in the Canadian group predicted higher quit intentions, suggesting that GHWLs potentially act as catalysts for behavior change by effectively capturing smokers' attention and prompting deeper engagement with the health information presented. Furthermore, Canadian participants exhibited superior knowledge of smoking-related health risks, potentially influenced by the graphic imagery incorporated into their warning labels, highlighting the ability of GHWLs to supplement and enhance text-based messaging.[8]

The implementation of GHWLs encompassing 50% of cigarette packaging in Thailand in 2006 provided a valuable opportunity to analyze their impact on smokers' risk perception and quitting intentions. Fong (2007) reported a significant increase in the proportion of Thai smokers contemplating health risks and actively planning to quit following the introduction of GHWLs, in contrast to the unchanged landscape in Malaysia, which retained text-only warnings. This stark contrast underscores the potential of GHWLs to amplify salience, leading to heightened risk awareness and ultimately motivating behavior change.[9]

Public health interventions often grapple with limited reach and resource constraints. Yet, readily visible health warning labels on tobacco products stand out as a uniquely cost-effective tool for disseminating information about the hazards of tobacco use to both smokers and non-smokers. Hammond (2009) highlights that in numerous countries, smokers report deriving their knowledge of smoking risks more frequently from warning labels than any other source besides television.[6] This ubiquity ensures consistent exposure to critical health information, even among non-smokers, including children, who exhibit remarkably high awareness of these labels.

The efficacy of GHWLs in conveying health information to populations with limited literacy merits particular consideration. Siahpush et al. (2006) explored this issue, noting the correlation between lower educational attainment and smoking prevalence across nations. However, the study also revealed that nations implementing GHWLs exhibited reduced disparities in health risk awareness across educational strata. This suggests that GHWLs, by virtue of their visual nature, circumvent literacy barriers and ensure broader dissemination of critical health information, thereby promoting greater equity in risk perception across diverse populations.[10]

Hammond's (2011) comprehensive review sheds light on the critical role of design and prominence in maximizing the impact of GHWLs. While text-only warnings with limited visibility yield minimal results, prominent and strategically placed warnings act as readily accessible sources of health information for both smokers and non-smokers. Their effectiveness lies in demonstrably increasing knowledge of health risks associated with tobacco use, heightening risk perception, and even sparking cessation behaviors among existing smokers. Notably, evidence suggests that comprehensive warnings, particularly those

incorporating graphic elements and evoking strong emotional responses, are especially impact full in deterring smoking initiation among youth.[3]

Further bolstering the case for GHWLs, an experimental study by ITC among Chinese smokers, non-smokers, and youth across four cities revealed their compelling influence on various stakeholders. Participants consistently rated pictorial warnings as more effective than text-only labels in motivating smokers to quit, deterring youth from initiating tobacco use, and raising public awareness of smoking's detrimental health consequences. This demonstrates the broad societal impact of GHWLs, extending beyond influencing smokers to shaping societal norms and discouraging uptake among future generations.[11]

Tobacco warnings can do more than just warn about health risks. They can highlight the financial cost of addiction, reminding smokers of the economic burden they carry. They can address secondhand smoke's impact on loved ones and pets, or even encourage adherence to safety regulations. This broader focus expands the reach of warnings, turning them into multifaceted public health advocates.

3.2 Evolution of design and Global implementation

The initial emergence of package health warnings on tobacco products occurred in the 1960s and 1970s, primarily through legislative or voluntary measures. Notably, the United States pioneered the initiative in 1966.[12] Early iterations of these warnings were characterized by their limited visibility, confined to the lateral side of packages. The content featured a singular, weak message using general language and notably omitted specific health consequences like cancer or heart disease. This minimalist approach gradually evolved, with countries like Australia in 1973 implementing front-of-package warnings, albeit still text-based and unobtrusive due to size and color restrictions. [13]

Sweden's 1977 approach marked a shift towards greater complexity, utilizing a system of 16 rotating messages conveying specific health risks and occupying a larger 20% of the package surface. However, this innovative system was short-lived, replaced in 1993 by EU-mandated 4% text warnings.[14] Meanwhile, Thailand (1993) and Canada (1994) adopted their own

models, featuring 10 and 8 rotating text warnings respectively, occupying significant portions of the package front and back. [15][16]

prior to the Framework Convention on Tobacco Control (FCTC) negotiations in October 2000, graphic picture warnings on tobacco packaging were only mandated in Canada, occupying at least 50% of the front and back surfaces. At the FCTC's approval in May 2003, Brazil joined Canada as the sole additional nation requiring pictorial warnings or exceeding a 50% average coverage Brazil, however, implemented a front-of-pack exemption, with warnings exclusively occupying 100% of the back.[17]

Since 2007, a substantial wave of tobacco control policy has swept across the globe, with 94 countries implementing strong graphic package warnings. This measure now reaches over half of the global population (57%) and encompasses a majority of the world's nations (67% of high-income, 53% of middle-income, and 21% of low-income countries). While a small minority (21 countries) remain without any warning labels, and 45 others use weaker measures covering less than half of designated pack surfaces (falling short of the WHO FCTC recommendations), significant progress has been made in raising awareness of tobacco's harms through visually impact full packaging warnings.

The 2008 Framework Convention on Tobacco Control (FCTC) Guidelines for Article 11 (packaging and labeling) acknowledge the principle of size-driven effectiveness for health warnings, encouraging Parties to maximize their coverage on product displays.[18] Furthermore, the Guidelines recognize the superior efficacy of combined pictorial and textual warnings, highlighting their broader reach for populations with low literacy or language barriers.[18]

A 2011 legal challenge in the US temporarily hampered the implementation of GHWLs on tobacco packaging due to concerns regarding their effectiveness in reducing smoking. Subsequently, researchers aggregated data from multiple sources, including the WHO MPOWER package, Euromonitor International, and the World Bank database. This extensive analysis demonstrated that GHWLs were associated with statistically significant reductions in both adult smoking prevalence (0.9-3 percentage points) and per capita cigarette consumption (230-287 sticks) compared to countries without GHWLs. [19]

The landscape of tobacco packaging warnings has undergone a dramatic transformation in recent decades. What may have seemed unthinkable 30 years ago is now becoming the norm, with an expanding canvas serving as a potent visual reminder of the dangers. As of October 2021, a staggering 122 countries/jurisdictions mandated warnings covering at least 50% (on average) of both the front and back of cigarette packs. This figure further climbs to 27 and 10 for jurisdictions requiring 70% and 85% coverage, respectively.[20]

Beyond static visuals, some countries are employing even more dynamic methods. Rotated black-on-yellow text warnings appearing on lateral sides add an element of movement and grab attention, as seen in several countries. Timor-Leste and Nepal have taken this a step further, mandating warnings/messages on a remarkable five out of six pack sides.[21]

These developments signify a global recognition of the critical role tobacco packaging warnings play in public health. By increasing their size, placement, graphic impact, and coverage, countries are effectively leveraging this platform to educate consumers, raise awareness of the detrimental health consequences, and ultimately encourage cessation behaviors.

