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Community-based quit smoking intervention in Sarawak, Malaysia

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ABSTRACT

Rising worldwide adolescent smoking necessitates national and global research to establish intervention methods. This research evaluated the efficacies of ask, advise, assess, assist, arrange (5A's) and ask, advise, act (3A's) interventions. Self-reported quit-smoking attempts were the outcome measure. Six villages were randomly selected and equally divided into three groups: 5A's, 3A's, and control (no intervention). There were 519 current participant-smokers aged 13-17 followed-up by phone (first and third months) and face-to-face interviews (sixth and ninth months). Most 3A's participants (n=12, 7.1%) quitted smoking in the first month, followed by the 5A's (n=9, 5.3%) and the control (n=3, 1.9%). In the third month, 5A's participants topped the rank (n=16, 10.7%), followed by the 3A's (n=14, 9.2%), and control (n=5, 3.4%). As per sixth-month follow-up, the 5A's group maintained its position on top of the list (n =27, 21.4%), followed by the 3A's (n=22, 17.1%) and the control (n=5, 4.0%). The majority of 5A's participants quitted smoking after nine months (n=36, 33.0%), followed by the 3A's (n=27, 25.5%), while control maintained its position (n=5, 5.0%). Division health officers and school health-teams nationwide should implement them.

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1. INTRODUCTION

As adolescent smoking prevalence rises globally, national and global-level research is necessary to determine patterns and variables and develop intervention programs to curb its adverse consequences [1]. According to the centre for disease control analysed global youth tobacco survey (GYTS) data in 61 countries, the median of current smoking prevalence among adolescents aged 13 to 15 was 10.9%, with Sri Lanka and Timor Leste reporting the lowest (1.7%) and highest (35.0%), respectively [2]. Adolescent smoking prevalence data in the world's poorest countries are limited. Jallow *et al.* [3] reported a 16.7% prevalence in the Gambia, whereas Seychelles (20.2%) and Zimbabwe (16.2%) recorded a high incidence rate of adolescent smoking [2].

In Malaysia, smoking has been associated with cancer, cardiovascular disease, and premature death [4]. Smoking has killed approximately 20,000 Malaysians, and if the trend continues, the mortality rate

might rise to 30,000 by 2020 [5]. Additionally, smoking accounts for one-fifth of disability adjusted life years (DALYs) and one-third of life lost in Malaysia [6]. In recent years, smoking-related morbidity and mortality rates remained constant as roughly half of the male adults and one-quarter of 13 to 15-year-old adolescents engaged in smoking [7]. These findings reflected the national and state-level on adolescent-smoking prevalence in Malaysia. The inaugural GYTS revealed that 20.2% of 13 to 15-year-old adolescents (36.3% males) and (4.2% females) smoked in 2003; however, an 18.2% decrease in active adolescent smokers was reported in 2009. In Malaysia, a more recent study depicted that 14.2% of 10 to 19-year-old adolescents smoked with a prevalence of 24.3% and 3.7% in males and females, respectively [8].

Adolescents' impulsive and peer-influenced character leads them to illegal and harmful drugs, which include a socially acceptable drug, tobacco [9]. Tobacco abuse causes premature mortality, cardiovascular diseases, and lung cancer [10]. Adolescent smokers also engage in risky behaviours such as premarital sex, alcohol use, and drug abuse, which might increase the risk of lung, bowel, and cervical cancers [11], [12]. Given the significant health risks associated with adolescent smoking, more effective smoking prevention and cessation measures are necessary.

Treatments may considerably reduce smoking prevalence by curbing initiation or boosting cessation. Smoking cessation programs are classified into population-level and individual-level [13]. Brief advice, medication, and behavioural assistance may help individuals quit smoking. The 5A's brief smoking cessation is an evidence-based smoking cessation model [14], comprising five main facets or strategies: i) Ask patients regarding smoking every time they visit; ii) Advise smokers to quit smoking; iii) Assess their willingness to attempt quitting; iv) Assist their efforts through treatment and referrals; and v) Arrange follow-up sessions to assist smokers' cessation efforts [14].

