Community-based intervention strategies to reduce tobacco use in Asia: a systematic review of randomized controlled trials

Gilbert Lazarus[1], Jessica Audrey[1]

[1]Faculty of Medicine, Universitas Indonesia, Indonesia

Correspondence should be addressed to

Gilbert Lazarus, Faculty of Medicine, Universitas Indonesia, Indonesia.

E-mail: gilbert.lazarus@ui.ac.id

Abstract

Introduction Tobacco use remains a global health challenge as one-tenth of world's population consume it regularly–thereby increasing its disease burden. Among all programs implemented, community-based interventions showed great potential, considering its ubiquity and practicableness. However, since tobacco consumption's prevalence persists, especially in Asia, further reviews are needed. **Objective** To analyze prior community-based tobacco control programs in Asia and identify potential approaches to be implemented as a mean to reduce tobacco use. **Methods** A systematic review was conducted through PubMed, Scopus, and CENTRAL, searching for randomized controlled trials (RCT) implementing community-based programs to control tobacco usage in Asia. Studies selected were assessed for bias risk with Cochrane risk-of-bias tool for randomized trials. **Results** The search yielded eleven RCTs with a total of 28,805 subjects. Smoking cessation interventions focusing on education and counselling are proven to be effective in reducing tobacco consumption and increasing quit rate. Moreover, prevention programs which include school-based interventions, reduce the likeliness of adolescents to smoke in the future and also prevent further tobacco use in recent youth smokers. **Conclusions** To conclude, community-based interventions showed promising results to be widely implemented as tobacco control and prevention strategies, helping to raise public awareness towards tobacco hazards and reducing the number of tobacco-related diseases and mortality worldwide.

Key words: *community-based, tobacco use, smoking cessation, Asia*

Introduction

The world has fallen into an alarming pandemic of tobacco use with an estimation of 1 billion smokers worldwide, mainly amounting to 30% of men and 7% of women.[1] An epidemiologic study stated that Asia, led by China, is leading tobacco consumption. This enormous prevalence is followed by a massive number of deaths caused by tobacco consumption.[2] Tobacco smoking accounts for 6 million premature deaths annually, characterized by loss of 10 years of life expectancy. Morbidities associated with tobacco use varies from cardiovascular disease (i.e. coronary heart disease, cerebrovascular disease), neoplasm (i.e. lung and upper airways cancers), chronic obstructive pulmonary disease, to miscarriage and fetal anomalies.[1]

Despite various approaches in overcoming tobacco consumption, its' prevalence remained relatively high (20.2%).[3] These approaches include media advocacy[4], increase of tobacco taxes and prices[2], smoke-free laws and tobacco regulations[2], provision of cessation assistance[2], social marketing[4] and many more. Among them, media advocacy (e.g. warning labels, social marketing) proves to be the most ubiquitous interventions available.[4]

Recent studies have shown the effectivity of community-based interventions to control substance use.[5,6] Although they are more challenging due to heterogenous communal characteristics, they occur in natural settings and thus highly applicable and representable to populations around the world.[7] Community-based framework consists of multidimensionality, coordination in order to successfully reach all communities, and widespread support for nonsmoking behavior. Practically, community-wide initiatives are sought as tobacco regulations (i.e. age-of-purchase law), media utilization, curriculum integration, and smoke-free public places.[5] In order to establish effective yet practical programs to further decrease tobacco use, we conducted a systematic review to seek out prior community-based tobacco control programs and identify potential approaches to be implemented as a mean to reduce tobacco consumption–which in turn may alleviate disease burdens caused by tobacco.