The potency of warnings weakens over time with infrequent updates. To combat this "wear-out" effect, continuous rotation is crucial. Countries like Ecuador and Mexico exemplify success with nine or more rounds of pictorial warnings. A readily available arsenal of diverse messages ensures sustained public exposure and prevents complacency.[22]

3.4 Ethiopia's context

Ethiopia, along with many sub-Saharan African nations, navigates a precarious path regarding tobacco use. While national prevalence remains relatively low compared to neighboring countries, the potential for a burgeoning tobacco epidemic looms large. The 2014 WHO and CDC GATS survey paints a nuanced picture of tobacco use, revealing a national prevalence of 5.0% (95% CI 3.5, 6.9). Notably, this figure masks diverse consumption patterns. The majority (65.8% of users) solely engage in smoking, while 22.5% prefer smokeless tobacco, and 11.8% indulge in both forms.[23] Recognizing this heterogeneity is crucial for crafting targeted interventions tailored to each group's specific risk factors and preferences.

Further complexities emerge when examining sociodemographic and geographical variations. Gender disparities play a significant role, with male adults exhibiting a disproportionately higher tobacco use rate (8.1%) compared to their female counterparts (1.8%). This necessitates gender-sensitive strategies that address the social and cultural forces influencing male tobacco use in Ethiopia. Similarly, eight out of eleven states surpass the national average smoking rate, highlighting the need for localized interventions catering to regional dynamics and risk factors.[23]

The survey sheds light on concerning trends in youth initiation. Among daily cigarette smokers aged 20-34 at the time of the survey, a significant proportion (26.5%) had begun smoking daily before the age of 15; 14.8% started at age 15-16; 17.1% started at age 17-19; and 41.6% started at age 20 or older. This early uptake underlines the urgency of implementing effective tobacco control measures focused on youth prevention.[23]

A school-based cross-sectional study conducted in Ethiopia using the Global Youth Tobacco Survey (GYTS) investigated cigarette smoking among 564 students aged 15-22. The study revealed an overall prevalence of smoking at 11%, with a clear gender discrepancy – male students showed a nearly triple rate (8.2%) compared to their female counterparts (2.8%). Age emerged as a significant predictor, with students above 18 years more likely to smoke.[5]

A systematic review and met analysis of literature from January 2011 to December 2018 which included 13 studies showed that the pooled prevalence of current cigarette smoking among Ethiopian university students was found to be 12.55%. Male Gender, peer influence, khat chewing, and current alcohol use were significantly associated with cigarette smoking.[24]

Following its commitment to the WHO Framework Convention on Tobacco Control (FCTC) in 2014, Ethiopia has implemented a robust legislative framework to safeguard public health from the deleterious effects of tobacco use. These measures encompass smoke-free environments, advertising and promotion restrictions, and stringent packaging and labeling regulations.[25]

At the core of Ethiopia's strategy lies a comprehensive smoke-free law. Smoking and the use of any tobacco product are prohibited in all indoor public places, workplaces, and public transport. Notably, the policy extends beyond enclosed spaces, encompassing outdoor areas of

schools and universities, government facilities, youth centers, and amusement parks. This emphasis on smoke-free spaces minimizes exposure to secondhand smoke and fosters a healthier environment for all.[25]

Recognizing the insidious influence of tobacco advertising, Ethiopia has enacted a blanket ban on all forms of direct and indirect promotion. This includes traditional channels like television and print media, but also encompasses subtler tactics such as sponsorship and product placements. Recognizing the crucial role packaging plays in influencing consumer behavior, Ethiopia mandates prominent health warnings on all tobacco products. These warnings occupy a mandatory 70% of both the front and back surfaces, maximizing their visibility and effectiveness. Furthermore, the law prohibits deceptive packaging and labeling practices, outlawing terms like "light" and "low tar" that often downplay the inherent risks of tobacco use.[25]

4) Objectives of the study

4.1 General objectives

To assess the impact of GHWLs in influencing the emotional response and intentions to smoke in adolescent non-smokers attending high school in Addis Ababa Ethiopia

4.2 Specific Objectives

- Evaluate the impact of different types of GHWLs on intentions to smoke of adolescent non-smokers.
- Investigate the moderating role of individual factors (e.g., age, gender, previous smoking exposure, School Type)

5.1 Study Area

This study will be conducted in high schools in Addis Ababa, Ethiopia. Addis Ababa is a city characterized by a robust and multifaceted educational landscape. Addis Ababa boasts a vast network of educational institutions, encompassing 225 high schools, 143 non-governmental and 72 governmental schools. This diversity caters to a wide range of student populations with varying backgrounds and socioeconomic circumstances. highlighting the significant scale and potential impact of research conducted within this setting.

5.2 Study period

- The study was conducted from January 2024 to February 2024 G.C

5.3 Study Design

- AMulti centeric Quasi Experimental study

5.4 Population

5.4.1 Sources population

- All students currently enrolled in high schools in Addis Ababa

5.4.2 Study population

- All students who meet the inclusion criteria

5.5 Sample size

- The sample size for the study was calculated using The formula for **comparing two proportions** proposed by Casagrande, Pike, and Smith (1978). the following assumptions were made,

- Specified significance level (α)= 0.05,
- power (1-β)=0.02
- Desired minimum detectable difference (δ) between proportions as 7%, , based on the finding from A Lebanesse study . [26]
- Based on these assumptions sample size is determined to be 276 for each group and 552 in total.
- Considering 10% non response rate, final becomes 607

5.6 Sampling procedures

This study employs a two-step stratified sampling design to examine the effectiveness of mild versus strong warning images on cigarette packs in influencing the smoking intentions of adolescents

- A stratified random sample of schools was drawn, ensuring representation of both public and private institutions
- Within each selected school, a further stratified random sample of classes was chosen targeting grades 9-12
- Stratification within this step was based on class year (e.g., 9th vs. 12th grade)

5.7 Study Variables

5.7.1 Dependent variable

- Impact related effectivness (emotional reponse and intention to smoke)

5.7.2 Independent variables

- Type of warning image
- Age
- Sex
- School type
- Prior smoking exposure
- Perception about Smoking
- Message related effectivness

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5.8 Inclusion and exclusion criteria

5.8.1 Inclusion Criteria

1. **Age:** 15-20 years old (late adolescents as defined in the proposal).
2. **Smoking status:** Non-smoker (never smoked).
3. **School attendance:** Currently enrolled in grades 9-12 of a high school in Addis Ababa, Ethiopia.
4. **Consent:** Willing to participate and provide informed consent (verbal or written, depending on ethical requirements).
5. **Understanding:** Able to comprehend the study information and instructions in the local language (Amharic or English).

