SHOULD WE PAY THE SMOKERS? A META-ANALYSIS OF FINANCIAL INCENTIVES FOR SMOKING CESSATION AMONG SMOKERS IN LOW SOCIOECONOMIC GROUP

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Abstract

Today around 80% of smokers worldwide live in low- and middle-income countries, and in most countries, regardless of country income group, tobacco use is more concentrated in low socioeconomic status (SES) populations. This meta-analysis was conducted to review current available evidences to determine the effectiveness of financial incentive strategies on smoking cessation among low-SES smokers. Database search using PubMed, Science Direct and Cochrane Library were used to search financial incentive intervention prior to October 2018. Appraisal of methodological quality was assessed using Cochrane Collaboration's tool. Six identified randomized control trials with 2450 and 2437 participants in intervention and control group respectively were included in the analysis. The random-effect model was used to combine results from individual studies. The pooled odds ratio (OR) was 2.16 (95% CI: 1.66-2.82) comparing financial incentive intervention with control. Heterogeneity was not significant across studies (Chi^2 = 8.17, p = 0.15, I^2 = 39%). Current evidences from the RCT researches suggest that financial incentives are promising potential strategy to encourage smoking cessation among low-SES smokers.

Keyword: financial incentive, smoking cessation, low socioeconomic status, meta-analysis

1.0 Introduction

Cigarette smoking is the only legal product that kills a large proportion of its consumers when used as intended by its manufacturer. The World Health Organization (WHO) has estimated that around six million people die each year from tobacco use and projected to increase to eight million by 2030 if no strong tobacco control measures are put in place [1]. Today around 80% of smokers worldwide live in low- and middle-income countries, and in most countries, regardless of country income group, tobacco use is more concentrated in low socioeconomic status (SES) populations where the burden of tobacco-related illness and death is heaviest [2]. In addition, smokers in the low-SES are more likely to be trapped in the vicious cycle of smoking and disadvantages [3].

Some studies reported that smokers in low-SES are as likely to prioritise and attempt quitting as high-SES smokers, but they are less likely to be successful and confident in quitting [4,5]. Smokers from low-SES face unique barriers to smoking cessation such as higher level of dependent on nicotine [6-9], higher level of stress in daily life [10,11] and living in the pro-smoking community norm [3,12] which increase the social stress and become a cue to smoke and prevent smoking cessation.

There is a growing enthusiasm for incentive-based programmes to change unhealthy behaviours, including smoking [13], weight loss [14,15], alcohol consumption [16], vaccination uptake [17] and levels of physical activity [18]. Incentives and rewards (terms used interchangeably) routinely feature in many smoking cessation programmes which can be used to encourage recruitment into the programme [19], to reward compliance with the process [20,21], and to reward cessation achieved at predefined stages [22]. A variety of rewards have been used for these purposes, including cash payments, gift vouchers exchangeable for goods (excluding alcohol and cigarettes), food packages, certificates, promotional items such as clothes and others [23,24]. The effectiveness of financial incentive strategies for smoking cessation were repeatedly evaluated in the general population [22,25]. Thus, the aim of this study was to review current available evidences to determine the effectiveness of financial incentive strategies on smoking cessation among low socioeconomic smokers.

2.0 Methodology

2.1 Literature searches

This meta-analysis was performed based on PRISMA statement [26]. The literature search was performed on three databases which are PubMed, ScienceDirect and Cochrane Library. The search strategy utilized the PICO framework to improve searching for clinical question [27]. The search term used were: ("poor" OR "poverty" OR "low income" OR "disadvantage*" OR "low socioeconom*") AND ("financial incentive" OR "financial reward" OR "cash" OR "monetary" OR "payment" OR "lotter*" OR "gift card" OR "voucher") AND ("smoking" OR "tobacco" OR "quit smoking" OR "stop smoking" OR "smoking cessation" OR "smoking abstinence"). The search was not restricted to any duration timeline.

2.2 Study Selection

The process of study selection was conducted in two phases by two reviewers after excluding duplicates studies. In the first phase, a pair of reviewers (F.H.J and Z.O) were independently screened the titles and abstracts for the potential article to be included in the study. During this phase, irrelevant studies were excluded, and any disagreement will be solved by the third reviewer (M.A.A.R). In the second phase, the full-text articles were retrieved for detailed evaluation for selection of articles. Study were included if they meet the following criteria: (i) Randomized controlled trials (RCTs) or clinical controlled trial (CCTs) that described the evaluation of financial incentive intervention with smoking cessation; (ii) among low-income or socially disadvantages smokers and (iii) adult smoker, published prior to October 2018. Studies that were not published in English, that were case reports or observational studies or full-texts not available were excluded.

2.3 Data Extraction

The selected articles that met the inclusion and exclusion criteria by the two reviewers were retained for full review. Several authors were also contacted to get details of the eligible studies. The characteristic of each studies was examined including setting, study location, participants, intervention, follow-up period, primary outcome measures and results of the studies.