Materials and Methods

Search strategy

This systematic review of clinical trials is conducted based on PRISMA statement[8] and Cochrane Handbook[9]. We explored PubMed, Cochrane Controlled Register of Trials (CENTRAL), Scopus databases from inception to 23 April 2019 using keywords as follows: "tobacco OR cigarette* OR nicotine", "addict* OR "use* OR usage OR consum* OR intake OR using", "community* OR population* OR peer*", "prevent* OR reduc* OR intervent* OR promot* OR educ*", and "Asia". The search was limited to human participants and no language restrictions were applied. However, studies included in the review was restricted to Bahasa Indonesia and English, which were the only languages readable by the authors. Details of the literature search strategy are shown on Figure 1.

Inclusion and exclusion criteria

Inclusion criteria were set to filter the results as follows: (1) study design, randomized controlled trials identifying community-based program implementations to reduce tobacco use; and (2) study population, healthy subjects with confirmed tobacco use. Conversely, exclusion criteria were also set: (1)

2

irretrievable full-text articles, (2) unknown and/or inappropriate study types and settings, (3) studies using pharmacological interventions, and (4) incompatible language (articles not in English or Bahasa Indonesia).

Data extraction and risk of bias assessment

Essential data from articles were extracted, including: author and year of publication, study design and location, sample size and mean or range of sample age, intervention implemented, duration of follow-up, and outcome which is picturized by point prevalence of abstinence (PPAs), validated abstinence rate, p value, and any other reported outcome. Lastly, the articles were assessed for risk of bias through Cochrane risk-of-bias tool for randomized trials (ROB 2)[10], which consist of 5 domains and illustrated by bias judgements of low (-), high (+), and some concerns (?). Risk of bias assessment was conducted by two reviewers collaboratively and discrepancies were resolved by consensus between reviewers. Appendix 1 provides details of risk of bias assessment of included studies

Results

Study selection

The selection process for included studies in this systematic review is illustrated in Figure 1. The initial search yielded 1716 relevant studies from PubMed, Scopus, and Cochrane Controlled Register of Trials (CENTRAL) databases. Among them, 956 were deduplicated, while the other 893 were excluded after screening the titles and abstracts. In addition, 52 studies were excluded since 16 were not conducted in community settings (e.g. health center, hospital settings), 14 used pharmacological interventions, 13 includes non-healthy participants (e.g. tuberculosis,

psychosis), 7 were irretrievable, and lastly 2 were neither in English nor Bahasa Indonesia. At the end, 11 clinical trials were included for qualitative analysis, all of which were randomized controlled trials (RCT).

Study characteristics and outcomes

The main patient characteristics of included studies in this systematic review are shown in **Table 1**. A total of 28,805 patients, ranging from adolescents to adults, were recruited in this study, comprising of studies published between 2006 and 2018.

All trials are RCT, most of which were clustered, varying from non-blinded to double-blind design. Almost half of the studies were conducted in India, while Hong Kong, Taiwan, Thailand, and China share smaller proportion in this review.
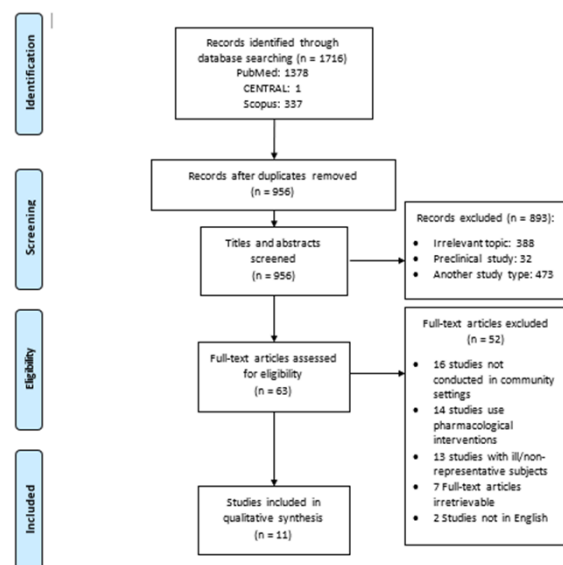

Figure 1. Diagram flow of literature search strategy for this systematic review

Discussion

Based on the above included studies, we classified the interventions into 2 main groups, based on the objectives of the trials:

3

interventions aimed for prevention and interventions aimed towards smoking cessation. Both types of community-based interventions mostly showed positive results towards tobacco reduction within a community.