5.8.2 Exclusion Criteria

- **Current smoker:** Individuals who have smoked more than 100 cigarettes in their lifetime.

5.9 Operational definitions

- **Graphic Health Warning Labels (GHWLs):** Visually explicit images and messages on cigarette packs depicting the negative health consequences of smoking.
- **Adolescents:** Defined in this study as students in grades 9-12 (approximately 13-20 years old).
- **Non-smokers:** Individuals who have never smoked cigarettes or have smoked less than 100 cigarettes in their lifetime.
- **Emotional Responses:** Internal subjective experience evoked by GHWLs, such as disgust, fear, sadness, or anger.
- **Perceptions of Smoking:** Beliefs and attitudes towards smoking, including perceived risks, harmfulness, and social acceptability.
- **Anti-smoking Intentions:** intention with regard to future Smoking
- **Weak GHWLs:** Images considered less emotionally evocative and graphic compared to strong GHWLs.
- **Strong GHWLs:** Images considered more emotionally evocative and graphic, designed to elicit stronger reactions.
- **Message related cumulative score**: the sum of the scores selected by the participants on the message related questions. High score if 6 or less.
- **Impact related cumulative score**: the sum of the scores selected by the participants on the impact related questions. High score if 12 or less
- **Perception related cumulative scores**: the sum of the scores selected by the participants on the perception related questions. High score if 12 or less

- **Smoking Exposure:** Having ever smoked a cigarette, even if not currently a smoker.

5.10 Data collection procedure and quality

1. Participants: Non-smokers below 18 years old (e.g., high school) recruited through 2 step stratified sampling
2. Stimulus material
    - In a pilot study A selection of 24 images of different themes from the archieves of tobaccolabels.Ca[26] was presented to a limited group of students, and their subjective emotional responses measured on the SUDS scale. Based on these ratings, the images will be classified as either "Weak" or "Strong" in terms of their perceived warning strength.
    - Using digital image software, each constructed warning was placed on the image of a cigarette pack so that the resulting image was consistent with the Article 11 Guidelines: they occupied 70% of the top part of the package and each was set apart by a thick black box surrounding the warning.
    - Each of the selected images was placed on a mock cigarette pack of the same size to that which is currently in use in Ethiopia. And the image will be displayed electronically to the students.
3. Data Collection: A self-administered questionnaire, structured for quantitative analysis, was used. The questionnaire is derived from a similar study done among Lebannese Adolescents[27] and adapted to our context and it included:
    - Demographic information (age, gender, economic status, exposure to smoking)
    - Likert scale and multiple-choice questions to assess perceptions of smoking, awareness of smoking consequences, and personal intentions.
    - Exposure to two different images: a mild warning image, and a strong warning image related to smoking.
    - Questions about emotional responses evoked by each image, changes in perception of smoking, and potential influence on decision-making.

5.11 Data processing and analysis

After checking for completeness and internal consistency data was entered into SPSS version 26 manually. The descriptive analysis of data is indicated using numerical summary measures and the data presented using frequency tables, figures, and graphs. Bivariate and Multivariate logistic regression is used to show the association between dependent and independent variables.

6) Ethical consideration

The study proposal will be submitted for approval and ethical clearance to the Department of Internal medicine, research, and ethics committee.

Verbal Informed consent will be taken from all the participants. It will be ensured that adequate explanations are given to participants about the study project and their right not to be involved in the study if they don't wish and their ability to withdraw from the study.

7) Dissemination of the results

The results of the study will be presented to Addis Ababa University, College of health sciences, internal medicine department and be submitted for publication in peer-reviewed journals. Findings will also be presented on local and international conferences.

