A Systematic Review and Meta-analysis on the Prevalence of Smoking Cessation in Cardiovascular Patients After Participating in Cardiac Rehabilitation

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Abstract: Smoking is the most important modifiable cardiovascular risk factor causes around approximately one of every 4 cardiovascular-related deaths worldwide. Cardiac rehabilitation (CR) is the standard way of management of heart diseases after myocardial infraction. This study aimed to determine the prevalence of cardiovascular patients' quit smoking after participation in CR. PubMed, EMBASE, Web of Science, Scopus, and google scholar were searched systematically. In total, 18 studies were analyzed. Results showed that the mean age of smokers' were 54.80 (52.06, 57.55), and of them 53 % (22%, 83%) quit smoking after participating in CR. Subgroup analysis showed that among type of CR the most effective one was the educational along with physical exercise (comprehensive CR) cause 99% (98%, 100%) smoking cessation (SC). Group-based methods with76% (57%, 94%) of quitters showed to be more effective than individual-based. It can be concluded that CR has been effective in terms of smoking cessation. (Curr Probl Cardiol 2021;46:100719.)

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Introduction

The prevalence of cardiovascular diseases (CVDs) as the first cause of death is increasing in both the developed and developing countries due to the changes in human lifestyles.[10] Cigarette smoking is the most damaging lifestyle related risk factors for CVDs and causes at least 1 of every 10 deaths from CVD globally.[11] Continuing smoking after cardiac event increase the rate of death[12] while quitting smoking reduce the risk of all-cause mortality substantially.[5] smoking cessation (SC) and participation in CR programs reported to be the most influential way of interventions in terms of positive impacts on CVD consequences.[13] A study showed that the risk of recurrent CVD was reduced by 40% within 1 year of SC.[14]

Cardiac rehabilitation (CR) called also as cardiac rehab is a managed treatment program planned and applied specifically for CVD patients and consists of 3 phases: phase 1 which begins in hospital by assessing the patient's physical ability and motivation to tolerate rehabilitation and some nonstrenuous exercises in the bed or at the bedside, phase 2 which is outpatient cardiac rehab and phase 3, postcardiac rehab or maintenance. Phase 2 of CR which is outpatient included exercise program, education and psychological intervention usually lasting several weeks or several months focused on improving dietary and lifestyle habits such as quitting smoking, preventing weigh gain and reducing the stress and anxiety.[15-17] Given that SC and CR program are both effective at reducing CVD related morbidity and mortality, the association between these 2 and evaluating the efficacy and success of CR in terms of SC is of great interest that has not been studied so far. The study presented here is a meta-analysis on the prevalence of CVD patients who quit smoking after participating in CR and comparison between the prevalence of smoking quitters and smokers after CR in order to evaluate the successfulness of CR in terms of smoking cessation.

Material and Methods

In addition to pooling the effect sizes, meta-analysis can also be used to estimate prevalence and portions.[18]

This study is a meta-analysis, based on the findings of studies on the prevalence of CVD smokers participated in CR program, those who smoke still after participating in CR program and those who quit smoking after participating in CR program. PubMed, Scopus, Web of Science (ISI), EMBASE and google scholar were searched systematically with no date restriction using key words: "cardiac rehabilitations," "cardiac

rehabilitation," "smoking," "tobacco," "cigarette," "cessation," "smoking cessation," "tobacco cessation," "cigarette cessation." Only English studies were considered. The PICO was smoking individuals with cardiovascular disease participated in CR program, CR with SC program, quitting smoking followed by CR or continuing smoking followed by CR/ number of CVD smokers quit smoking after CR.

All references were uploaded in reference management EndNote software and then analysed for de-duplication, screening and data extraction. The full text of the articles was made available and the full text of each article was read. The review, conferences, and abstracts were excluded from the list of articles. The search, data extraction, and quality assessment were completed independently by 2 reviewers (GS and AA). Any discrepancies between the 2 reviewers were resolved through a discussion until a consensus was reached. Figure 1 shows the summary of overall steps in our meta-analysis.

Criteria for Considering Studies for This Review

Types of Studies. Randomized controlled trials (RCTs) and observational studies (cohort or case-control) were eligible for inclusion. Systematic reviews and meta-analyses were studied as a source of additional references.

Types of Participants. The study population includes adults CVD smoker patients with myocardial infarction (MI), angina, or who had undergone revascularization (coronary artery bypass grafting, percutaneous transluminal coronary angioplasty, or coronary artery stent), or heart failure who have taken part in cardiac rehabilitation.

Types of Interventions. Any type of CR (home-based, exercise-based, education-based, comprehensive, and etc.) with SC program is considered in our study.

Types of Outcome Measures. The prevalence of smoking quitters after participation in cardiac rehabilitation, the prevalence of smoking quitters after CR in terms of type of CR, geographical region, being group or individual and the CR/follow-up duration

Statistical Method. Eighteen studies reported the number of CVD patients who participated in CR and those quit smoking or continued