2.4 Assessment of methodological quality

Studies included in the review were assessed for methodological quality and risk of bias using Cochrane Collaboration's tool [28]. The study quality was assessed by two authors (F.H.J and N.S) and any disagreement were resolved through discussion. The Cochrane Collaboration's tool has been widely used for assessing risk of bias in randomized trials [29]. Cochrane Collaboration's tools evaluates six domains: random sequence generation (assessing selection bias on allocation to intervention due to inadequate generation of a randomized sequence), allocation concealment (assessing selection bias on allocation to intervention due to inadequate concealment allocation prior to assignment), blinding of participant and personnel (assessing performance bias due to knowledge of the allocated interventions by participants and personnel during the study), blinding of outcome assessment (assessing detection bias due to knowledge of the allocated intervention by outcome assessor) incomplete outcome data (assessing attrition bias due to amount, nature or handling of incomplete outcome data) and selective reporting (assessing reporting bias due to selective outcome reporting). Each study was given a rating of "Low Risk", "High Risk" or "Unclear Risk" in the methodological quality for each domain according to pre-defined criteria [28]

2.5 Meta-analysis

Random-effect model was used to estimate the pooled effect size from included studies as suggested by [30]. Odds ratio (OR) with 95% confidence interval (CI) and statistical measure of heterogeneity (Chi^2 and I^2) was calculated using Review Manager Ver5.3 [31]. All studies were included in the meta-analysis. Subgroup and sensitivity analysis were performed if p<0.10 and I^2 value $\geq$ 50%.

2.6 Outcome measures

The primary outcome measures were smoking abstinence at any point assessed after the start of the intervention. Smoking abstinence assess at 12-month duration or less after quit date is considered short-term abstinence while smoking abstinence assess at any point of time after 12 months is considered long-term abstinence [32]. Biochemically validated evidence of quit rates was preferred over self-reported quit rates and biomarker of cotinine-confirmed measures were preferred over carbon monoxide (CO) measures. To ensure consistency in outcome measure, 7-day point prevalence abstinence rates were preferred although continuous abstinence rate were used if this was the only outcome measure reported. Analysis using intention-to-treat approach was used if possible. Where study had more than one type of intervention group, the most intensive condition was compared to the control group [33].

3.0 Results

3.1 Literature search

The initial search strategy yielded a total of 119 literatures where 18 articles were excluded because of duplication. The remaining 101 articles were screened for title and abstracts which further excluded another 62 articles for irrelevant studies (n=53), language other than English (n=4), review articles (n=4) and protocol study (n=1). The retained 39 articles were assessed for their eligibility. Among them; ten studies using different intervention other than financial incentive such as psychosocial intervention; 17 studies have different outcome measure such as measuring quality of life and tobacco cessation service engagement; five studies had different target population other than low-income or socially disadvantages smoker; and one study measuring cost-effectiveness of financial incentive for smoking cessation among low income smoker. Six remaining articles [20,21,33-36] were included for meta-analysis. A flow diagram describing the article retrieval based on PRISMA flow diagram [26] is provided in Figure 1.
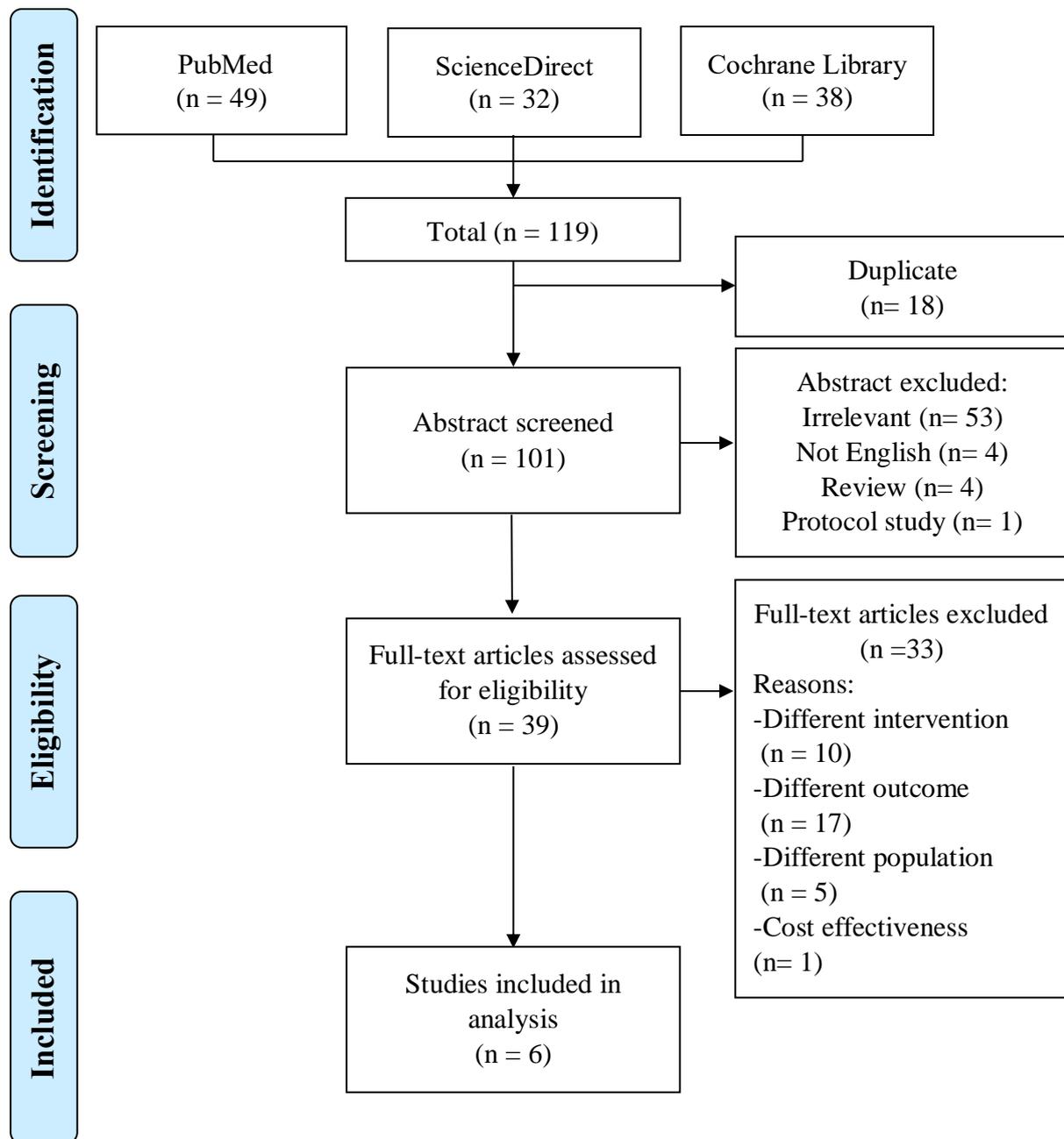
Figure 1: PRISMA flow diagram