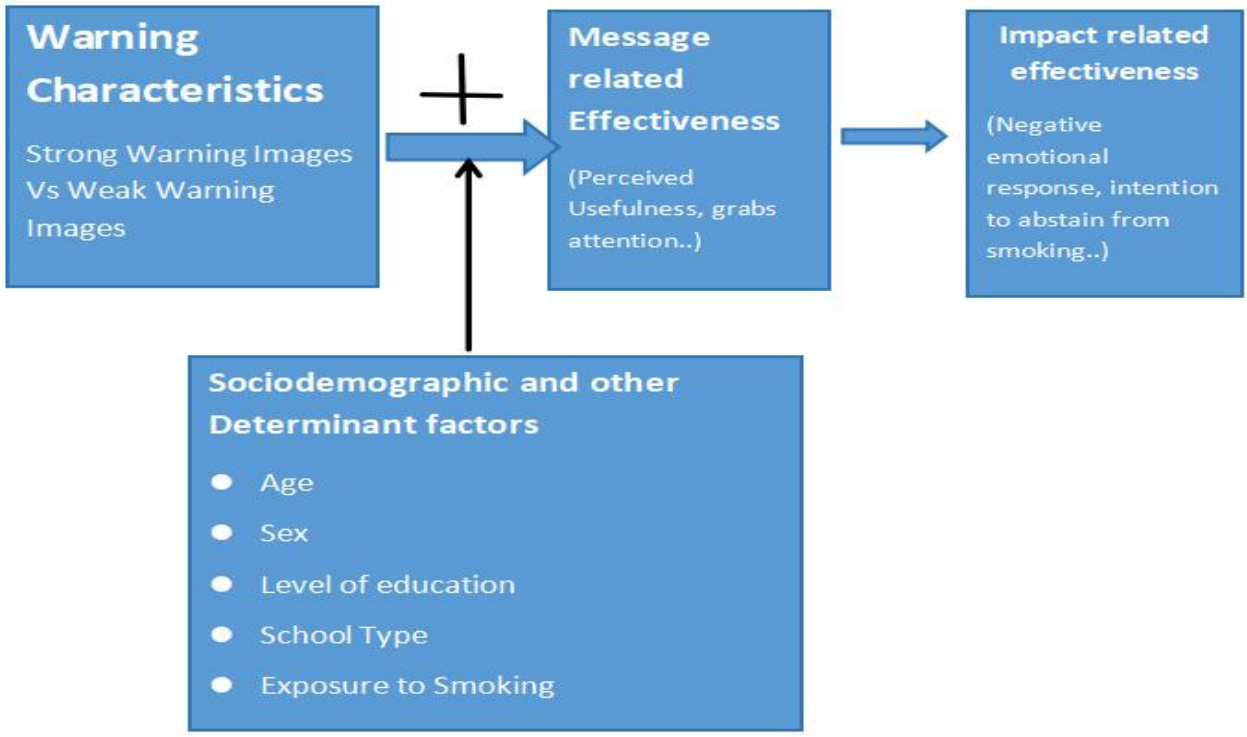
8) Result

Developing the set of pictorial warnings to be tested

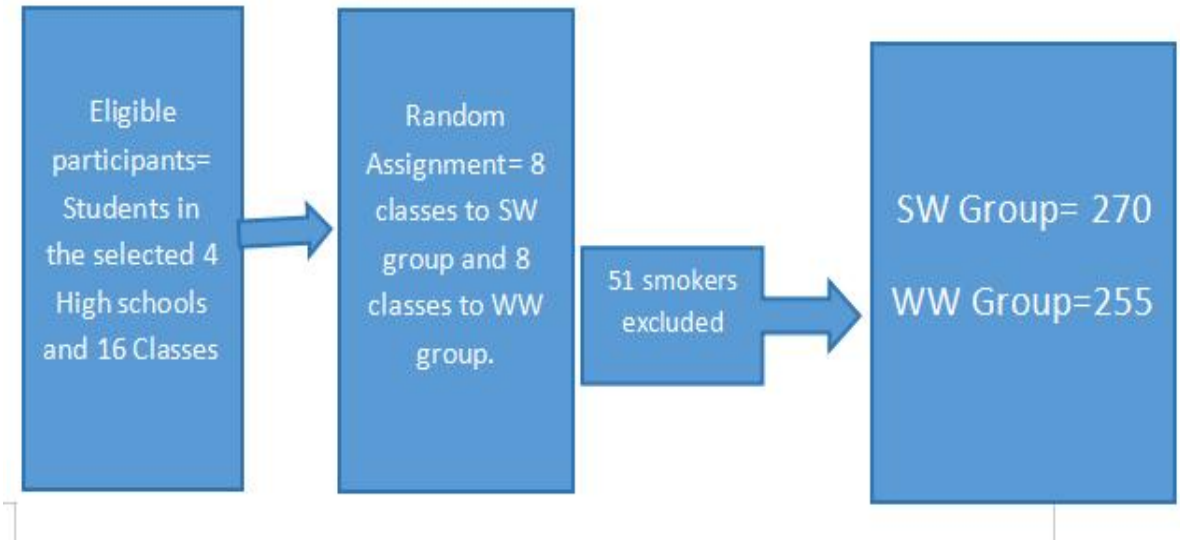
This study utilized existing pictorial warnings from various countries, accessible on a dedicated website (ttp://www.tobaccolabels.ca). These warnings were chosen based on two primary criteria: (1) their perceived relevance to the targeted age groups and (2) their effectiveness in conveying the major health consequences of tobacco use. Following this selection process, eight thematic categories were established, each accompanied by corresponding pictorial health warnings. These themes addressed: dependence, oral disease, increased lung cancer risk, blindness, risk of gangrene and amputation, cardiovascular disease, premature death, and aging.

A total of 24 pictorial warnings were chosen for further testing and were designed to occupy 70% of a mock cigarette pack (see section 13). To assess perceived stress levels associated with the images, a pilot study was conducted. This study involved a class of students with similar demographic characteristics to the target population, who were not included in the main study. Participants (n = 45) rated each image on a 10-point scale based on their perceived stress level. Based on these ratings, the four images perceived to induce the highest level of stress were designated as "strong warning images," while the four images perceived to induce the lowest level of stress were designated as "weak warning images." These images were subsequently used in the main study.

Conceptual frame work



Flow Chart



Baseline Characteristics

A total of 525 students participated in the Study from 4 different high schools. The age of the participants is categorized into three groups: 13-15 years, 16-17 years, and 18-20 years. The majority of the participants fall into the 16-17 years category, accounting for 52.6% of the total. The 13-15 years and 18-20 years categories represent 21.1% and 26.3% of the participants, respectively. The gender distribution among the participants is relatively balanced, with females representing a slightly higher proportion at 54.5%, while males account for 45.5%.

The participants' educational level is also considered, with the data divided into four categories: grade 9, grade 10, grade 11, and grade 12. The largest group of participants are in grade 9, accounting for 29.0% of the total. This is followed by grade 12 students at 23.2%, grade 10 students at 25.5%, and grade 11 students at 22.3%. The type of school the participants attend is also taken into account, with a near-even split between governmental and private schools. Governmental schools account for a slightly larger proportion at 51.4%, while private schools represent 48.6% of the total.

Characteristics	frequency	Percent
Age in years		
13-15	111	21.1
16-17	276	52.6
18-20	138	26.3
Gender of the study participants		
Male	239	45.5
female	286	54.5
Level of education		
grade 9	152	29.0
grade 10	134	25.5
grade 11	117	22.3
grade 12	122	23.2
School type		
governmental	270	51.4
private	255	48.6

Table 1. **sociodemographic characteristics of the study participants at four different high schools, Addis Ababa, Ethiopia,January 2024**

Table 2 presents the baseline characteristics of participants assigned to each group within the study. A convenience sampling approach was employed, whereby all students from the selected classes were invited to participate. This recruitment strategy necessitates acknowledging the potential for unequal distribution of baseline characteristics across the study groups.

		image		
		S-strong warning image	W-weak warning image	Total
		Count	Count	Count
Age in years	13-15	47	64	111
	16-17	134	142	276
	18-20	86	52	138
Gender	male	119	120	239
	female	148	138	286
level of education	grade 9	46	106	152
	grade 10	87	47	134
	grade 11	46	71	117
	grade 12	88	34	122
School type	government	158	112	270
	private	109	146	255
knows a smoker	yes	15	36	51
	no	252	222	474
Score_perception	Low	121	134	255
	high	146	124	270

Table 2. **Baseline characteristics of the study participants at four different high schools, assigned to the two groupd of exposure, Addis Ababa, Ethiopia,January 2024**

Message related Dimensions

The first statement is about the usefulness of the warning graphic. The majority of participants (57.7% SW and 42.3% WW) strongly agreed that the warning was very useful, followed by 42.6% SW and 57.2% WW who agreed. Only a few participants (10% SW and 90% WW) disagreed, and even fewer (9.1% SW and 90.9% WW) strongly disagreed. Two participants (40% SW and 60% WW) neither agreed nor disagreed.

The second statement is about the attention-grabbing effect of the warning graphic. The most common response was agree (58.6% SW and 41.4% WW), followed by strongly agree (56.4% SW and 43.6% WW). A smaller proportion of participants (8.9% SW and 91.1% WW) disagreed, and only two participants (8.7% SW and 91.3% WW) strongly disagreed. Three participants (30% SW and 70% WW) neither agreed nor disagreed.