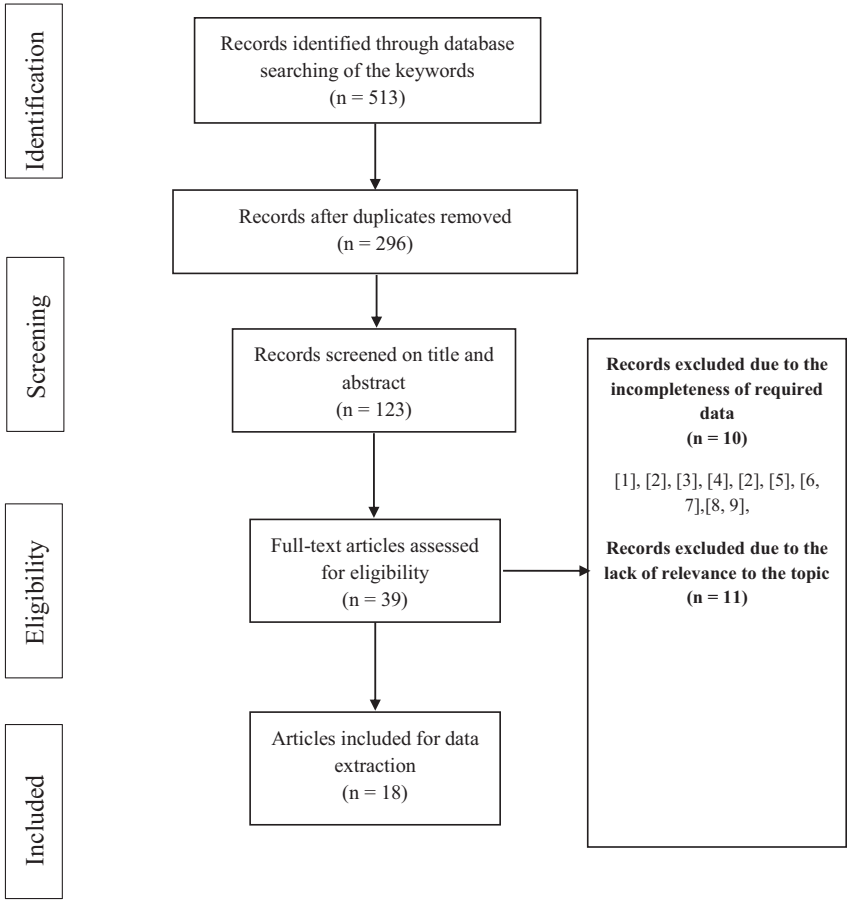

FIG 1. Flow chart shows literature search and selection of studies for CR and SC.

smoking after participating in CR program. The overall proportion of smoking and quitter individuals after CR was estimated by the random-effects model.[19] I^2 statistic was used to evaluate the heterogeneity of studies and subgroup analysis based on CR duration/follow-up duration, type of CR and geographical area (continent) to diagnose the source of the heterogeneity. Publication bias was evaluated by Begg and Egger's test and the trim and fill method used for confirmation.[20, 21] All statistical analyses were performed using Stata version 14.

Quality Assessment. To evaluate the quality of the studies, the Newcastle-Ottawa Scale (NOS) was used for 11 studies that were observational and risk of bias table was used for 2 RCTs. Using the NOS method, all studies were

TABLE 1. Characteristics of studies included in this meta-analysis

Study ID	Year	Country	Study type	Type of CR	Age	CR duration / follow-up	Sex	Smoking before CR	Smokers after CR	Quitter after CR	Score	Criteria for considering as a smoker
Bakker et al.	2015	Nether-lands	Cross sectional study	Out-patients CR/ physical CR	56	2-4 W	69% male	149	46	103	8	Smoked in past two years, mean of 20 cigarettes/day
bertelsen et al	2016	Den-mark	RCT	Hospital-based CR (H-CR)	80 >	4-5 M	71% male	39	17	22	9	Daily smoking
bertelsen et al	2016	Den-mark	RCT	Shared Care CR (SC-CR)	80 >	4-5 M	79% male	44	20	22		Daily smoking
Dawood et al	2008	USA	Cohort	Face to face/ phone interview	54	6 M	69% male	639	342	297	8	mean of 10- 25 cigarettes/day
Friedman et al	1997	USA	retrospective observational	Home exercise/ SCP	53	8.2±1.1 M	80% male	16	6	10	7	nicotine levels urinalysis
Friedman et al	1997	USA	retrospective observational	Home exercise / SCP	56	8.2±1.1 M	65% male	3	1	2		nicotine levels urinalysis
Goettler et al	2020	Germany	Cohort /subset of Europe survey	Face to face/ phone interview	60	6-36 M (3.5 y)	most male	104	39	65	9	Self-reported or breath CO>10 ppm
Harbman	2014	Canada	Cohort	Consoling, nurse practitioner	58	3 M	83% male	12	5	7	8	
Keskin et al	2018	Turkey	cross sectional study	Out-patients CR	55.1	6 M	87% male	21	15	6	8	Having history of smoking in the time of index coronary intervention

(*continued on next page*)

TABLE 1. (*continued*)

Study ID	Year	Country	Study type	Type of CR	Age	CR duration / follow-up	Sex	Smoking before CR	Smokers after CR	Quitter after CR	Score	Criteria for considering as a smoker
Kotseva et al	2012	Europe	cross sectional study	Exercise based CR	63.7	1.4 year	74.7% male	903	527	376	9	Smoking one month before IE
Kubilius et al	2012	Lithuania	observational/ questionnaires	Comprehensive rehabilitation	57.7	6 M		10	0	10	9	mean of 10- 14 cigarettes/day
Lindsay et al	2003	UK	retrospective observational		57.9	16.4 M	69% male	14	14	0	9	Questionnaire/ self-reported
Riley et al	2018	USA			57	4-8 W	73% male	81	53	38	8	Self-reported/ mean of 17 cigarettes/day
Sochor et al	2015	USA	retrospective observational/ cohort	Nicotine replacement therapy/ smoking free places		12 M		84	57	27	8	
Sochor et al	2015	USA	retrospective observational/ cohort	Nicotine replacement therapy/ smoking free places		12 M		251	150	101		
Sochor et al	2015	USA	retrospective observational/ cohort	Nicotine replacement therapy/ smoking free places		12 M		78	44	34		

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TABLE 1. (*continued*)

Study ID	Year	Country	Study type	Type of CR	Age	CR duration / follow-up	Sex	Smoking before CR	Smokers after CR	Quitter after CR	Score	Criteria for considering as a smoker
Prabhakaran et al	2020	India	prospective randomized open blinded endpoint	Yoga-based CR	53.4	12 W	86.2% male	610	161	449	9	Self-reported
Prabhakaran et al	2020	India	prospective randomized open blinded endpoint	Enhanced standard CR	53.4	12 W	85.9% male	592	147	445		Self-reported