3.2 Characteristics of included studies

A detailed description of the included studies was listed in Table 1. The included studies were published between 2015 and 2018. All studies were RCTs study design. Five studies were conducted in United States [20,21,33,35,36] and one study from Switzerland [34]. One study conducted among pregnant women [20] and one in mentally-ill adult [33] while others study participant were

recruited from general population or community-based health care clinic. Total financial incentive offered range from USD150 to approximate USD1557 (converted from CHf1500 on 28 June 2012 [37]) and the incentives were given in gift cards or monetary form.

3.3 Evaluation of Quality of Studies

Individual rating for risk of bias in each study against the six domains from Cochrane Collaboration's tool are reported in Table 2. Overall, most of the studies has low risk of bias across all six domains but blinding of participant and personnel was not possible to perform. Detail of assessments were provided in Supplemental Material.

Table 2. Risk of bias assessment

Study	Random sequence generation	Allocation concealment	Blinding of participant and personnel	Blinding of outcome assessment	Incomplete outcome data	Selective reporting	Others
36	U	U	H	L	L	L	L
34	U	L	H	L	L	L	L
21	L	U	H	L	L	L	H
33	L	U	H	L	L	L	L
35	L	L	H	L	L	L	H
20	L	L	H	L	L	L	H

H: High Risk, L: Low Risk, U: Unclear Risk

Table 1. Characteristic of the studies

Study, Design, Location	Participant Characteristic	Smoking Characteristic	Intervention	Incentive method; total; type	Primary Outcome Assessment; Follow-up	Result; Odds Ratio (Confidence Interval)
36 RCT Dallas, Texas	Participant were socioeconomically disadvantage smoker who visit the Tobacco Cessation Clinic of safety net hospital. Age: Mean (SD) year Intervention= 51.7(7.3) Control=52.6(7.4) Gender: (Male%) / (Female%) Intervention: (48%) / (52%) Control: (36.6%) / (63.4%)	Cigarettes per day: Mean (SD) Intervention: 18.0(9.7) Control: 17.0(7.7) HIS: Mean(SD) Intervention= 3.4(1.3) Control= 3.1 (1.2)	*Intervention:* 75 participants received usual care for smoking cessation plus financial incentive. *Control:* 71 participants received usual care for smoking cessation includes: 1. One initial educational session provided by a respiratory therapist 2. Weekly group support sessions facilitated by social workers. 3. Receive pharmacotherapy and individual follow-up weekly/as needed basis	$20 gift card for biochemically confirmed abstinence on the quit date then amount of the incentives increased by $5 with each weekly successive abstinent visit through 4 weeks after the quit date. Total incentive $150 Type: Gift card .	7-day PPA; 4 weeks follow-up verified by breath CO level.	Abstinence rates in intervention and control group were 49.3% versus 25.4%. OR = 2.87 (1.42-5.77) AOR = 3.40 (1.61-7.16) Adjusted for pharmacological treatment, race, gender, age, years of education, cigarettes smoked per day