Smoking cessation interventions

Community-based tobacco cessation interventions have gained popularity over the years, especially in developing countries, due to their accessibility and cost-effectivity. Eight out of eleven studies included in the above review were interventions given to smokers aiming to reduce their tobacco or cigarette consumption as well as to encourage them to quit. The interventions given varied considerably between trials, but mostly focused on counselling or education sessions in which participants were given materials regarding the tobacco-related health problems along with advice on how to quit smoking. Overall, such methods yielded favorable outcomes, mostly shown by a higher rate of abstinence, quit attempt, and cigarette or tobacco reduction.

Studies by Wang[11], Jayakrishnan[17], Lam[18], and Kumar[19] emphasized solely on health education and counselling. Education materials were given through booklets, leaflets, or delivered directly in sessions. Meanwhile, counselling sessions were carried out either through telephone or face-to-face sessions with a counsellor. The studies by Jayakrishnan[17] and Kumar[19] showed a higher point prevalence of abstinence (PPA) in intervention group compared to control (RR=1.85 and OR=2.66 respectively). Jayakrishnan[17] and Lam[18] also showed that the interventions succeeded in lowering the mean number of daily cigarette consumption (p<0.05 and p<0.001 respectively), as well as increasing the proportion of subjects who were successful in reducing their tobacco consumption by more than 50%. These results were consistent with previous large

population-based surveys which indicated that smokers with lower level of education were less likely to intend to quit, make a quit attempt, or successful in quitting.[22,23] Another study also showed that subjects with higher level of education were more likely to benefit from counselling sessions, as they would have a better comprehension and health knowledge in addition to the psychological support given.[24] Integrating both education and counselling methods is therefore important to create effective ways to help individuals quit smoking.

Aside from the standard smoking cessation programs mentioned above, several studies adapted additional strategies to aid cessation. Study by Wang et al actively referred smokers to smoking cessation (SC) services in addition to quitting advices given to smokers, so that subjects could be dealt with more intensively.[12] Meanwhile, Hong et al in his study innovated a creative way of combining art therapy into smoking cessation programs, especially targeting adolescents who may perceive traditional cessation programs as boring or useless. Art helps smoking youths express their feelings non-verbally, allowing them to achieve a better sense of self-understanding, better control over self-emotion, and a higher self-esteem, which would psychologically support smokers to cease smoking. Results were promising, with a significant reduction in smoking addiction, nicotine dependence, and increased in self-efficacy and self-esteem in these adolescents.[13]

Aside from art, a trial by Sarkar et al evaluated the effects of yogic breathing exercises in addition to standard quit advice. Results were again positive, showing a higher cessation rate in the intervention group (RR=5.32, p=0.013).[14] This is consistent with a previous study which showed that yogic breathing exercise was effective in reducing cigarette cravings and withdrawal symptoms, possibly through its actions in the insular cortex.[25]

4

Incentives, both monetary and social forms, are also found to play a role in enhancing the effectivity of cessation programs. A study by White et al tested the impact of giving monetary incentives to smokers who successfully quit smoking in addition to smoking-cessation counseling. The subjects were grouped in pairs, in which they would receive cash bonus when both individuals succeed to quit smoking, creating a form of social commitment and inducing peer pressure. A significantly higher abstinence rate was found in intervention groups (aOR=4.2, p<0.001).[16] These methods mentioned above highlighted the potential of incorporating new, creative ideas into standard non-pharmacological smoking cessation programs in order to further enhance the effectiveness of the interventions.