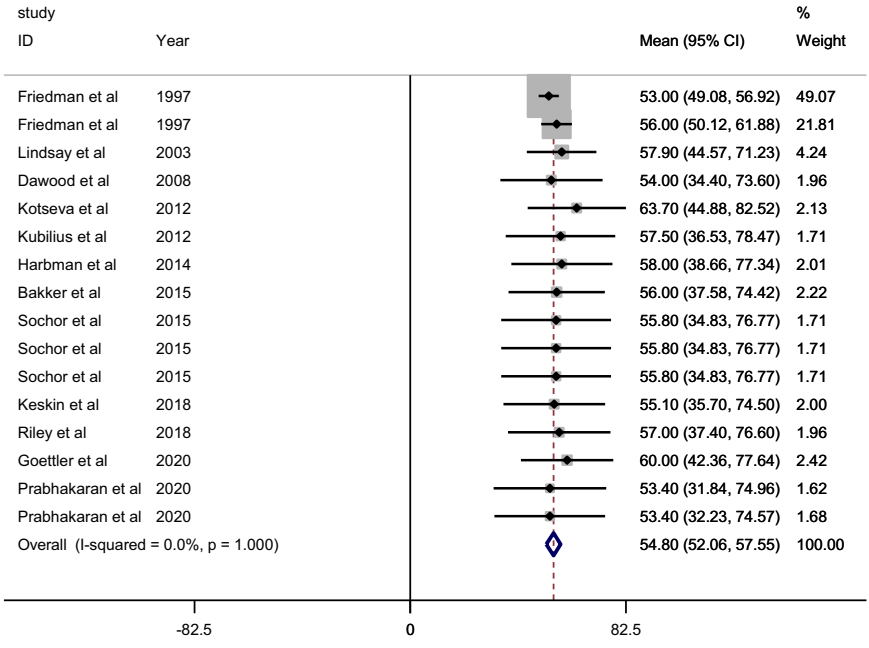

FIG 2. Forrest plot of mean age of CVD smokers participating in CR program.

scored between 7 and 9, which indicates that all the included studies were high quality.[22] We evaluated bias of 2 RCTs such as selection bias, performance bias and etc. by Cochrane Collaboration's tool showed that the studies were out of bias.[23]

Results

Of 39 eligible found studies 11 were excluded due to the lack of relevancy to our topic and 10 were excluded due to the lack of sufficient data.[1–9] The basic characteristics of all included studies summarized in Table 1. The results of the meta-analysis on 18 studies with mean age of 54.80 (52.06, 57.55) (Fig 2) showed that performing the CR method on smokers caused 53 % (22%, 83%) of these people to quit smoking. However, 47% (16%, 77%) of these people continued smoking after CR[24-36] (Figs 3 and 4). Three studies reported 2 sets of different results[24,27,36] and one study reported 3 different sets of results.[33]

Subgroup analysis showed that among CR methods applied the most effective method was the educational along with physical exercise (comprehensive CR), so that the results of combining 7 studies that used both of these methods showed that 99% (98%, 100%) of people quit smoking after

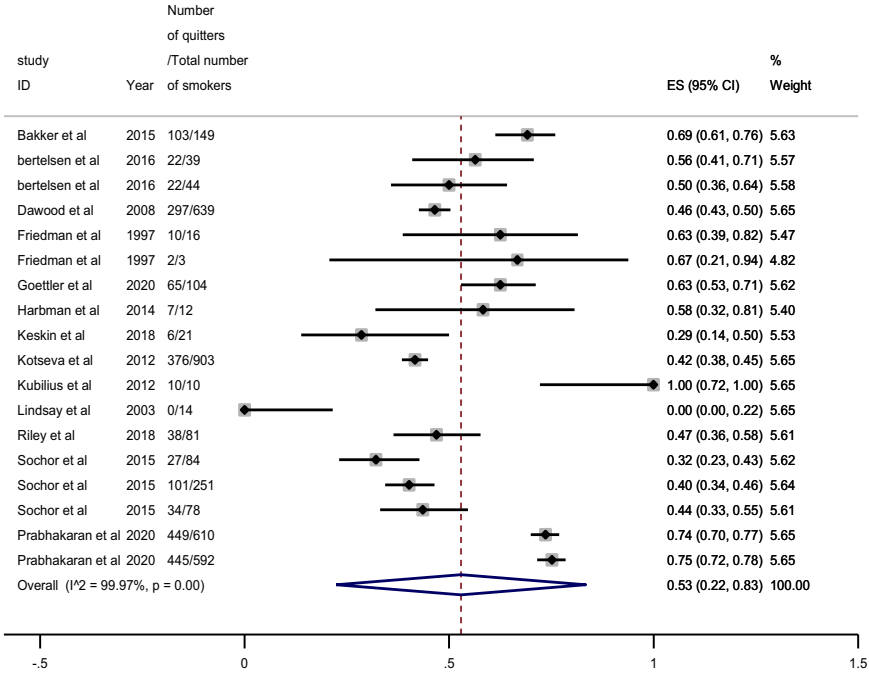

FIG 3. Forrest plot of prevalence of CVD patients quit smoking after participating in CR program.

using this method (Fig 5). Group-based CR showed to be more effective than individual-based CR 76% (57%, 94%) vs 49% (42%, 56%) (Fig 6).

In term of geographical regions the proportion of people who quit smoking after the CR participation was higher respectively in Asia 67% (57%, 77%), Europe 54% (3%, 105%), and finally America 44% (39%, 49%) (Fig 7). Also, the proportion of people who quit smoking was higher in studies with duration of less than 6 months 57% (32%, 82%) (Fig 8). Eger test was not significant for checking publication bias (p = 0.581). Summary of the results for smoking quitters and SC is presented in Table 2.

Discussion

To the best of our knowledge this study is the first meta-analysis on the prevalence of CVD smokers who quit smoking followed by participation in CR programs and how effective can CR be in terms of smoking cessation.