The ask, advise, act (3A's) model is a simplified ask, advise, assess, assist, arrange (5A's) model [15], which is believed to address the time constraints associated with executing the 5A's intervention model [16], [15]. The national centre for smoking cessation training (NCSCT) in the United Kingdom defined the 3A's intervention as "very brief advice" (VBA), consisting of three main steps: i) "Ask" patients' about tobacco consumption; ii) "Advise" them on the most effective strategy of quitting is a mix of medicine and behavioural therapy; and iii) "Act" by aiding them in achieving smoking cessation [17]. The 3A's technique involves inquiring about smoking habits, advising on the benefits of stopping, and responding to the patient's responses. This quick course takes about a minute. The 3A's approach has been acknowledged as a suitable alternative to this frenetic atmosphere [17].

The dearth of data on the efficacy of teenage smoking reduction activities in Malaysia necessitates studies on effective non-pharmacological interventions [10]. This study is the first attempt to compare the effectiveness of various non-pharmacological interventions by measuring participants' carbon monoxide (CO) levels and nicotine dependency. Most adult smokers began smoking as teenagers and continued until adulthood due to complex behaviours and several variables. Adolescent smoking has been linked to preventable chronic conditions, hence the present research findings might be tailored towards reducing adolescent smoking and the risk of adult diseases. The results will assist the Malaysian ministry of health, practitioners, and policymakers innovate quit-smoking policies and programmes. It is crucial to pinpoint effective behavioural interventions for smoking cessation and to segregate available funds accordingly [18]. In this context, this study aimed at determining the efficacy of the 5A's or 3A's smoking cessation interventions among secondary school-aged adolescents in Malaysia. The findings contribute to the body of knowledge regarding whether the 5A's or 3A's models can effectively implement smoking cessation programs in Malaysian secondary school students.

2. RESEARCH METHOD

2.1. The setting, population, and sampling

The study employed a three-arm cluster randomised controlled trial with a parallel design. The experimental groups were divided into two treatment groups: i) Smokers receiving 5A's and 3A's smoking cessation behavioural interventions; and ii) One control group receiving no intervention. The study population involved male secondary school students residing in Sarawak's Samarahan and Asajaya districts. They were recruited regardless of their socioeconomic backgrounds and ages.

The cluster randomized control trial research was conducted in rural villages of Kota Samarahan and Asajaya districts consisting of 99 villages. However, only 29 villages were included in this study due to the fact that they met the inclusion criteria. The study reached a total of 764 adolescent smokers within the age group of 13 to 17 years old. However, only 600 of them gave consent to participate voluntarily in the study, while 164 parents did not consent, even though their children were interested in being study participants. A total of 81 adolescents nevertheless were excluded from this study after age matching was performed, making the final number of respondents of this study was 519 participants. The response rate was 78.53%.

Six villages in the Samarahan district were selected. Two villages were chosen randomly to enrol 5A's, 3A's, and control groups. Six villages were selected in the district of Asajaya utilising the same method. A baseline survey of secondary school students' socio-demographic characteristics and smoking habits was conducted in each village.

During the baseline survey, students were required to answer whether they had smoked in the preceding 30 days. If the response was "No," the breath carbon monoxide level was measured for verification. Students determined as smokers based on the carbon monoxide test results were required to answer the smoking characteristics once again. They were included in the analysis if the result corroborated their responses as shown in Figure 1.