Preventive interventions

Three of the studies included in the review focused on smoking prevention programs, which were mostly aimed at adolescents. Harrell[15], in his study, investigated the effect of multicomponent intervention, such as youth leader training, peer-led interactive activities, and other strategies which would promote awareness regarding tobacco use among youths. Meanwhile, Perry[20] and Chou[21] applied school-based smoking interventions. Studies by Harrell[15] and Perry[20] found that students given intervention were significantly less likely to smoke in the future. Moreover, Chou[21] also demonstrated similar results, in which the programs prevent further tobacco use in recent youth smokers, although effects for primary prevention is not significant in his study. From all preventive methods implemented, peer-led activities as well as parental involvement posed as the most successful method to reduce smoking intention (cigarette, p<0.01; chew tobacco, p=0.03) and prevalence (cigarette, p<0.05; bidi, p<0.01; tobacco use, p<0.04) among adolescents. This may be true since

adolescence is a period characterized by acceptability and peer-reinforcements, thereby implying that support from peers and families are highly essential.[20]

Other than peer-led activities, community-based interactive activities and outreach programs comprising followed by text message campaign also showed reduction in tobacco usage. Psychosocial aspects to control tobacco utilization were also improved, showing remarkable difference between intervention and control group on knowledge about tobacco's harmful effects (p=0.02), its control policies (p=0.06) as well as increased normative belief to not use tobacco (p=0.036) and motivation to advocate on promoting tobacco-free communities (p<0.001).[15] Lastly, anti-smoking social norms and resistance skill training (e.g. public commitment) as implemented by Chou[21] showed the least amount of smoking reduction for baseline non-smokers. However, this method is useful to show deterrent effect for recent smokers to quit smoking (OR, 95% CI = 0.45, 0.23-0.98).

Both Harrell[15] and Perry[20] applied social cognitive theory, which contains personal (i.e. self-efficacy support), behavioral (i.e. reinforcement based on operant conditioning), and environmental (i.e. promotion on tobacco-free environment) approaches.[26] Both studies also showed significant reduction in the usage of cigarette, bidi, and other tobacco forms, except chewing tobacco.[15,20] Chewing tobacco is a smokeless tobacco with a gum-like shape, usually flavored with artificial sweeteners, making it more popular for children and adolescents.[20]

These approaches provide new, relevant methods to cut down tobacco use especially in low- to middle-income countries in which pharmacological interventions may be unaffordable for such populations. Moreover, since the assistance

5

Table 1. Study characteristics and outcomes

Author and Year (RoB2[*])	Study Design	Location	Sample Size	Range/ mean of sample age	Intervention	Duration of follow-up	Outcome[†]
Wang MP et al[11], 2018 (-)	Cluster RCT	Hong Kong	1077 (559 CDTQ, 518 QI)	42.8 years	Brief advice on smoking reduction using AWARD model	6 months	**Cut-down-to-quit arm (CDTQ)[‡]** Validated abstinence 5.4%; aOR 0.99 (0.58-1.70) Smoking reduction 20.9%; aOR 1.54 (1.11-2.14); P<0.01 Quit attempt 39.8%; aOR 1.07 (0.77-1.49) **Quit immediately arm (QI)** Validated abstinence 5.6% Smoking reduction 14.5% Quit attempt 41.1%
Wang MP et al[12], 2017 (-)	Single-blind, 3-arm, pragmatic cluster RCT	Hong Kong	1226 (818 I, 408 C)	42.0 years	Active referral and model-guided brief advice about smoking cessation using AWARD model	6 months	**Active referral arm (AR)** Response rate 72.9% PPA 17.2%; OR 1.59 (1.07-2.37); P=0.03 Validated abstinence 9.0%; OR 1.81 (1.04-3.16); P=0.04 Smoking reduction 22.9%; OR 0.91 (0.66-1.26); P=0.59 SC service use 25.1%; OR 9.44 (5.29-16.85); P<0.001 **Brief advice arm (BA)** Response rate 71.9% PPA 9.4%; OR 0.80 (0.51-1.24); P=0.36 Validated abstinence 5.0%; OR 0.98 (0.53-1.82); P>0.99 Smoking reduction 23.3%; OR 0.94 (0.68-1.29); P=0.69 SC service use 2.4%; OR 0.69 (0.30-1.58); P=0.41 **Control arm** Response rate 72.3%
Hong R-M et al[13], 2017 (?)	Mixed-method study	Taiwan	100 (50 I, 50 C)	16-20 years	Art therapy interventions	6 weeks	Art therapy effectively reduced smoking addiction (B 7.07, P<0.001) by reducing nicotine dependence (FTND score) (B 2.50, P=0.007), and increasing self-efficacy and self-esteem (B 66.39, P<0.001; B 23.46, P<0.001, respectively)
Sarkar BK et al[14], 2017 (?)	Pragmatic cluster RCT	India	1213 (611 I, 602 C)	46.3 years	Face-to-face quit advice session and single training session on yogic breathing exercises (BA-YBE)	6 months	Abstinence for 6 months 2.6%; aRR 5.10 (1.46-17.84); P<0.01 PPAs 3.1%; aRR 2.87 (0.92-8.93); P=0.07 Breathing exercises are helpful in reducing smoke use (mean 5.2, SD 1.8), and no adverse events were reported
Harrell MB et al[15], 2016 (-)	Cluster RCT	India	6023 (3034 I, 2989 C)	14.4 years	Community-based multi-component tobacco control	2 years	Intervention reduced tobacco use (-20.9% vs -3.3%), smoking prevalence (-33.1% vs. -24.6%), and SLT use (-37.5% vs. -27.6%) effectively. However, the intervention arm had more susceptibility to smoke (-77.1% vs. -66.7%), to use SLT (-83% vs. -