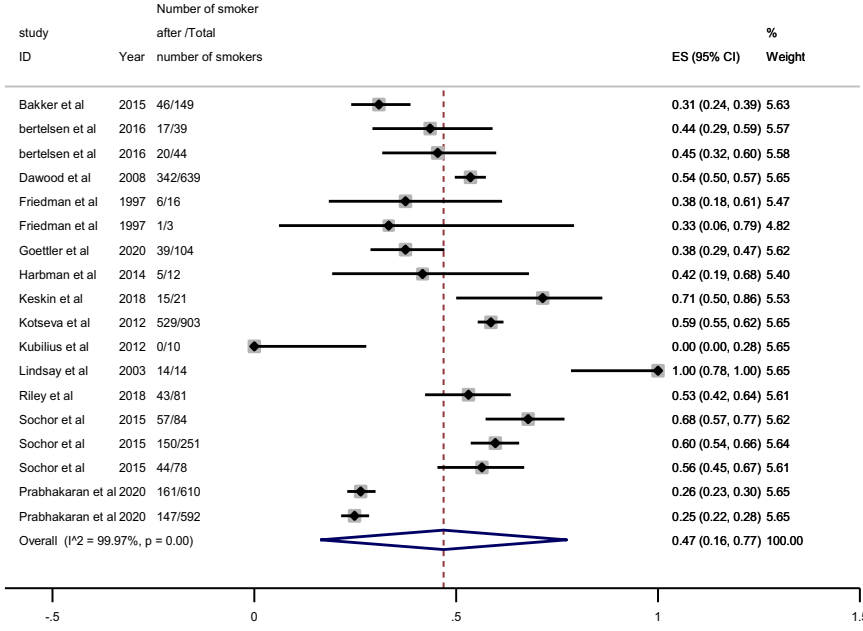

FIG 4. Forrest plot of prevalence of CVD patients continued smoking after participating in CR program.

CR is used in order to prevent CVD recurrence and improve the quality of life while decreasing the CVD related all-cause mortality. CR programs have been shown to enhance exercise tolerance and functional capacity, as well as adjusting the lipid levels, blood pressure, smoking habits, symptoms of angina and dyspnea, and psychosocial functioning.[17,37-39] A 14-year follow-up study showed that not participating in CR is associated with higher CVD related mortality.[40] SC also reduce the CVD-related mortality rate like CR programs,[41] however, a study on predictors of not refereeing to CR showed that current smoking is of the main predictors for not attending or referring to CR,[8] and therefore, the association between cardiac rehab programs and SC is not still clear.

Based on the results of 18 studies (12 articles) collected and analysed in our meta-analysis more than half of CVD smoking patient (53%) quit smoking after participating in CR program which indicates that the CR has been effective in terms of smoking cessation. According to a recent analysis 58% of the beneficial effects of CR were attributable to changes in cardiovascular risk factors and approximately half of the 28% reduction in CVD-related mortality may be attributed to reductions in major risk factors, particularly smoking.[42] In consistent to their study our results

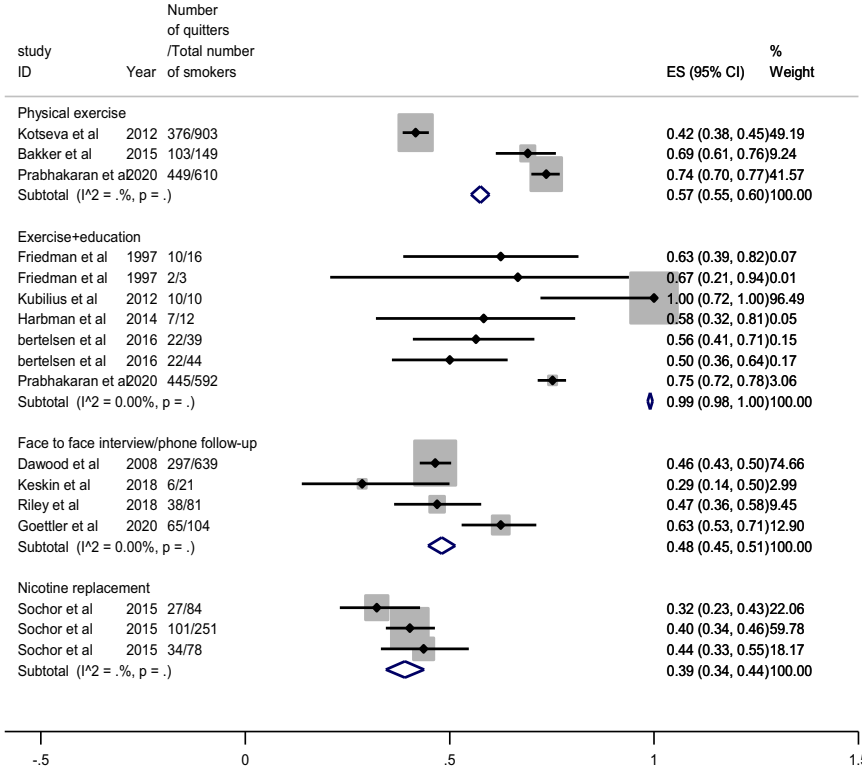

FIG 5. Forrest plot of prevalence of CVD smoking quitters after CR based on type of CR.

also showed that CR is effective in terms of SC and cause more than half of CVD smokers to quit.