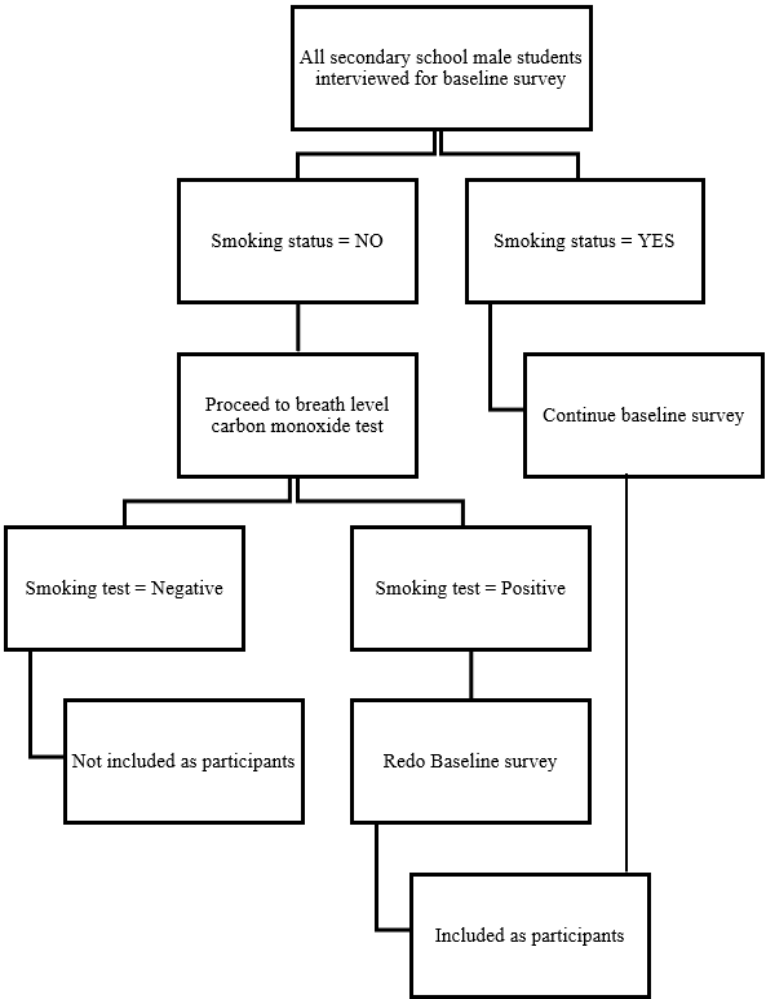

Figure 1. Schematic diagram of the sampling procedure

A simple formula for calculating sample size with 95% confidence interval is as follows: i) Size per group=c$X\pi_1(1-\pi_1)+\pi_2(1-\pi 2)/(\pi_1-\pi_2)^2$; ii) Where c=7.9 for 80% power (utilised in this study); and iii) π_1 and π_2 are the proportion estimates [19]. As per this study, π_1=0.176 (17.6%) and π_2=0.053 (5.3%). Thus, size=7.9((0.176(1-0.176)+0.053(1-0.053))/(0.176-0.053)^2)=103 (each group)x70%+103=175 (each group).

2.2. Participation and follow-up

The study reached a total of 764 adolescent smokers within the age group of 13 to 17 years old. However, only 600 of them gave consent to participate voluntarily in the study, while 164 parents did not consent, even though their children were interested in being study participants. A total of 81 adolescents nevertheless were excluded from this study after age matching was performed, making the final number of respondents of this study was 519 participants as presented in Figure 2.