The third statement is about the perceived risk of smoking addiction after seeing the warning graphic. The responses were more evenly distributed across the scale, with the highest percentage of participants (52.4% SW and 47.6% WW) disagreeing that they might get addicted to cigarettes if they start smoking. The next highest percentage was neither agree nor disagree (50.4% SW and 49.6% WW), followed by agree (60.6% SW and 39.4% WW) and strongly disagree (30.5% SW and 69.5% WW). Only a few participants (57.1% SW and 42.9% WW) strongly agreed with the statement.

	Response with respect to warning level of graphics									
Variable	**SA**		**A**		**N**		**D**		**SD**	
	SW (%)	**WW (%)**	**SW (%)**	**WW (%)**	**SW (%)**	**WW (%)**	**SW (%)**	**WW (%)**	**SW (%)**	**WW (%)**
I thought this warning was very useful	192(57.7	141(42.3	71(42.6	95(57.2	1(10	9(90	1(9.1	10(90.9	2(40	3(60
I thought this warning grabs my attention'	101(56.4	78(43.6	157(58.6	111(41.4	4(8.9	41(91.1	2(8.7	21(91.3	3(30	7(70
After seeing this warning, I feel that if I start smoking, I might get addicted to cigarettes	56(57.1	42(42.9	77(60.6	50(39.4	43(52.4	39(47.6	29(30.5	66(69.5	62(50.4	61(49.6

Table 3. **Response to Message related Questions of the study participants at four different high schools, Addis Ababa, Ethiopia,January 2024**

Analysis of overall message-related responses revealed that at least 53% of participants expressed agreement or strong agreement.

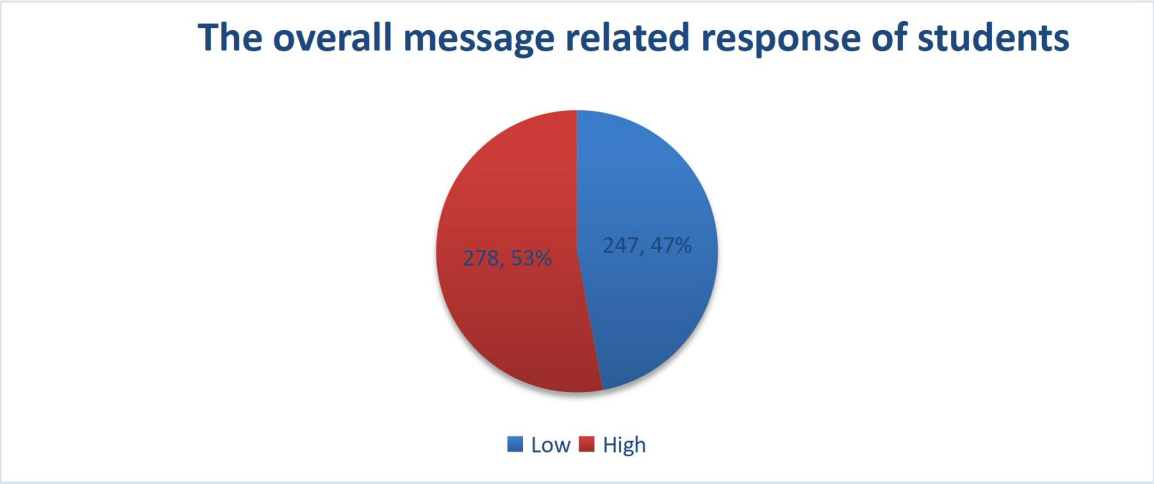


Figure 1 Overall Message related response among study participants at four different high schools, Addis Ababa, Ethiopia,January 2024

When looking at the two groups over all degree of agreement with message related out comes it is evident that 69% of the SW group had a high level of agreement in contrast to 39% of those in the WW group. Analysis using a chi-square test revealed a statistically significant association (p-value < 0.001) between the message intention of anti-smoking warnings and the level of graphic intensity employed. This finding suggests a strong, non-random relationship between the two variables. as shown the figure below.

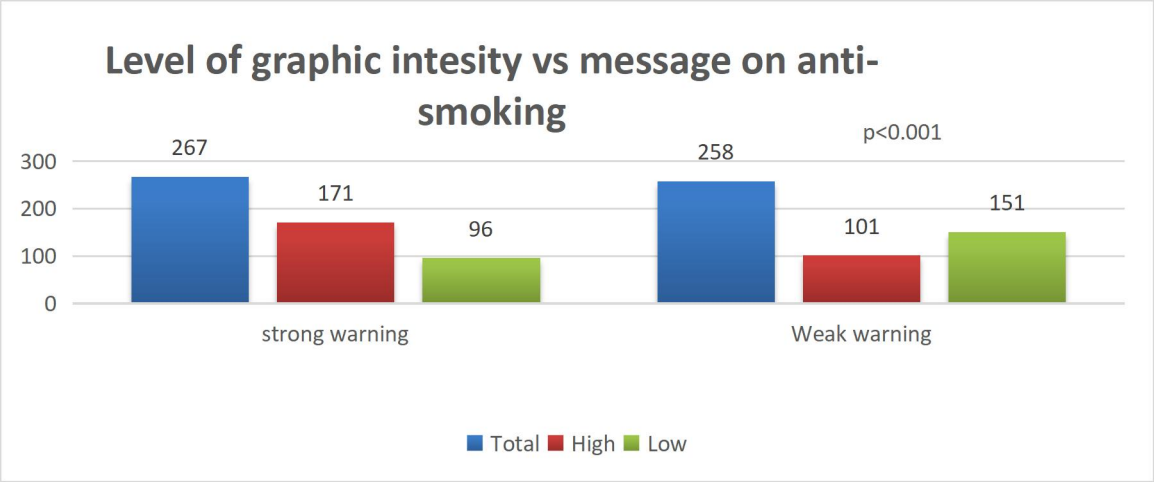


Figure 2: Overall Message related response among study participants based on the level of GHWLs intensity at four different high schools, Addis Ababa, Ethiopia,January 2024

Impact related dimension

The first statement is about the effectiveness of the warning graphic. Most participants (61.1% SW and 38.9% WW) strongly agreed that the warning was very effective, followed by 53.8% SW and 46.2% WW who agreed. Only a few participants (9.1% SW and 90.9% WW) disagreed, and even fewer (7.1% SW and 92.9% WW) strongly disagreed. No participants neither agreed nor disagreed.

The second statement is about the scariness of the warning graphic. This statement had a high level of agreement, with 75.7% SW and 24.3% WW strongly agreeing and 59.6% SW and 40.4% WW agreeing that the warning was very scary. A smaller proportion of participants (4% SW and 93% WW) disagreed, and only one participant (4.1% SW and 95.9% WW) strongly disagreed. Another participant (1.9% SW and 98.1% WW) neither agreed nor disagreed.