34 RCT Geneva, Switzerland	Participant were low-income smoker enrolled from the general population Age: Mean (SD) year Intervention=32(11) Control=32(11) Gender: (Male%) / (Female%) Intervention: (53%) / (47%) Control: (44%) / (56%)	Cigarettes per day: Mean (SD) Intervention: 16(9) Control: 16(9) FTND: Mean(SD) Intervention: 4.1(2.3) Control: 3.9(2.4)	*Intervention:* 404 participant received financial incentives plus Internet-based support. *Control:* 401 participant received Internet-based support, but no financial incentives Internet-based support is a Stop-tabac.ch smoking cessation website, which offers fact sheets, discussion forums, testimonials, and an interactive "coach" that provides automatically written, personalized feedback reports.	Incentives given 6 times during 6 months from quit date: CHf 100 (1st week) CHf 150 (2nd week) CHf 200 (3rd week) CHf 300 (1st month) CHf 350 (3rd month) CHf 400 (6th month) Total incentive CHf 1500 Type: Gift card	7-day PPA; 6- and 18-month follow-up both verified by breath CO level and either cotinine or thiocyanate measurements	Rates of continuous abstinence between months 6 and 18 were 9.48% in the intervention group and 3.71% in the control group OR = 2.72 (1.47-5.02) AOR = 2.94 (1.57-5.50) Adjusted for sex and past quit attempts

| [21]

RCT

Wisconsin, United States | Participants were Medicaid recipients recruited from primary care patients and callers to the Wisconsin Tobacco Quit Line.

Age: Mean (SD) year
Intervention=45.0(11.2)
Control=44.9(11.2)

Gender: (Male%) / (Female%)
Intervention: (40.0%) / (60.0%)
Control: (39.4%) / (60.6%) | Cigarettes per day: Mean (SD)
Intervention: 17.0(10.3)
Control: 17.4(10.9)

FTND (Item 1: % Smoking Within 30 Min)
Intervention: 83.8%
Control: 87.1% | *Intervention*
948 participants were offered five quitline cessation calls from Wisconsin Tobacco Quit Line (WTQL) and were encouraged to obtain cessation medication.
Incentive were given in each counselling calls and during verified abstinence at 6-month visit.

Control
952 participants were offered five quitline cessation calls from WTQL and were encouraged to obtain cessation medication without financial incentive | Participants in the incentive condition could receive payment of $30/call for up to five WTQL calls and $40 for producing biochemical evidence of abstinence at the 6-month follow-up visit.

Total incentive $ 190
Type: Monetary | 7-day PPA; at 6-months follow-up post study entry verified by breath CO level or cotinine or nicotine test | Abstinence rates in incentive condition participants were 21.6% compared to 13.8% in controls

OR = 1.73 (1.36-2.20)
AOR = 1.75 (1.37-2.23)

Adjusted for type of entry into study, motivation to quit and Fagestrom-Test Nicotine Dependence (FTND) |
| [33]

RCT

New Hampshire, United States | Participants were community-dwelling adult Medicaid beneficiaries with a mental illness diagnosis who were receiving services at community mental health centers (CMHC)

Age: Mean (SD) year
PV: (43.0 ± 10.8)
PV+Q: (45.0 ± 10.7)
PV+CBT: (46.0 ± 11.0)

Gender: (Male%) / (Female%)
PV: (44%) / (56%)
PV+Q: (34%) / (66%)
PV+CBT: (33%) / (67%) | Cigarettes per day: Mean (SD)
PV: 16.0(10.9)
PV+Q: 18.0(10.2)
PV+CBT: 17.0(10.5)

FTND: Mean(SD)
PV = 5.0(2.4)
PV+Q = 5.0(2.1)
PV+CBT = 6.0(2.4) | *Intervention*
75 participants in pharmacotherapy only (PV) + incentives
152 participants in pharmacotherapy and facilitated quitline (PV+Q) + incentives
108 participants in pharmacotherapy and telephone cognitive-behavioral therapy (PV+CBT) + incentives

Control
71 participants in PV only
151 participants in PV+Q
104 participants in PV+CBT | Participants in the incentive conditions received $50 in cash for verified abstinence on Mondays, Wednesdays, and Fridays in the first two weeks of the quit attempt and additional $75 for verified abstinence in third and fourth week.