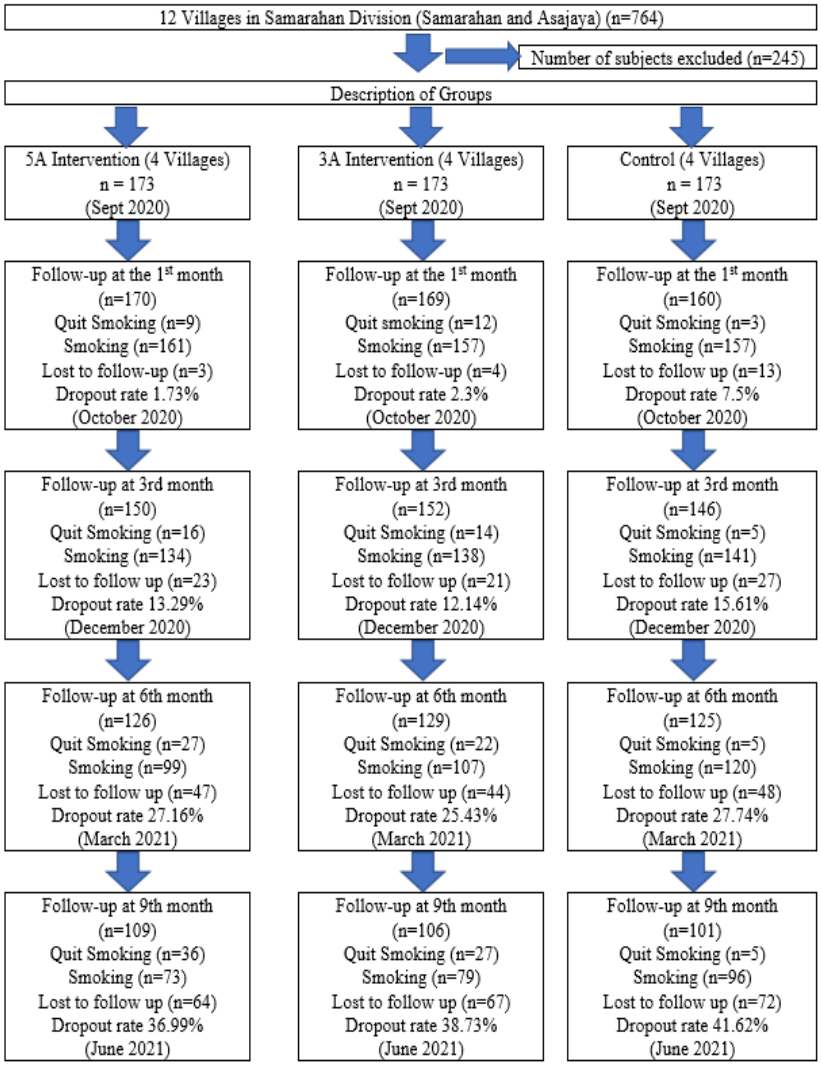

Figure 2. Flow diagram of consolidated standards of reporting trials (CONSORT) of the participant's progress

2.3. Intervention and follow-up

2.3.1. Intervention

The 3A's intervention consisted of ask, advise and act. It took approximately three minutes for each session [5]. Meanwhile, the 5A's intervention consisted of ask, advise, assess, assist and arrange [5].

2.3.2. Follow-up

During the first visit to the villages, all the respondents had a face-to-face session with facilitators. A baseline survey was carried out, and the intervention was conducted according to the intervention group consisting of 3As, 5As and the control group. The questionnaires were divided into several parts, comprising respondents' socio-demographic status, smokers' characteristics, level of nicotine dependence, and stage of change using the contemplation ladder. In the first and third months of the baseline study, all respondents in the intervention and control groups were followed up by a telephone call or WhatsApp message.

During the follow-up call, all respondents were inquired about their average number of cigarettes consumed per month in the last month and their progress in quitting smoking. Each respondent was scheduled for face-to-face examination and evaluation of carbon monoxide in breath in the sixth and nine months. During the 6th month of follow-up, the intervention was performed again according to their groups. Respondents were surveyed regarding their motivation stage, level of nicotine dependence, the number of cigarettes smoked per month, and whether they had already quit smoking or not, accompanied by a piCO smokerlyser check. However, during the ninth-month follow-up, no intervention was provided to participants in the 3A's and 5A's groups.

2.3.3. Measures

In this study, smokers referred to adolescents who smoke at least one cigarette stick in the past 30 days [20]. Quit smoking was measured by self-reported quit-smoking in 30 days. Background characteristics included variables such as age, gender, ethnicity, religion, father's and mother's education levels, household income, and presently smoking family members. This section consisted of eight questions. Smoking characteristics considered the respondents' smoking initiation time, the onset of regular smoking, and the number of cigarettes smoked per day. There were three questions in this section [21].

The level of nicotine dependence was assessed by the Fagerström Test for Nicotine Dependence (FTND) that mainly measured the levels of nicotine dependence [5]. The motivation level and stage of change were measured utilising the contemplation ladder questionnaire [22]. We also employed instrument (piCO+CO monitor). The piCO Smokerlyzer is a multi-patient carbon monoxide monitor used in smoking cessation programs and research by healthcare professionals. The sensitivity level was 84.7%, while the specificity level was 65.5% [23].

2.3.4. Data collection instruments

The 3A's and 5A's interventions groups and the control group participated in a baseline survey. The questionnaires were divided into several sections, consisting of students' socio-demographic status, tobacco use characteristics (determined by assessment and recording), level of nicotine dependence, and stage of change (determined by the contemplation ladder), respectively. Additionally, the carbon monoxide concentrations were measured using the piCO+CO monitor for validating the quit smoking result.

2.3.5. Data entry and analysis

All data entry and analysis were performed using the statistical package for social sciences (SPSS), Version 27 [24]. Results were presented in a frequency table, while means and standard deviations were used to summarize the numerical data. In contrast, absolute numbers and percentages were used for categorical data. Other numerical variables such as the age of smoking onset, age of regular smoking, and total cigarettes smoked in a day were analysed using the Kruskal-Wallis H test to determine the relationship between control and intervention. The association between the categorical variables, such as father's education, mother's education, family's income, and smokers among family members were assessed using the Chi-square test. Cochran's *Q* test was employed to determine the number of participants quitting smoking from previous time points. Finally, a binary logistic regression model was fitted to identify the factors associated with quitting smoking between the intervention and control groups. A p-value of 0.05 was set for statistically significant relationships.