Results of our meta-analysis showed that comprehensive cardiac rehab intervention (exercise +education + SC program) leads to higher rate of SC compared to nicotine replacement therapy/use of smoking free places and other CR programs that based only on physical activity or face to face interview/phone follow-up.[24,27,31] A review study showed that nicotine replacement therapy (gum, transdermal patch, nasal spray, inhalator, and sublingual tablets/lozenges) can effectively help with smoking quitting and increase the rate of quitting by 50%-60%,[43] however our meta-analysis proved that nicotine replacement therapy was less effective in terms of SC compared to other methods specially the comprehensive method. According to the results of study by[30] in Turkey where comprehensive CR with special SC program is not available and only out-patient

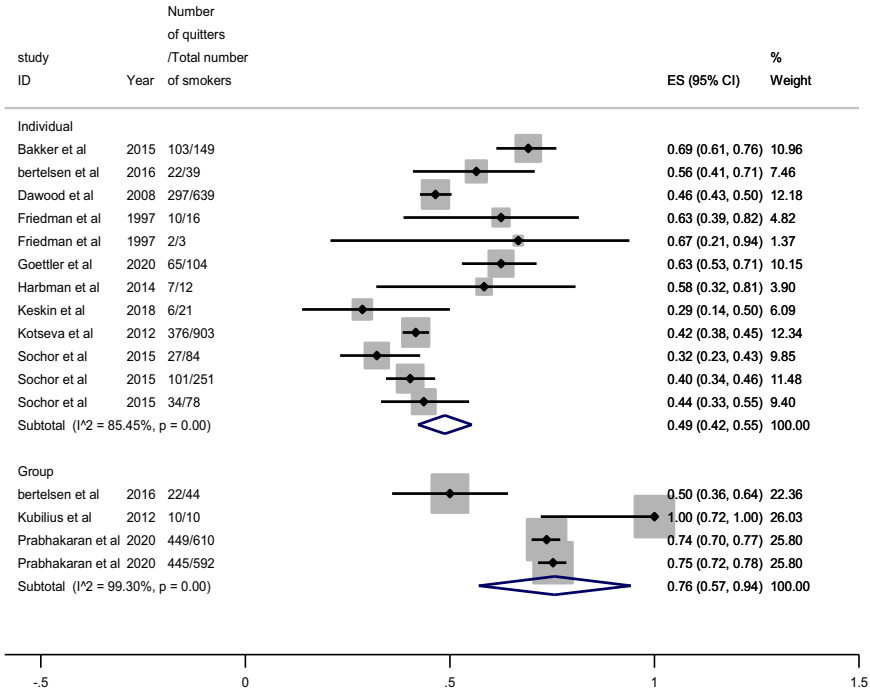

FIG 6. Forrest plot of prevalence of CVD smoking quitters after CR based on group-based/individual-based CR.

CR is the choice patients were not completely interested in participating out-patient CR.

Based on subgroup analysis in terms of follow-up/CR duration, prolonged CR periods as well as follow-ups have not helped to improve the results and statistics of those who quit smoking. This is consistent with evidence that short-term secondary prevention programmes can be more effective in improving CVD risk factors.[29,44] Unfortunately, although most of CVD patients showed great interest in SCand considering the fact that SC is the uniqe best way to change their lifestyle after MI, however, still up to 60% of smoker patients relapse to smoking within 1 year of hospitalization.[45] Another study mentioned that within 1 year after SC, around 80% of quitters resumed smoking.[30] It is obvious that as time goes on, patients become more interested in returning to smoking.

Subgroup analysis showed that when smokers participate in group-based CR and SC programs achieve much better results compared when they have participated individual-based programs and the rate of SC is almost doubled. This is consistent with previous studies which reported

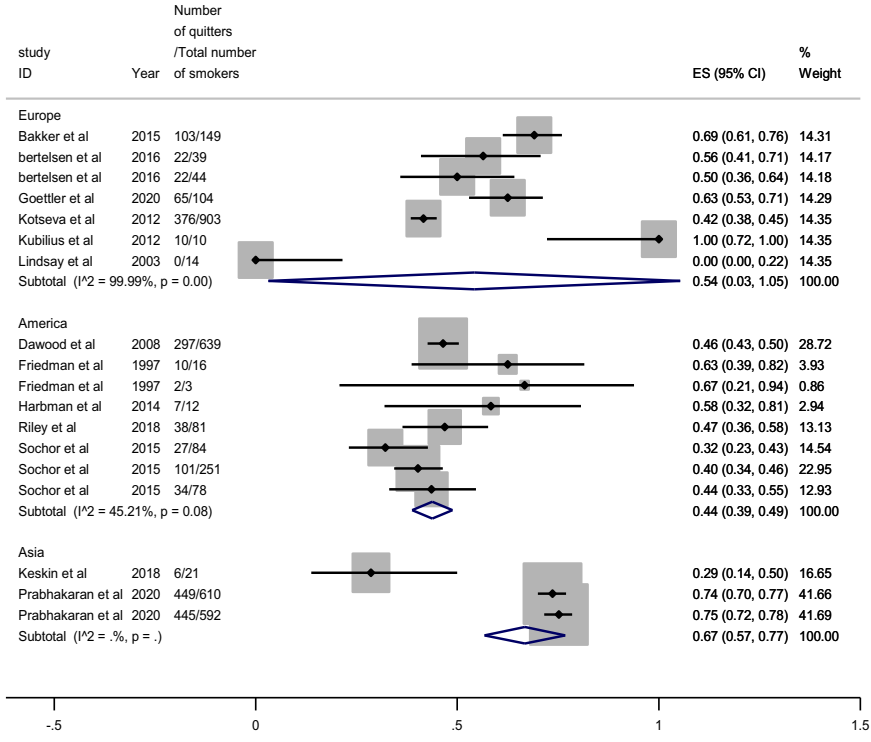

FIG 7. Forrest plot of prevalence of CVD smoking quitters after CR based on geographical region.

that group-based CR caused better results in terms of quality of life and patients' functional capacity.[46]

In terms of geographical regions, Asia showed the best results but this might be due to the study by[36] since as mentioned above, group-based CR has much better results. Due to the small number of studies in Asia continent, it was not possible to delete this article for sensitivity analysis, and more studies are needed to be more decisive for conclusion. Previous studies reported that the social, economic, and cultural conditions affect the smoking epidemic diversity among different regions and countries while the most population in terms of gender are men in all regions of the world and women in industrialized countries specially north America.[47] Although most of CVD smokers were men worldwide, however, CR enrolment rates for men and women, once referred, are similar for both.[8]