Total incentive $450
Type: Monetary | 7-day PPA; at 12 months follow up confirmed with breath CO and urine cotinine test (or solely breath CO if a participant was using NRT) | Abstinence rates at 12 months among participants receiving PV+Q with incentives is greater (14%) compared with PV+Q without incentives (4%)

AOR = 3.94 (1.32-11.75)

adjusted for gender, psychiatric diagnostic group, severity of nicotine dependence, and equipoise stratum. |

| [35] RCT Boston Massachusetts, United States | Participants were low-SES and minority daily smokers with income ≤ $20,000/year receiving primary care at Boston Medical Center

Age: Mean (SD) year Intervention= 49.9(11) Control= 50.1(10)

Gender: (Male%) / (Female%) Intervention: (43%) / (57%) Control: (49%), (51%) | Cigarettes per day: Mean (SD) Intervention: 15.1(7) Control: 14.9(7)

FTND: Mean(SD) Intervention: 4.9(2) Control: 5.0(2) | *Intervention* 177 participants received the same materials in control; in addition, they received up to 4 hours of patient navigation delivered over 6 months, and financial incentives

Control 175 participants received a low literacy smoking cessation brochure and a list of hospital and community resources for smoking cessation. | Participants in incentive condition received $250 for smoking cessation 6 months after study enrollment; additional $500 for an additional 6 months after the initial cessation (12-month time point)

Total incentive: $750 Type: Monetary | 7-day PPA; at 12 months follow up confirmed with salivary cotinine | Abstinence rates at 12 months follow up among participants in the navigation and incentives condition were 11.9% compared to 2.3% in control

OR = 5.8 (1.9-17.1) AOR = 6.09 (2.01 – 18.40)

Adjusted for age and sex |
| [20] RCT Wisconsin, United States | Participant were low-income (Medicaid-registered) pregnant smokers receiving perinatal smoking cessation program at Wisconsin Women's Health Foundation (WWHF).

Age: Mean (SD) year Intervention= 26.7(5.4) Control= 26.1(5.1)

Gender: All female | Age first started smoking daily: Mean(SD) year Intervention: 16.3(3.4) Control: 16.4(3.3)

FTND (Item 1: % Smoking Within 30 Min) Intervention: 54.7% Control: 58.4% | *Intervention* 505 participants receiving smoking cessation counseling with monetary incentive

Control 509 participants receiving smoking cessation counseling only | Participants in incentive condition received $25 for each of 6 prebirth provider visits, $25–40 for each of 4 postbirth home visits at Weeks 1, 2, 4, and 6 (total = $130), $20 for each of 5 postbirth counseling calls, $40 for biochemically verified abstinence at the Week 1 and 6-month visits. Total incentive: $460 Type: Monetary | 7-day PPA; at 6-month follow up verified by breath CO level. | Incentive condition participants had a higher abstinence rate at 6-month post-birth than controls (14.65% vs. 9.23%) respectively

OR = 1.69 (1.14-2.49) |

FTND: Fagerström Test for Nicotine Dependence, HSI: Heaviness of Smoking Index, CHf: Swiss franc, $: United States Dollar, SD: Standard deviation, Currency conversion 1 CHf = 1.038 USD (on 28 June 2012 during period of study) [37]

3.4 Publication Bias

The shape and symmetry of the funnel plot of log ORs from the six studies as shown in Figure 2 suggest that there is minimal publication bias present. All of the studies have high precision except for one study [35].
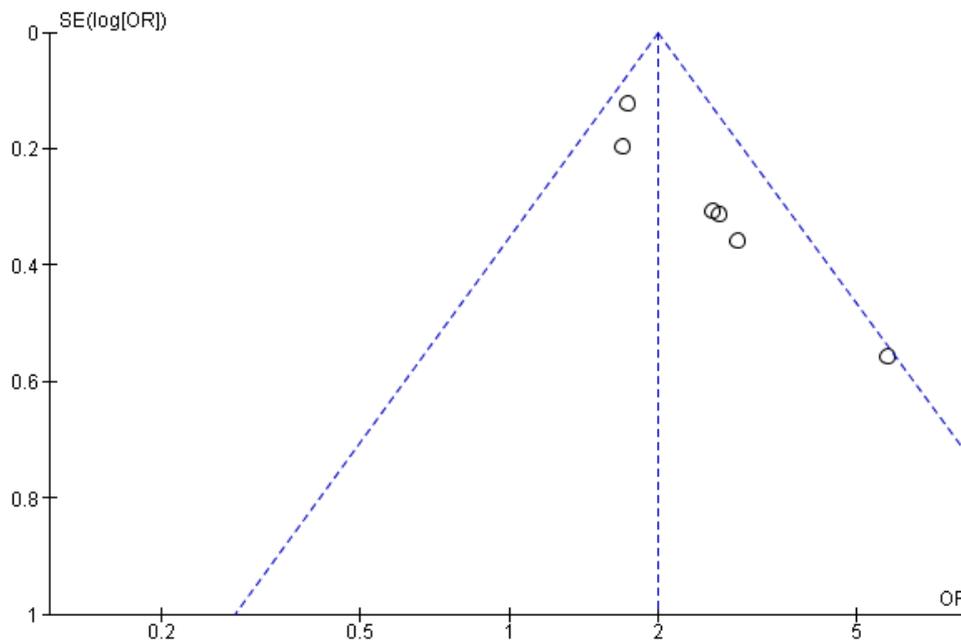

Figure 2. Funnel plot of the six studies included in the meta-analysis.