2.3.6. Ethical issues

The faculty ethics committee approved the research. Written informed consent was obtained from both parents or guardians and participants. All participants were briefed and volunteered to participate in the study. District offices and local councils granted permission for data collection in their respective localities.

3. RESULTS AND DISCUSSION

3.1. Results

3.1.1. Characteristics of the students

The mean standard deviation (SD) age for the 5A's, 3A's, and control groups was 14.88 (1.10). In terms of father's education level, the majority of them in 5A's (n=138 subjects), 3A's (n=147 subjects), and control (n=141 subjects) groups completed secondary school, but the difference was not statistically significant ($p>0.05$). The mother's education level was identical, with most participants in 5A's (n=106 subjects), 3A's (n=123 subjects), and control (n=113 subjects) groups completing secondary school. The mean SD=2891.14 (699.50) family income across the three groups was statistically significant ($p<0.05$). Regarding smoking among family members, 5A's group had the highest numbers of non-smokers (n=106 subjects) while the 3A's (n=102 subjects) and control groups (n=100 subjects) had significantly higher ($p<0.05$) numbers of smokers among family members as shown in Table 1.

3.1.2. Characteristics of the smokers

The mean SD and mean rank age at which participants began smoking for the 5A's (13.93 [0.83], 238.40); 3A's (14.29 [1.11], 284.12); and control groups (14.06 [0.89], 257.48) were statistically significant ($p=0.010$). However, the mean SD and mean rank age at which participants smoked regularly for the 5A's (14.10 [0.91], 243.76); 3A's (14.33 [1.07], 272.39); and control groups (14.21 [0.89], 263.85) were not statistically significant ($p=0.152$) as shown in Table 2. Likewise, the mean SD and mean rank age for total

cigarettes smoked in a day for the 5A's (3.93 [0.60], 368.27); 3A's (1.47 [1.05], 146.55); and control groups (2.79 [1.52], 265.18) were statistically significant (p<0.001).

Table 1. Demographic characteristics of the participants (n=519)

Characteristics	Group 5A (n=173)	3A (n=173)	Control (n=173)	Statistic	p-value
Age					
13	17	17	17		
14	51	51	51		
15	54	54	54		
16	38	38	38		
17	13	13	13		
*f*Age (years), mean±SD	14.88±1.10	14.88±1.10	14.88±1.10		
Father's education§					
Primary school	25	14	23		.397
Secondary school	138	147	141		
Pre-university	10	12	9		
Mother's education§					
Primary school	30	28	25		
Secondary school	106	123	113		.201
Pre-university	37	22	35		
Family's income§					
0-2,000	15	32	34	Median=3,000 Mean (SD)=2,891.14 (699.50) Min, 900; Max, 5,100	.022*
2,001-3,000	88	95	85		
>3,000	70	46	54		
Smokers among family members§					
Yes	67	102	100		<.0001***
No	106	71	73		

Table 2. Smoking characteristics of the participants (n=519)

Smoking characteristics	Group 5A (n=173)	3A (n=173)	Control (n=173)	p-value
Age started smoking				
*f*age (years), mean SD	13.93±0.83	14.29±1.11	14.06±0.89	.010*
Mean rank	238.40	284.12	257.48	
Age regular smoking				
*f*age (years), mean±SD	14.10±0.91	14.33±1.07	14.21±0.89	.152
Mean rank	243.76	272.39	263.85	
Total cigarettes smoked in a day				
*f*total cigarettes, mean±SD	3.93±0.60	1.47±1.05	2.79±1.52	<.001***
Mean rank	368.27	146.55	265.18	

*p<.05, **p<.01, ***p<.001; *f*p-value obtained from the test of Kruskal-Wallis H

3.1.3. Quit-smoking at different follow-up

Cochran's *Q* test determined if the number of participants who could quit smoking varied between time points. The number of participants who could quit smoking was statistically and significantly different at each time point, $\chi 2(3)=91.450$, p<0.001. Exact McNemar's tests assessed all pairwise comparisons. In comparison to the baseline of participants who were able to quit smoking, there was a statistically significant increase in the number of them following the first month (p<0.001), the third month (p<0.001), the sixth month (p<0.001), and ninth month follow up (p<0.001) as shown in Table 3.