						84.1%), and less reduced intention to smoke (-38% vs. -52.2%) and to use SLT (-62.5% vs. -67.5%) compared to that of the control arm
White JS et al[16], 2013 (-)	Non-blinded RCT	Thailand	201 (132 I, 69 C)	51.06 years	Team commitment contracts: commitment savings account, abstain rewarding system, and weekly follow-up	6 months	Abstinence rate in intervention group (44.3%) better than that of control group (18.8%) with aOR 4.2 (1.8-9.7), P<0.001. The intervention enhanced abstinence by 91-136% relative to the control group and offered a viable and cost-effective alternative to smoking cessation approaches in low-resource settings (P<0.001).
Jayakrish nan R et al[17], 2013 (+)	Cluster RCT	South India	928 (474 I, 454 C)	44.56 years	Anti-tobacco leaflets and reference guide for tobacco cessation	12 months	PPA in intervention group compared to control 14.7% vs. 6.8%; RR 1.85 (1.05-3.25); P<0.05 Intervention successfully reduced smoking by 50% (41.3% vs 13.6%), while also lowering the number of cigarettes (RR, 95%CI = 1.1, 1.01-1.20;P<0.05)/bidi (RR, 95%CI = 1.1, 1.02-1.18;P<0.05) used, nicotine dependence (RR, 95%CI = 1.15, 1.01-1.34;P<0.05), and increasing the number of doctors visit (RR, 95%CI = 2.42,1.50-3.87;P<0.05)
Lam TH et al[18], 2012 (+)	Single-blinded RCT	Hong Kong	1154 (928 I, 226 C)	42.04 years	Smoking reduction counselling and adherence counselling for NRT	6 months	Lower mean daily cigarette consumption (p<0.001) Higher quit rate than controls (17% vs 10.2%, p=0.012) Higher self-reported cigarette reduction ≥50% (50.9% vs 25.7%, p<0.001)
Kumar MS et al[19], 2012 (+)	Cluster RCT	India	366 (181 I, 185 C)	30.45 years	Two sessions of health education with self-help material on tobacco cessation	2 months	Higher PPA than control (aOR=2.66, p=0.016) Higher quit attempt (aOR=1.83, p=0.033) Higher harm reduction (aOR=2.79, p=0.003)
Perry CL et al[20], 2009 (-)	Group RCT	India	14063 (6365 I, 7698 C)	6th to 8th grade students	Multicomponent, school-based intervention	2 years	Significant differences in trajectories of cigarette smoking (p<0.05), bidi smoking (p<0.01), and any tobacco use (p<0.04). Tobacco, cigarette and bidi smoking increased in control population, but decreased in intervention group. Lower intention to chew tobacco (p=0.03) and smoke cigarettes (p<0.01) than control
Chou CP et al[21], 2006 (?)	Longitud inal RCT	China	2454 (1197 I, 1257 C)	12.5 years	School-based smoking prevention program	1 year	No significant primary prevention effect Lower risk of remaining a recent smoker (OR, 95% CI=0.45, 0.23-0.98)