3.5 Main Analysis

The meta-analysis data using random-effect model [30] combining all six studies to explore the effect of financial incentive intervention for smoking cessation in low socioeconomic group of smokers shown in Figure 3. The forest plot illustrates the spread of the six studies risk estimates and their confidence intervals in relation to the summary OR of meta-analysis. There was no heterogeneity was found across studies ($p_{heterogeneity} = 0.15$, $I^2 = 39\%$). Based on the six studies, the pooled OR estimates showed that financial incentive intervention was significantly associated with smoking cessation among low socioeconomic group of smokers. (pooled OR: 2.16; 95% CI: 1.66-2.82).

When subgroup analysis done to explore between total amount of financial incentive received in the studies in relation to smoking cessation, the odds ratio of smokers who received financial incentive of more than USD500 was significantly magnified (pooled OR: 3.41; 95% CI: 1.67-6.97) compared to group that received financial incentive of less than USD500 (OR: 1.86; 95% CI: 1.53-2.26) as shown in Figure 4.
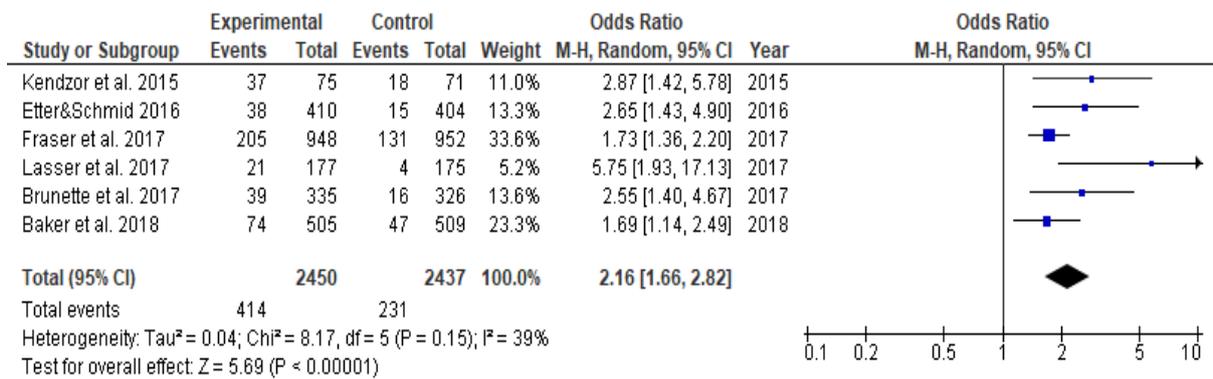
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Figure 3. Forest plot of the six studies included in meta-analysis
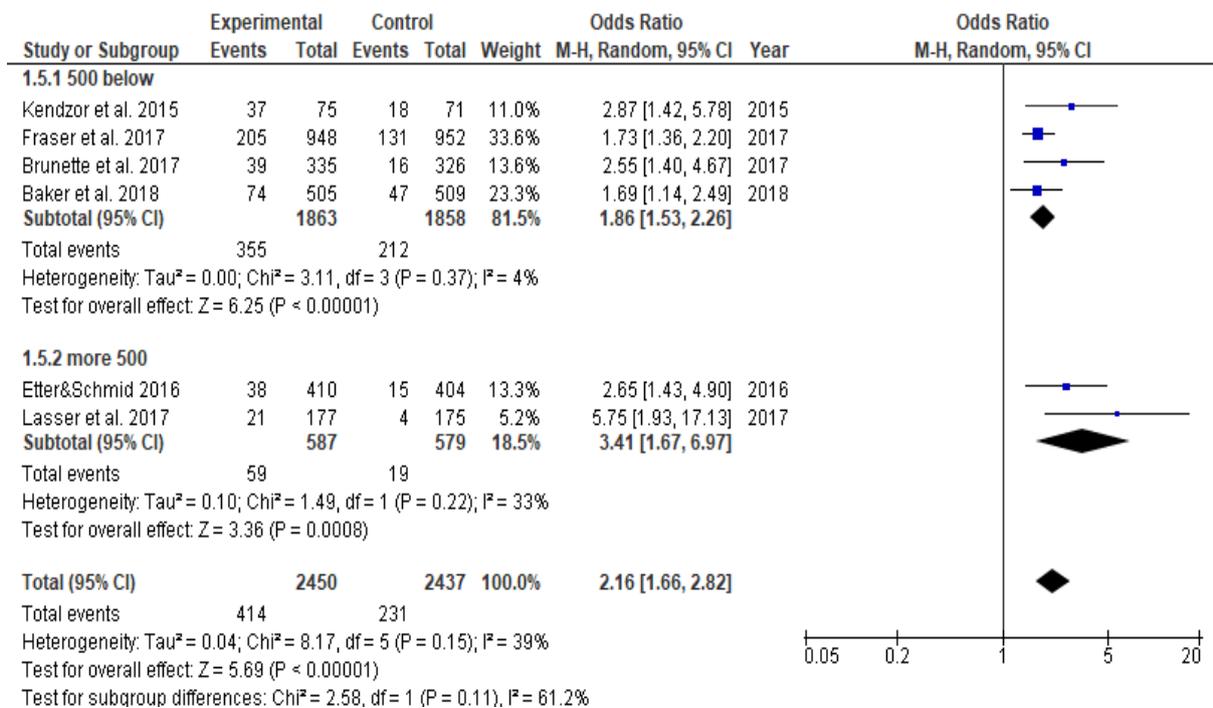