Table 3. Quit-smoking at different follow-up

Follow up	Quit smoking								£p-value
	First month		Third month		Sixth month		Ninth month		
	Yes	No	Yes	No	Yes	No	Yes	No	
Baseline	24	292	35	281	54	262	68	248	.001
*f*p-value	.001***		.001***		.001***		.001***		

*p<.05, **p<.01, ***p<.001; *f*p-value obtained from the test of McNemar; £p-value obtained from Cochran's Q test

A binomial logistic regression analysis was conducted to ascertain the effects of 5A's, 3A's, and control interventions on participants' likelihood of quitting smoking while controlling the other variables.

The variables were father's education, mother's education, age, family income, total cigarettes smoked per day, whether family members were smokers, motivation level, Fagerstrom score, and carbon monoxide level. The logistic regression model was statistically significant at the first-month, ninth month ($\chi^2(13)=82.262$, $p<0.01$).

For the ninth month follow-up, the independent variables explained 22.9% (Cox and Snell R square) to 35.4% (Nagelkerke R square) of quitting smoking status variance. The goodness of fit was not statistically significant, indicating a well-fitted model with homogeneity. Additionally, it could classify 82.0 % of the cases correctly. The smoker among 5A's group adjusted odds ratio (AOR)=19.883, 95% confidence interval (CI): 5.900,67.004), 3A's group (AOR=10.362, 95% CI: 3.333,32.214), mother education in secondary school (AOR=4.289, 95% CI: 1.339,13.741) and motivation level (AOR=2.488, 95% CI: 1.795,3.447) were significant predictors of quit smoking status. The 5A's group was 19.883 times more likely to stop smoking than the control group without intervention at the ninth-month follow-up. However, 3A's group was 10,362 times more likely to quit smoking than the control group without intervention. Mother education in secondary was 4,289 times more likely to quit smoking than the primary school education. An increase in motivation level was associated with an increased likelihood of quitting smoking as shown in Table 4.

Table 4. Factors affecting quit smoking among adolescents at ninth month follow up: binary logistic regression analysis

Variables	β	Ninth month	
		AOR	95% CI
Group			
Control (RC)			
5A	2.990	19.883***	5.900,67.004
3A	2.338	10.362***	3.333,32.214
Father's education			
Primary school (RC)			
Secondary school	0.281	1.324	0.443,3.955
Pre-university	0.890	2.436	0.476,12.459
Mother's education			
Primary school (RC)			
Secondary school	1.456	4.289*	1.339,13.741
Pre-university	0.426	1.531	0.375,6.255
Age	-0.178	0.837	0.573,1.222
Family income	0.000	1.000	1.000,1.001
Total cigarettes smokes in a day	0.168	1.183	0.816,1.716
Motivation	0.911	2.488***	1.795,3.447
Fagerstrom	-0.085	0.919	0.669,1.261
Carbon monoxide (PPM)	-0.133	0.875	0.701,1.093
Smokers among family members			
Yes	-0.389	0.677	0.342,1.343
No (RC)			
Constant	-4.626	0.010	
Model chi-square (df)		82.262 (13) ***	
n		316	
Goodness of fit		7.961 (8); 0.437	
Nagelkerke R square		0.354	
Cox and Snell R square		0.229	

*p<0.05;**p<0.01;***p<0.001; Dependent variable=quit smoking status (yes vs. no).
RC=reference category; AOR

3.2. Discussion

The smoking age group for all groups in this study was similar to Lim *et al.* [7]. In terms of parental education, most groups had identical father and mother education levels of up to secondary school, which is consistent with the findings of Kuntz and Lampert [25], although not statistically significant. Regarding household income, most participants in this study earned between RM 2,000 and RM4,000. It is in line with the findings of Nur Atikah *et al.* [26]. Similarly, previous research has demonstrated that socioeconomic status and personal income were significant determinants of smoking risk [27]. The present analysis deduced that most participants lived with smokers in their families. Adolescents' intentions to smoke have also been connected with parental or sibling tobacco use and perceived parental approval of smoking [28], [29]. These relationships might be attributed to various factors, including children modeling behaviours, beliefs, expectations, and attitudes of their parents, perceived parental approval of smoking, and possibly some degree of genetic predisposition [30]. It can be inferred from this study that most participants began smoking and were regular smokers at the age of 14. Individuals between the ages of 14 to 18 years were most prone to

develop a smoking habit and be addicted for the rest of their lives. This stage of development depicts the maturation of adolescents, during which they choose lifestyle choices and envision their future selves [31].