*(-), low risk of bias; (?), some concerns; (+), high risk of bias, as assessed with Revised Cochrane risk-of-bias tool for randomized trials.
†OR/RR (95% CI) between intervention and control group; ‡Adjusted OR between CDQT and QI arms; NRT, nicotine replacement therapy; RCT, randomized controlled trial; I, intervention; C, control; PPA, point prevalence of abstinence; SC, smoking cessation; OR, odds ratio; FTND, Fagerstorm Test for Nicotine Dependence; aOR, adjusted odds ratio; aRR, adjusted relative risk, SD, standard deviation; SLT, smokeless tobacco; BI, brief intervention; BI-FS, brief intervention with family support; SIS, smoking involvement score; BSS+, behavioral support plus 7 wk of bupropion therapy; BSS, behavioral support sessions.

provided is mostly non-physician based and could be performed by trained community health workers, these non-pharmacological methods are potentially scalable in settings where healthcare system is still lacking with limited access to professional physicians and medications.

Study strengths and limitations

The strength of this study lies on the fact that most studies included in our review were carried out in developing countries, where socioeconomic and environmental factors are mostly similar, making the results more applicable in Asia. Moreover, samples included in our study is also relatively large. However, this study is not without limitation as inaccessible articles and studies with incompatible languages were excluded. Furthermore, plenty of results in the trials were self-reported outcomes, which may be subjected to memory bias.

Future application and research

The result of above systematic review can be further implemented to help guidelines-making process to reduce tobacco use since community-based interventions showed great efficacy in reducing the intention to and prevalence of smoking. Furthermore, it is practical, ubiquitous, and cost-effective, thus making it more applicable in resource limited settings. As a preventive mean, it may be implemented based on social cognitive theory (i.e. personal, behavioral, and environmental approaches) by peer-led design and parents' involvements. On the other hand, more researches on community-based prevention need to be conducted in order to identify more diverse preventive methods, as school-based prevention was the only preventive measure available in this study.

Conclusion

To conclude, community-based interventions are proven to be effective in preventing and reducing tobacco use in the population, shown by a reduction in cigarette consumption, higher quit rate, quit attempt, and abstinence. Most interventions focused on education and counselling, in an attempt to increase awareness towards smoking health hazards as well as giving useful advices on quitting. Novel strategies, such as art and incentives, can be integrated with these interventions to enhance participation and effectiveness of the programs. Prevention programs of tobacco use, mostly school-based interventions aimed for adolescents, also showed positive outcomes. It may be best implemented by using peer-led design and parents' involvement since adolescence period is characterized by identity exploration, making them demand more acknowledgement and peer-reinforcements.

We hope that the results of this systematic review could encourage the implementation of such community-based interventions in the prevention and reduction of tobacco use. Moreover, these approaches are relatively simple, cost-effective and could be performed by community health workers, hence are suitable in low- and middle-income settings. The implementation of such community-based strategies is hoped to raise public awareness regarding tobacco health hazards, encourage further reduction of tobacco use, thus helping to reduce tobacco-related diseases and mortality worldwide.

Acknowledgement

8

Conflict of Interest

The authors declare no conflict of interest

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9

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