Figure 4. Subgroup analysis by amount of incentive offered

4.0 Discussion

This study analyzed the evidence from a published RCTs identified from different databases to evaluate the effectiveness of financial incentive intervention on smoking cessation among low-SES. There was only six RCTs fulfilled the criteria that addressing this issue. The result of the meta-analysis that involved 2450 and 2437 participants in intervention and control group respectively suggest that financial incentive intervention have significantly higher smoking cessation rates

among low-SES (pooled OR: 2.16; 95% CI: 1.66-2.82) with homogeneity observed across studies (Chi^2=8.17, p value=0.15, I^2 = 39%).

The small number of relevant studies precludes conclusions regarding optimal amount of financial incentive to achieve effect even though the subgroup analysis showed that financial incentive more than USD500 have higher effect estimate. Furthermore, to date, there have been no studies done at regional area other than United States and Switzerland to explore different effect of financial incentive according to ethnic group that have different smoking behavior and level of nicotine dependent [38-40]

This analysis provides a useful synthesis of RCT evidence on the effect of financial incentive on smoking cessation among low-SES and facilitates identification of future research opportunities. However, there are several caveats which concern the validity of the assessment results that must be acknowledged and interpreted with caution. The homogeneity across studies in the meta-analysis could be due to small numbers of included studies [28]. Besides, the pooled effect estimate does not differentiate duration of follow up and amount of financial incentive offered in the intervention group which are varies among studies.

The six trials reviewed had some methodological limitation. One study [36] have a very short duration of 4-week follow up assessment thus it limits the ability of smoker to change behaviour and quit smoking because study by Phillippa Lally et al found that on average it takes 66 days for a habit to become ingrained [41] . The Transtheoretical Model of Change which is the famous theoretical model of behaviour change has been the basis for developing effective intervention to promote health behaviour change. The Transtheoretical Model [42-44] is the model of intentional change that describes how people modify a problem behaviour or acquire a positive behaviour. The model discovered that long term effect after 12 months of health habits, 43% failed to maintain their healthy behaviour but the risk of relapse dropped to 7% if the behaviour maintained until 5 years. Thus, a very much longer period of time was required in the research to see the true effect of smoking cessation behaviour as compared to the maximum intervention period of 18 months among the studies. All trials were conducted in United States except study by Etter&Schmid 2016 which conducted in the Switzerland. Thus, the finding may not be generalized to countries that have different index in measuring socioeconomic status, diverse sociocultural and political environment. Some of the trials have relatively small sample size. Study by Kendzor et al had only 75 participants in intervention group and 71 participants in control group and this may attenuate the power of study. Apart from that, trial by Lasser et al had incorporated additional intervention in incentive group which is differ from the control group. Thus, the effect of financial incentive may be masked by the effect of additional intervention and may not reflect the actual significant different between the group. Finally, among all trials, none described evidence of dose-response relationship according to amount of financial incentive offered with smoking cessation rates. Thus, amount of financial incentive that would yield optimal smoking cessation rate is unknown.

The longest period of follow-up assessment was done at 18-month [34]. Long term abstinence beyond this point doubt to be sustained as the trend of abstinence rates reduce by time [33,34,36]. The incentive might have the short-term desired effect but still weaken the intrinsic motivation. Thus, once the incentives have been removed, the desired outcome will be pursued less eagerly, suggesting challenges for long-term sustainability [45] . This similar pattern of behaviour changes was also seen in other incentive-based intervention [16,46-48].

Generally, the key finding of this analysis support those similar reviews of financial incentive interventions across wider range of smoker population [13] in which they are effective in encouraging smoker to quit smoking.