Most smokers smoked at least 1 to 4 cigarettes per day in this study, which corroborates a previous study by Lim *et al.* [7]. Although the number of cigarettes smoked each day was minimal, researchers discovered that adolescents who smoked even a few cigarettes had smaller and fewer linked brain areas than their non-smoking counterparts. This suggests that the brains of adolescent smokers develop and function differently, affecting their decision-making and self-control in adulthood. Cigarettes contain nicotine, a neuroactive chemical and addictive substance that primarily affects the brain. Nicotine stimulates dopamine release through nicotinic acetylcholine receptors (nAChRs)-in human brains. Dopamine is a feel-good chemical that triggers a pleasurable response in the brain, playing a critical part in developing nicotine addiction [32].

Additionally, this study discovered that smokers with a high degree of motivation had a higher level of abstinence while attempting to quit smoking [33]. Youth's response to cessation treatment may also be influenced and closely related to their quit-smoking intrinsic motivation (i.e., motivations derived from internal factors such as personal enjoyment or interest) or extrinsic motivation (i.e., motivations derived from external factors such as reward gain or punishment avoidance) or focused motivations [34]. This study acknowledged that children born and raised by mothers with a lower level of education were more likely to become adolescent smokers as a result of their mothers' lack of concern and supervision. In comparison, mothers with a higher education safeguard their children from smoking at an earlier age, hence reducing adolescent smoking behaviours [35]. Moreover, parents who are educated about the risks and consequences of smoking are better prepared to raise their children in a spiritually and physically healthy environment [36].

However, there was a significant difference in smoking cessation effectiveness between the intervention and control groups at the ninth-month follow-up. Compared 3A's to 5As behavioural therapy, 5A's have more components namely assess, assist and arrange, are the 5A's extra strengths compared to 3A's that focus on the physiological, psychological, social, and environmental aspects of smoking and nicotine dependence, thus decreasing nicotine dependence level [37]. As medical health practitioners did this study, it helped to improve quit smoking among adolescents as the implementation of the 5A's and 3A's by physicians is effective in increasing tobacco cessation and quit attempts among patients and engagement among patients [37]. The increased abstinence in the 5A's group was due to 5A's behavioural therapy which was assessed by participants' readiness to change. On the contrary, regardless of the participant's readiness to change, 3A's does not incorporate self-regulation and social support from family, friends or colleagues, which are critical for increasing their motivation to quit smoking [15], [34]. The interventions' effectiveness urges division health officers and school health-teams nationwide to implement them. This simultaneously reduces physicians' clinic workloads.

4. LIMITATION

Participants were challenging to reach, necessitating several phone calls to complete follow-up. In addition, some participants insisted on being contacted at times other than those designated for investigators to perform telephone follow-up. Some other participants answered the first follow-up call but were hesitant to answer the subsequent calls. Furthermore, several participants scheduled for follow-up appointments at sixth and ninth months did not attend. As a result, the inability to engage patients in the anticipated manner and to administer the complete intervention to those enrolled prompted valid concerns, serving as a cautionary note for future studies and interventions. Cluster randomised trials are not generally designed to demonstrate individual-level efficacy as interventions are administered at the village level.

5. CONCLUSION

Tobacco and nicotine consumption and addiction often begin throughout adolescence, implying that vulnerable adolescent smokers are undoubtedly at risk of health consequences throughout their lives due to risky behaviours and lifestyles. Hence, the most critical strategy to curb the smoking epidemic would be to halt the influx of new smokers, primarily adolescents. Thus, it is crucial to support adolescents who smoke in their attempts to quit through interventions such as 5A's or 3A's intervention. However, the 5A's approach is more appropriate and effective in smoking cessation among adolescents. This could reduce or prevent nicotine dependence and stop the progression of chronic smoking once and for all.

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