The third statement is about the worry induced by the warning graphic. Most participants (62.4% SW and 37.6% WW) strongly agreed that the warning made them more worried about the health effects of smoking than they were before seeing it, followed by 45.4% SW and 54.6% WW who agreed. Only a few participants (3.6% SW and 96.4% WW) disagreed, and

even fewer (15% SW and 85% WW) strongly disagreed. One participant (14.3% SW and 85.7% WW) neither agreed nor disagreed.

The fourth statement is about the confidence boosted by the warning graphic. Most participants (57.6% SW and 42.4% WW) strongly agreed that after seeing the warning, they were more confident that they would not start smoking than before seeing it, followed by 43.7% SW and 56.3% WW who agreed. A smaller proportion of participants (30.6% SW and 69.4% WW) disagreed, and only one participant (12.5% SW and 87.5% WW) strongly disagreed. No participants neither agreed nor disagreed.

The fifth statement is about the intention influenced by the warning graphic. Most participants (57.6% SW and 42.1% WW) strongly agreed that based on the warning, they intended not to start smoking, followed by 45% SW and 55% WW who agreed. A smaller proportion of participants (20% SW and 80% WW) disagreed, and no participants strongly disagreed. Six participants (100% WW) neither agreed nor disagreed.

The sixth statement is about the encouragement inspired by the warning graphic. The responses to this statement were varied, with the highest percentage of participants (56.2% SW and 43.8% WW) strongly agreeing that after seeing the warning, they would encourage their friends and relatives who are non-smokers to remain non-smokers more than they would have before seeing it. The next highest percentage was agree (52.8% SW and 47.2% WW), followed by disagree (40.8% SW and 59.2% WW) and strongly disagree (8.3% SW and 91.7% WW). Three participants (14.3% SW and 85.7% WW) neither agreed nor disagreed.

	Response with respect to warning level of graphics									
Variable	**SA**		**A**		**N**		**D**		**SD**	
	SW (%)	**WW (%)**	**SW (%)**	**WW (%)**	**SW (%)**	**WW (%)**	**SW (%)**	**WW (%)**	**SW (%)**	**WW (%)**
I thought this warning was very effective	162(61.1	103(38.9)	100(53. 8	86(46.2	3(9.1	30(90.9	2(7.1	26(92.9	0	13(100
I thought this warning was very scary	162(75.7	52(24.3	99(59.6	67(40.4	3(4	40(93	1(4.1	47(95.9	1(1.9	52(98.1
This warning made me more worried about the health effects of smoking than I was before seeing it	179(62.4	108(37.6	83(45.4	100(54. 6	1(3.6	27(96.4	3(15	17(85	1(14.3	6(85.7
After seeing this	196(57.6	144(42.4	59(43.7	76(56.3	11(30.6	25(69.4	1(12.5	7(87.5	0	6(100

warning, I am more confident that I will not start smoking than before seeing it'										
Based on this warning, I intend not to start smoking	194(57.6	141(42.1	67(45	82(55	6(20	24(80	0	6(100	0	5(100
After seeing this warning, I will encourage my friends and relatives who are non-smokers to remain non-smokers more than I would have before seeing it	150(56.2	117(43.8	93(52.8	83(47.2	20(40.8	29(59.2	1(8.3	11(91.7	3(14.3	18(85.7

Table 4. Response to Impact related Questions of the study participants at four different high schools, Addis Ababa, Ethiopia,January 2024

When evaluating the over all Impacted related responses at least 78% % of the participants have chosen either agree or strongly agree.

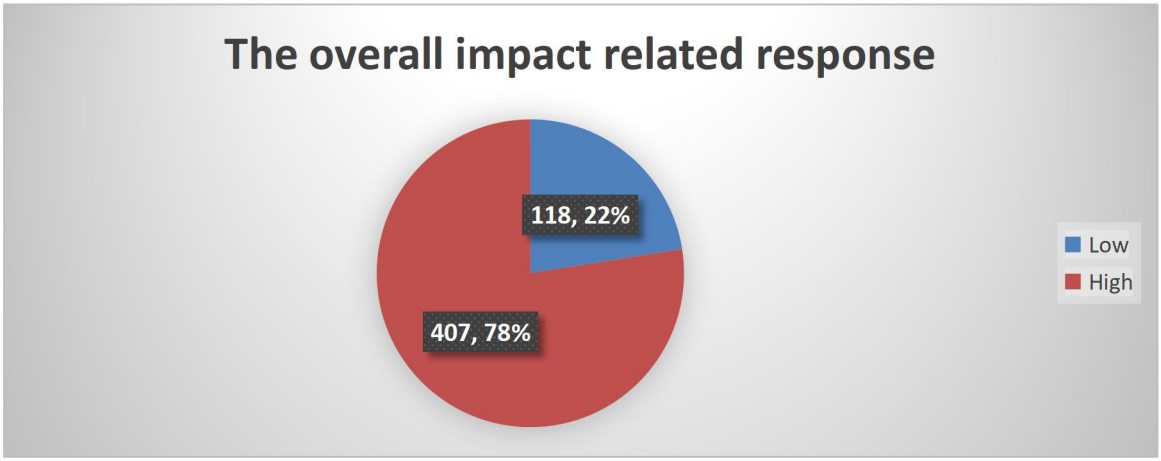


Figure 3: Overall Impact related response among study participants at four different high schools, Addis Ababa, Ethiopia,January 2024

The group that was exposed to SW images showed that 95% of them Scored High on the cumulative impact related outcomes as compared to 58% of the WW group. The correlation between the dimensions related to impact and the degree of graphic intensity was found to be statistically significant. This association was substantiated using the Chi-square test, yielding

a p-value of less than 0.001, which denotes a high level of statistical significance. The specifics of this correlation are graphically depicted in the ensuing figure

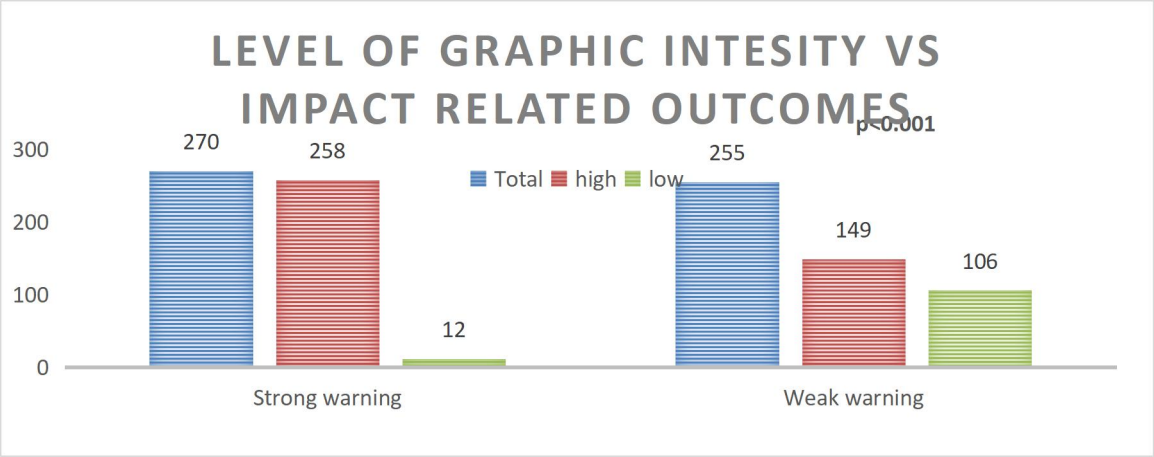


Figure 4 Overall Impact related response among study participants based on the level of GHWLs intensity at four different high schools, Addis Ababa, Ethiopia,January 2024