5.0 Policy Implication

Smoking cessation among low-SES smokers through financial incentive strategies are promising potential component. Nonetheless, there are challenges that need to be addressed in the effort to implement and sustain incentive-based policies such as feasibility, sustainability of funding mechanism through multifaceted approach and substantial commitment from government and non-government organization. Regulation on eligibility for low-SES to be a non-smoker as a prerequisite to receive financial assistance from social welfare or other financial institution should be a mandatory implementation which is similar of what some country did for vaccination issues [49].

6.0 Future research

Future research in RCTs design to measure the effectiveness of financial incentive on smoking cessation in low-SES among diverse sociocultural may be required as smoking behaviour and nicotine dependence are genetically related [40,50]. Furthermore, future RCTs should explicitly assess optimal amount of monetary offered to yield most desired effect of smoking cessation. Trial should be reported based on CONSORT statement [51] to facilitate quality assessment and ensure data availability for meta-analysis.

7.0 Conclusion

Current evidences from the RCT researches suggest that financial incentives are promising potential strategy to encourage smoking cessation among low-SES smokers.

Acknowledgements

Author Contributions

F.H.J designed the study, F.H.J and Z.O performed data collection. F.H.J and M.A.A.R performed data analysis and wrote the manuscript. F.H.J and N.S assessed studies' quality. M.R.A.M edited the manuscript. S.A.S provided suggestion for analysis and review the manuscript.

Conflict of Interest

The authors declare no conflict of interest.

Supplemental Material

Supplemental Table 1: Detail assessment on risk of bias

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Supplemental Table 1: Detail assessment on risk of bias

Study	Random sequence generation	Allocation concealment	Blinding of participants and personnel	Blinding of outcome assessment	Incomplete outcome data	Selective reporting	Other bias
Kendzor et al. 2015	**Unclear Risk** Participants recruited during their visit to the Tobacco Cessation Clinic at the Dallas County, Texas	**Unclear Risk** Eligible participants were randomly assigned	**High Risk** Both participant and personnel were not blinded	**Low Risk** primary outcome assessed using biochemically confirmed CO level	**Low Risk** No loss of follow up for 4 weeks intervention period	**Low Risk** outcomes that are of interest in the review have been reported in the pre-specified way.	**Low Risk** none
Etter&Schmid 2016	**Unclear Risk** Procedure of randomization was not explained	**Low Risk** allocation using sealed opaque envelope drawn by participants.	**High Risk** Participants could not be blinded. Researchers were not blinded	**Low Risk** primary outcome was verified by carbon monoxide and either cotinine or thiocyanate measurements	**Low Risk** No Participants were excluded from analysis	**Low Risk** outcomes that are of interest in the review have been reported in the pre-specified way.	**Low Risk** none
Fraser et al. 2017	**Low Risk** Randomization occurred via computer- generated lists	**Unclear Risk** Allocation of participant to treatment or control group not explained	**High Risk** Counsellors at the WTQL were not blinded. Participant in incentive group were not blinded	**Low Risk** primary outcome was verified by biochemical evidence	**Low Risk** using the intent-to-treat principle	**Low Risk** outcomes that are of interest in the review have been reported in the pre-specified way.	**High Risk** Clinics choose different cut-scores although testing method and cut-score was the same for initial screening and follow-up
Brunette et al. 2017	**Low Risk** Computer-generated tables for each stratum within each site were used for random assignment	**Unclear Risk** Participants were randomly assigned to receive incentives for biologically verified abstinence or no incentives	**High Risk** Both participant and personnel were not blinded	**Low risk** biologically confirmed with expired breath carbon monoxide and urine cotinine	**Low risk** Missing observations were imputed as smoking	**Low Risk** outcomes that are of interest in the review have been reported in the pre-specified way	**Low Risk** none

Study	Random sequence generation	Allocation concealment	Blinding of participants and personnel	Blinding of outcome assessment	Incomplete outcome data	Selective reporting	Other bias
Lasser et al. 2017	**Low Risk** randomized participants using a random number generator	**Low Risk** using sealed envelopes	**High Risk** Unblinded study (participant and researcher were unblinded)	**Low Risk** assessment using biochemically confirmed with saliva cotinine or urine anabasine test	**Low Risk** Using intention-to-treat analysis	**Low Risk** outcomes that are of interest in the review have been reported in the pre-specified way.	**High Risk** Baseline smoking status was not confirmed biochemically
Baker et al. 2018	**Low Risk** First Breath staff used randomization tables prepared by the UW-CTRI to randomize women upon consent.	**Low Risk** Separate computer determined randomization tables were used	**High Risk** Both participant and personnel were not blinded	**Low Risk** assessment using biochemically confirmed CO level	**Low Risk** Participants with missing data for the primary outcome were counted as smoking	**Low Risk** outcomes that are of interest in the review have been reported in the pre-specified way.	**High Risk** Smoking status was not confirmed biochemically at baseline