Totally 47% of CVD smokers in our study persist to smoke even after participating in CR programs. In a study by[30] most of the persistent smokers were low educated, being employed and almost young. The fact that

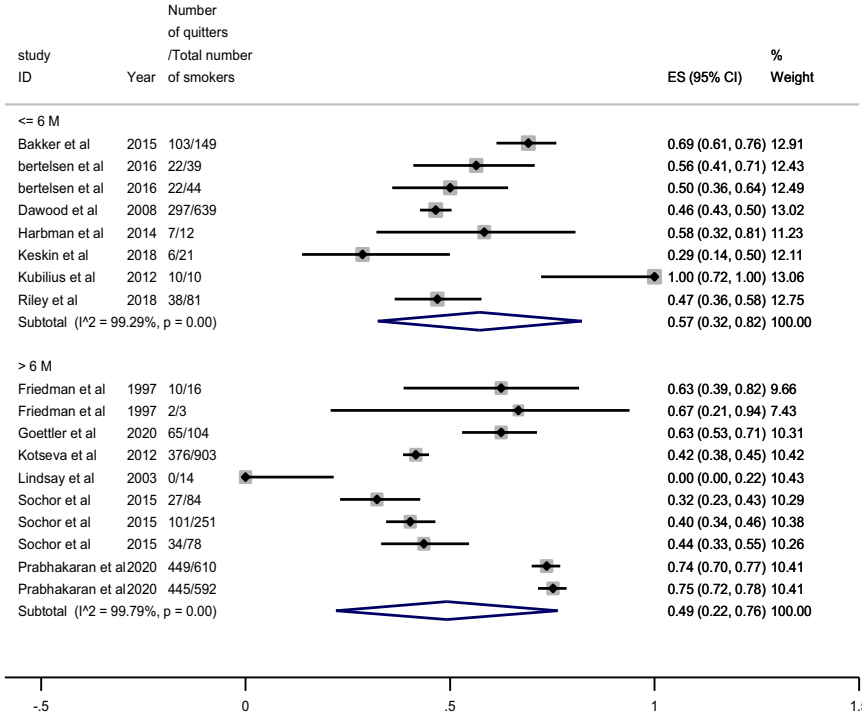

FIG 8. Forrest plot of prevalence of CVD smoking quitters after CR based on CR/follow-up duration.

most smokers belong to a younger age groups has been seen and reported in other studies as well.[9,48] In another study, age and sex found to be not associated with SC however the successfulness of SC only found to be directly associated with attendance in cardiac rehab programs[28,26] also reported that referral to CR is significantly associated with increased risk of SC. In study by[25] persistent smokers showed lower self-efficacy. They also showed less intention to permanently quit smoking based on special questionnaire. Study by[27] showed that the rate of SC was almost same between different economic classes. A study in Denmark reported that although CR is financed from taxes and is free of charge; however, attendance and participating in CR programs is not higher than in other countries.[24] In study by[34] most participants in CR were from low-income groups. Having first-time MI reported as one of the factors prevented patients in participating CR program and also avoid to quit smoking.[38] Male sex also may be a characteristic of not quitting smoking during/after CR.[9] Some studies have shown that average body mass index increases

TABLE 2. Summary of results

Outcomes	NO. of studies	Proportion (%) (95%CI)	I^2 (%)
Smoking after	18	0.47 (0.16, 0.77)	99.97
Quitter	18	0.53 (0.22, 0.83)	99.97
Type of PC			
Physical exercise	3	0.57 (0.55, 0.60)	0
Face to face interview/phone follow-up	4	0.48 (0.45, 0.51)	0
Physical exercise + Education	7	0.99 (0.98, 1)	0
Nicotine replacement therapy	3	0.39 (0.33, 0.45)	0
Group/individual			
Individual-based	12	0.49 (0.42, 0.55)	85.45
Group-based	4	0.76 (0.57, 0.94)	99.30
Continent			
Europe	7	0.54 (0.03, 1.05)	99.99
America	8	0.44 (0.39, 0.49)	45.21
Asia	3	0.67 (0.57, 0.77)	0
Duration			
$\leq$ 6 mouth	8	0.57 (0.32, 0.82)	99.29
$>$ 6 mouth	10	0.49 (0.22, 0.76)	99.79

after SC especially in the initial 10 years[49] and it is the most cited potential reason why women smokers resist to quit smoking.[50] Ideally hospitals would provide an intensive SC program that forced the primary abstinence and these programs should then be continued in following months after discharge and would help bridge the transition of returning home and promote maintained cessation.

Conclusion

The results of the current meta-analysis showed that CR is effective in terms of smokin cessation specially the comprehensive cardiac rehab which consists of education and excersice together. Group-based cardiac rehab programs also showed to be more effective compare to individual-based programs. Based on follow-up duration time it can be concluded that as time goes on, smokers relapse to smoking. In term of geographical regions. Asia showed better results than United States and Europe, however, due to the low number of articles in Asia more studies is needed for more confident conclusion.

Ethical Standards

This article does not contain any studies with human participants performed by any of the authors.