Analysis of participant confidence regarding their intention to avoid smoking revealed that 68% expressed either agreement or disagreement with the statement" *After seeing this warning, I am more confident that I will not start smoking than before seeing it".*

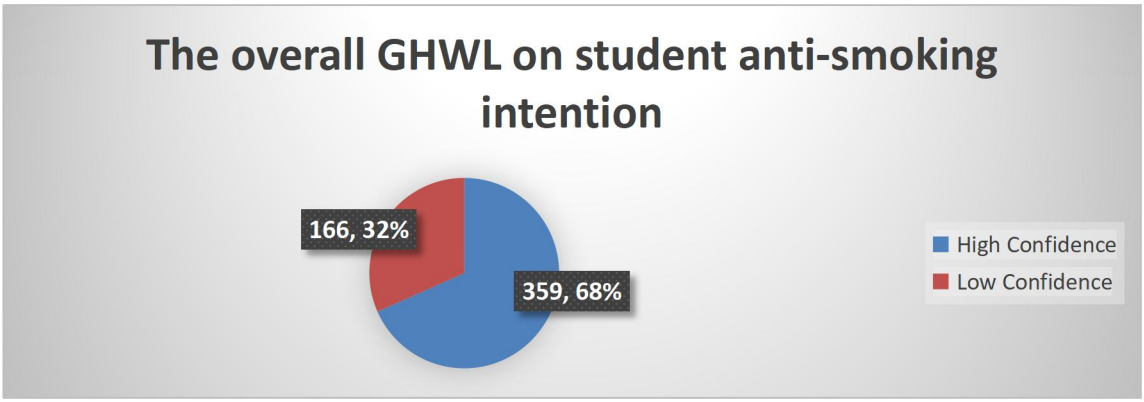


Figure 5: Overall Impact related response among study participants at four different high schools, Addis Ababa, Ethiopia,January 2024

The determinants of anti-smoking intention among student in high schools of Addis Ababa

The bi-variate logistic regression analysis indicated a significant association between the intensity of the graphic warnings viewed by the students, School Type, Knowing a smoker

and percived Message effectivness. a. The multivariate logistic regression analysis further revealed that participants who were exposed to strong graphic warnings were 20.5 times more likely to express that the warning was scary and they intend to abstain from smoking compared to those who viewed less intense warnings (Adjusted Odds Ratio (AOR) = 20.5, 95% Confidence Interval (CI) = (9.47-44.7).

School Type, Knowing a smoker and Percived message effectivness did not show Statistically significant association with Intention to abstain from smoking in the Multivariate analysis. This results are summarized in the following

variable	Cumulative Impact Score		p-value	COR with 95%CI	P-value	AOR with 95%CI
	Low	High				
Intensity of graphics						
Weak warning	109	149				
Strong warning	9	258	<0.01	20.9(7.22, 18.84)	**<0.01**	**20.5(9.47, 44.4)**
school Type						
Private	51	219				
Governmental	67	188	0.043	0.63(0.43,0.98)	0.236	0.724(0.425,1.234)
Knows a smoker						
yes	19	32				
No	99	375	0.09	2.2(1.22,4.13)	0.171	1.644(0.80,3.35)
Percived Message effectivness						
Low	74	173				
High	44	234	0.001	2.27(1.49,3.46)	0.179	1.42(0.85, 2.40)

Table 5. Summary of Multivariate analysis for determinants of smoking Intention of study participants at four different high schools, Addis Ababa, Ethiopia,January 2024

9) Discussion

Exposure to harmful chemicals in cigarette smoke, comprising over 7,000 toxins, poses a significant threat to human health. The severity of these health consequences is directly linked

to the degree of exposure, with chronic and heavy smoking patterns demonstrably amplifying the associated risks. This persistent inhalation of toxins leads to a multitude of adverse health outcomes, impacting both immediate and long-term well-being across various organ systems. These include a decline in overall health, increased susceptibility to acute illnesses and respiratory symptoms, and a higher risk of developing chronic diseases like coronary heart disease, cancer, and chronic obstructive pulmonary disease (COPD).

On a global scale, tobacco use remains a major public health concern, claiming millions of lives annually with projected figures to rise in the future. To combat this escalating epidemic, health warning labels (HWLs) featuring graphic imagery have emerged as a cost-effective and demonstrably effective policy tool. Studies have shown these graphic HWLs to be particularly successful in capturing attention, raising awareness of the detrimental health consequences of smoking, and influencing smoking behaviors. This impact extends beyond current smokers, acting as a deterrent for younger populations who are more susceptible to initiating the habit.

A 2003 study conducted in Addis Ababa, Ethiopia, among school children (grades 8-12) revealed that 7.6% had ever smoked cigarettes, with 6.6% being active smokers. Even more concerning, 12% of the never-smokers were deemed likely to initiate smoking within the following year.

In the past 4 decades there has been an ample evidence to suggests that comprehensive warnings, particularly those incorporating graphic elements and evoking strong emotional responses, are especially impact full in deterring smoking initiation among youth.(3) Participants of these studies had consistently rated pictorial warnings as more effective than text-only labels in motivating smokers to quit, deterring youth from initiating tobacco use, and raising public awareness of smoking's detrimental health consequences.[11] Encouraged by the 2008 FTCT Article 11 recommendation close to 122 countries are effectively leveraging GHWLs By increasing their size, placement, graphic impact, and coverage, to educate consumers, raise awareness of the detrimental health consequences, and ultimately encourage cessation behaviors.

This study aimed to investigate the effectiveness of anti-smoking graphic warnings on students in high schools of Addis Ababa, Ethiopia. The research employed a convenience

sampling approach, recruiting a total of 525 participants from four different high schools. The study explored the impact of the graphic intensity of the warnings on participants' perceptions and intentions regarding smoking.The participants were predominantly female (54.5%), with ages ranging from 13 to 20 years.The majority of participants were in grade 9 (29%) and from governmental schools (51.4%).