REFERENCES

1. Bradley F, Morgan S, Smith H, Mant D. Preventive care for patients following myocardial infarction. The Wessex Research Network (WReN). *Family practice* 1997;14 (3):220–6.
2. Dondo TB, Hall M, Timmis AD, Gilthorpe MS, Alabas OA, Batin PD, et al. Excess mortality and guideline-indicated care following non-ST-elevation myocardial infarction. *European heart journal Acute cardiovascular care* 2017;6(5):412–20.
3. Riley H, Ainani N, Turk A, Headley S, Szalai H, Stefan M, et al. Smoking cessation after hospitalization for myocardial infarction or cardiac surgery: Assessing patient interest, confidence, and physician prescribing practices. *Clinical cardiology* 2019;42 (12):1189–94.
4. Riley H, Headley S, Lindenauer PK, Goff S, Szalai H, Gaalema DE, et al. Patient Perception of How Smoking Status Influences Cardiac Rehabilitation Attendance After an Acute Cardiac Hospitalization. *Journal of cardiopulmonary rehabilitation and prevention* 2019;39(3):181–6.
5. Critchley J, Capewell S. Smoking cessation for the secondary prevention of coronary heart disease. *Cochrane Database Syst Rev* 2004(1):Cd003041.
6. Katz DA, Buchanan DM, Weg MWV, Faseru B, Horwitz PA, Jones PG, et al. Does outpatient cardiac rehabilitation help patients with acute myocardial infarction quit smoking? *Preventive medicine* 2019;118:51–8.
7. Katz DA, Graber M, Lounsbury P, Vander Weg MW, Phillips EK, Clair C, et al. Multiple Risk Factor Counseling to Promote Heart-healthy Lifestyles in the Chest Pain Observation Unit: Pilot Randomized Controlled Trial. *Academic emergency medicine: official journal of the Society for Academic Emergency Medicine* 2017;24 (8):968–82.
8. Weingarten MN, Salz KA, Thomas RJ, Squires RW. Rates of enrollment for men and women referred to outpatient cardiac rehabilitation. *Journal of cardiopulmonary rehabilitation and prevention* 2011;31(4):217–22.
9. Tzou W, Vitcenda M, McBride P. Smoking status after cardiac events and participation in outpatient cardiac rehabilitation. *Journal of cardiopulmonary rehabilitation* 2004;24(2):94–9.
10. Gaziano TA, Bitton A, Anand S, Abrahams-Gessel S, Murphy A. Growing epidemic of coronary heart disease in low- and middle-income countries. *Curr Probl Cardiol* 2010;35(2):72–115.
11. Ezzati M, Henley SJ, Thun MJ, Lopez AD. Role of smoking in global and regional cardiovascular mortality. *Circulation* 2005;112(4):489–97.
12. Gaalema DE, Elliott RJ, Morford ZH, Higgins ST, Ades PA. Effect of Socioeconomic Status on Propensity to Change Risk Behaviors Following Myocardial Infarction: Implications for Healthy Lifestyle Medicine. *Progress in cardiovascular diseases* 2017;60(1):159–68.
13. Pipe AL, Reid RD. Smoking Cessation and Cardiac Rehabilitation: A Priority!. *Canadian Journal of Cardiology* 2018;34(10, Supplement 2):S247–S51.
14. Twardella D, Küpper-Nybelen J, Rothenbacher D, Hahmann H, Wüsten B, Brenner H. Short-term benefit of smoking cessation in patients with coronary heart disease:

estimates based on self-reported smoking data and serum cotinine measurements. *European heart journal* 2004;25(23):2101–8.
15. Ades PA, Pashkow FJ, Nestor JR. Cost-effectiveness of cardiac rehabilitation after myocardial infarction. *Journal of cardiopulmonary rehabilitation* 1997;17(4):222–31.
16. Hamm LF, Sanderson BK, Ades PA, Berra K, Kaminsky LA, Roitman JL, et al. Core competencies for cardiac rehabilitation/secondary prevention professionals: 2010 update: position statement of the American Association of Cardiovascular and Pulmonary Rehabilitation. *Journal of cardiopulmonary rehabilitation and prevention* 2011;31(1):2–10.
17. A AC, Giakoumidakis K, Brokalaki H. Cardiac rehabilitation outcomes: modifiable risk factors. *British journal of nursing (Mark Allen Publishing)* 2013;22(4):200–7.
18. Barendregt J, Doi S, Lee YY, Pacella R, Vos T. Meta-analysis of prevalence. *Journal of epidemiology and community health* 2013;67.
19. DerSimonian R, Laird N. Meta-analysis in clinical trials. *Control Clin Trials* 1986;7 (3):177–88.
20. Begg CB, Mazumdar M. Operating characteristics of a rank correlation test for publication bias. *Biometrics* 1994;50(4):1088–101.
21. Egger M, Davey Smith G, Schneider M, Minder C. Bias in meta-analysis detected by a simple, graphical test. *BMJ (Clinical research ed)* 1997;315(7109):629–34.
22. Stang A. Critical evaluation of the Newcastle-Ottawa scale for the assessment of the quality of nonrandomized studies in meta-analyses. *Eur J Epidemiol* 2010;25(9):603–5.
23. Higgins JP, Altman DG, Gøtzsche PC, Jüni P, Moher D, Oxman AD, et al. The Cochrane Collaboration's tool for assessing risk of bias in randomised trials. *BMJ (Clinical research ed)* 2011;343:d5928.
24. Bertelsen JB, Refsgaard J, Kanstrup H, Johnsen SP, Qvist I, Christensen B, et al. Cardiac rehabilitation after acute coronary syndrome comparing adherence and risk factor modification in a community-based shared care model versus hospital-based care in a randomised controlled trial with 12 months of follow-up. *European journal of cardiovascular nursing: journal of the Working Group on Cardiovascular Nursing of the European Society of Cardiology* 2017;16(4):334–43.
25. Bakker EC, Nijkamp MD, Sloot C, Berndt NC, Bolman CA. Intention to abstain from smoking among cardiac rehabilitation patients: the role of attitude, self-efficacy, and craving. *The Journal of cardiovascular nursing* 2015;30(2):172–9.
26. Dawood N, Vaccarino V, Reid KJ, Spertus JA, Hamid N, Parashar S. Predictors of smoking cessation after a myocardial infarction: the role of institutional smoking cessation programs in improving success. *Archives of internal medicine* 2008;168 (18):1961–7.
27. Friedman DB, Williams AN, Levine BD. Compliance and efficacy of cardiac rehabilitation and risk factor modification in the medically indigent. *The American journal of cardiology* 1997;79(3):281–5.
28. Goettler D, Wagner M, Faller H, Kotseva K, Wood D, Leyh R, et al. Factors associated with smoking cessation in patients with coronary heart disease: a cohort analysis