An analysis of message-related outcomes revealed a significant disparity in agreement levels between the strong warning (SW) and weak warning (WW) groups. Notably, 69% of participants in the SW group exhibited a high level of agreement compared to just 39% in the WW group. This statistically significant difference (p-value < 0.001) obtained through a chi-square test suggests a robust and non-random association between the message effectiveness of anti-smoking warnings and the employed level of graphic intensity. This indicates that stronger warnings were perceived as more effective tools of anti-smoking message communication.

The statement regarding potential addiction following smoking initiation ("After seeing this warning, I feel that if I start smoking, I might get addicted to cigarettes") yielded a range of participant responses. While a substantial percentage within both the strong warning (SW) and weak warning (WW) groups expressed strong agreement (57.1% and 42.9%, respectively), a noteworthy proportion also exhibited disagreement or neutrality. This observed heterogeneity in perceived addiction risk highlights the necessity for further research to evaluate the efficacy of alternative risk communication strategies in specifically targeting and influencing this particular perception.

Participants exposed to strong warning (SW) images displayed a significantly higher cumulative impact score compared to those exposed to weak warning (WW) images. Specifically, 95% of the SW group scored high on the cumulative impact scale, while only 58% of the WW group achieved the same level. This finding aligns with a statistically significant correlation (p-value < 0.001) observed through a chi-square test, indicating a strong association between the degree of graphic intensity and the impact dimensions. This implies that exposure to stronger warnings is linked to a greater cumulative impact on participants.

These results align with similar studies done in Lebanon, China,and Thailand which showed that Graphic images are effective ways of delivering anti smoking messages, eliciting strong emotional responses and encouraging non smoker young adults to avoid smoking initiation.[27] [11]

Several factors were identified influencing the intention to avoid smoking. Participants exposed to strong graphic warnings were significantly more likely to have an intention to abstain from smoking compared to those who viewed weak warnings. Age, Gender, School Type , Having a family or friend smoker and baseline perception of smoking did not show any correlation with intention to avoid smoking.

Conclusion and recommendations

This study investigated the effectiveness of anti-smoking graphic warnings on students in Addis Ababa high schools. The findings suggest that strong warning images are more impactful than weak warning images. Students exposed to strong warnings showed: Higher agreement with the effectiveness of the Strong GHWL to Convey anti smoking messages, to elicit stronger negative emotions and impact on their anti-smoking intentions.These results support the use of graphic health warnings as a tool to deter smoking initiation among youth.

Based on the study's findings, we can recommend that Policymakers should consider implementing the use of stronger graphic warnings on cigarette packaging in Ethiopia. Educational campaigns can be developed to complement the impact of graphic warnings, further raising awareness about the dangers of smoking. Future research can explore the long-term effects of graphic warnings on smoking behavior among Ethiopian youth.

10) Limitations

The Principal limitation of the study was the use of Convenience sampling, potentially affecting the generalizability of the results. Additionally, The study only assessed short-term impacts on participants' intentions, not actual smoking behavior. Additional factors

influencing smoking initiation (e.g., peer pressure) were not explored. These limitations highlight the need for further research with more robust methodologies to strengthen the current findings.

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12) Annex

12.1 participant information sheet and informed consent

Good morning, dear participant! My name is _____. I am working as a data collector for the study being conducted to evaluate the effectiveness of Graphic warning labels on Cigarette packs in preventing smoking initiation among teenagers conducted by Dr. Mahfuz Ahmed (Final year internal medicine resident).

Your participation in this study will only be based on your willingness. You have the right to choose not to take part in this study and to stop participating at any time or withdraw without giving any reason. Your personal data used in the study, will be handled in a strictly confidential way and your name will not be registered,

Once you provide your personal data you will be exposed to a series of images that contain graphic warnings displayed on cigarette packs. After viewing the images you will fill the subsequent questinoaire.

There will be no direct benefit by participating in this study but in the future, information gathered by this study will help policy makers, programmers, physicians, and researchers to give appropriate attention on the issue and design specific preventive and treatment options. You will also be referred to lung specialists for further treatment if you are found to have this problem.

Consent form

I have read/ It was read to me the participant information sheet. I have clearly understood the purpose of the research, the procedures, the risks and benefits, issues of confidentiality, and the rights of participating. I have been given the opportunity to ask questions for things that may have been unclear. I was informed that I have the right to withdraw from the study at any time or not to answer any question that I do not want. Therefore, I declare my voluntary consent to participate in this study with my initials (signature) as indicated below.

Name of participant: _____ Signature of participant: _____

Name of Data collector _____Signature of Data collector_____

Questionnaire on Tobacco Warning Label Effectiveness

Thank you for taking part in this survey! We are interested in understanding how people perceive and respond to tobacco warning labels. Your honest answers will help us improve the effectiveness of these warnings in promoting healthy choices.

Part 1: Demographics

1. Age: _____ (years)
2. Gender: ____ (Male, Female)
3. What grade are you? _____
4. Do you attend in Governmental or Private school? ____ 1. Governmental 2. Private

Part 2: Exposure assessment

5. Have you ever tried smoking a cigarette? ____ (Yes), (No)
6. If yes How frequently do you smoke?
    1. I have tried smoking on one or a few occasions but doesn't smoke regularly.
    2. I Smoke occasionally, perhaps a few times a month or less.
    3. I Smoke cigarettes daily or weekly
7. Is there anyone in your family who smokes?_____(yes) (No)

Part 3: Perceptions of Smoking

On a scale of 1 (Strongly Disagree) to 5 (Strongly Agree), how much do you agree with the following statements about smoking?

No	Statements	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1.	Smoking makes you look cooler.					
2.	Smoking is dangerous and can harm your health.					
3.	Trying a cigarette once won't lead to addiction.					
4.	Smoking is expensive and a waste of money.					
5.	Smoking can cause serious illnesses like cancer and heart disease					

Part 4: Message and Impact

Please consider the most recent cigarette warning label you saw and answer the following questions: thick on the box which reflects your opinion of the statement

No	Statements	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1.	I thought this warning was very useful					
2.	I thought this warning grabs my attention’					
3.	After seeing this warning, I feel that if I start smoking I might get addicted to cigarettes					
4.	I thought this warning was very effective					
5.	I thought this warning was very scary					
6.	This warning made me more worried about the health effects of smoking than I was before seeing it					
7.	After seeing this warning, I am more confident that I will not start smoking than before seeing it’					
8.	Based on this warning, I intend not to start smoking					
9.	After seeing this warning, I will encourage my friends and relatives who are non-smokers to remain non-smokers more than I would have before seeing it					

12.2 Selected images for the study

Weak Warning Images

Strong Warning Images