of the German subset of EuroAspire IV survey. *BMC cardiovascular disorders* 2020;20(1):152.
29. Harbman P. The development and testing of a nurse practitioner secondary prevention intervention for patients after acute myocardial infarction: a prospective cohort study. *International journal of nursing studies* 2014;51(12):1542–56.
30. Keskin K, Sezai Yildiz S, Çetinkal G, Çetin S, Sigirci S, Kilci H, et al. Persistent smoking rate after coronary revascularization and factors related to smoking cessation in Turkey. *Journal of public health (Oxford, England)* 2018;40(4):806–12.
31. Kubilius R, Jasiukevičienė L, Grižas V, Kubilienė L, Jakubsevičienė E, Vasiliauskas D. The impact of complex cardiac rehabilitation on manifestation of risk factors in patients with coronary heart disease. *Medicina (Kaunas, Lithuania)* 2012;48(3):166–73.
32. Riley H, Headley S, Winter C, Mazur S, Gaalema DE, Goff S, et al. Effect of Smoking Status on Exercise Perception and Intentions for Cardiac Rehabilitation Enrollment Among Patients Hospitalized With an Acute Cardiac Condition. *Journal of cardiopulmonary rehabilitation and prevention* 2018;38(5):286–90.
33. Sochor O, Lennon RJ, Rodriguez-Escudero JP, Bresnahan JF, Croghan I, Somers VK, et al. Trends and predictors of smoking cessation after percutaneous coronary intervention (from Olmsted County, Minnesota, 1999 to 2010). *The American journal of cardiology* 2015;115(4):405–10.
34. Lindsay GM, Hanlon WP, Smith LN, Belcher PR. Experience of cardiac rehabilitation after coronary artery surgery: effects on health and risk factors. *International journal of cardiology* 2003;87(1):67–73.
35. Kotseva K, Wood D, Backer GD, Bacquer DD. Use and effects of cardiac rehabilitation in patients with coronary heart disease: results from the EUROASPIRE III survey. *European journal of preventive cardiology* 2012;20(5):817–26.
36. Prabhakaran D, Chandrasekaran AM, Singh K, Mohan B, Chattopadhyay K, Chadha DS, et al. Yoga-Based Cardiac Rehabilitation After Acute Myocardial Infarction. *Journal of the American College of Cardiology* 2020;75(13):1551.
37. Lavie CJ, Milani RV. Cardiac rehabilitation and preventive cardiology in the elderly. *Cardiology clinics* 1999;17(1):233–42.
38. Wallert J, Mitchell A, Held C, Hagström E, Leosdottir M, Olsson EMG. Cardiac rehabilitation goal attainment after myocardial infarction with versus without diabetes: A nationwide registry study. *International journal of cardiology* 2019;292:19–24.
39. Zwisler AD, Traeden UI, Videbaek J, Madsend M. Cardiac rehabilitation services in Denmark: still room for expansion. *Scandinavian journal of public health* 2005;33 (5):376–83.
40. Beauchamp A, Worcester M, Ng A, Murphy B, Tatoulis J, Grigg L, et al. Attendance at cardiac rehabilitation is associated with lower all-cause mortality after 14 years of follow-up. *Heart* 2013;99(9):620–5.
41. Klinsophon T, Thaveeratitham P, Sitthipornvorakul E, Janwantanakul P. Effect of exercise type on smoking cessation: a meta-analysis of randomized controlled trials. *BMC Res Notes* 2017;10(1):442.

42. Taylor RS, Unal B, Critchley JA, Capewell S. Mortality reductions in patients receiving exercise-based cardiac rehabilitation: how much can be attributed to cardiovascular risk factor improvements? *European journal of cardiovascular prevention and rehabilitation: official journal of the European Society of Cardiology, Working Groups on Epidemiology & Prevention and Cardiac Rehabilitation and Exercise Physiology* 2006;13(3):369–74.
43. Stead LF, Perera R, Bullen C, Mant D, Hartmann-Boyce J, Cahill K, et al. Nicotine replacement therapy for smoking cessation. *Cochrane Database Syst Rev* 2012;11: Cd000146.
44. Clark AM, Hartling L, Vandermeer B, McAlister FA. Meta-analysis: secondary prevention programs for patients with coronary artery disease. *Ann Intern Med* 2005;143 (9):659–72.
45. Gaalema DE, Cutler AY, Higgins ST, Ades PA. Smoking and cardiac rehabilitation participation: Associations with referral, attendance and adherence. *Preventive medicine* 2015;80:67–74.
46. Papathanasiou J, Boyadjiev N, Dimitrova D, Kasnakova P, Tsakris Z, Tsekoura D, et al. The effect of group-based cardiac rehabilitation models on the quality of life and exercise capacity of patients with chronic heart failure. *Hellenic Journal of Cardiology* 2017;58.
47. Yusuf S, Reddy S, Ounpuu S, Anand S. Global burden of cardiovascular diseases: part I: general considerations, the epidemiologic transition, risk factors, and impact of urbanization. *Circulation* 2001;104(22):2746–53.
48. Scholz J, Santos PCJL, Buzo CG, Lopes NHM, Abe TO, Gaya PV, et al. Effects of aging on the effectiveness of smoking cessation medication. *Oncotarget* 2016;7 (21):30032–6.
49. Flegal KM, Troiano RP, Pamuk ER, Kuczmarski RJ, Campbell SM. The influence of smoking cessation on the prevalence of overweight in the United States. *N Engl J Med* 1995;333(18):1165–70.
50. Women and smoking: a report of the Surgeon General. Executive summary. *MMWR Recomm Rep.* 2002;51(Rr-12). i-iv; 1-13.