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Smoking Cessation Interventions: Current and Emerging Approaches and Outcomes, A Systematic Review and Meta-Analysis

Brinker CL and Colwell KL*

Department of Graduate studies, Youngstown State University, USA

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***Corresponding author:** Dr. Kelly L Colwell, Youngstown State University, Department of Graduate studies, 1 Tressel Way, Department of Health professions, Cushwa Hall, Youngstown Ohio, USA

Abstract

Introduction: The indulgence of nicotine through cigarette smoking is the foremost cause of preventable death in the United States [1]. Approximately 8.7 million people globally die every year from tobacco-associated issues [2]. There are many different strategies for smoking cessation which include pharmacologic and non-pharmacologic interventions. Behavioral interventions, counseling, social media support, and mobile phone application support. Alternative therapies include acupuncture, hypnotherapy, behavior interventions, exercise motivational interviewing, and spirometry [3].

Methods: A meta-analysis consisting of the statistical evaluation of smoking cessation research studies was performed to combine the results of comparable studies and clinical trials. The inclusion criteria for this study focused on smoking cessation strategies and their impact on the success of becoming a non-smoker.

Results: Of the 117,214 studies that were obtained and examined, 25 were defined as potentially appropriate for inclusion. Of those studies initially selected, only 11 met the inclusion criteria [4-14]. A total of 264,133 participants were included in this review.

Discussion: This investigation sought the answer to emerging and current smoking cessation strategies and whether the method of delivery and experience had an impact on the effectiveness and success of becoming a non-smoker. Analysis of the existing evidence revealed behavioral and pharmacologic interventions seem to bestow additional benefits and success rates for smoking cessation. The dominance of combined interventions over individual smoking cessation strategies has the most impact on becoming a non-smoker. cessation strategies.

Keywords: Smoking cessation; Treatment; Tobacco; Lung screening; Smoking intervention

Abbreviations: HER: Electronic Health Record; CG: Control Group; IG: Intervention Group; KNHANES: Korean National Health and Nutrition Examination Survey; CO: Co-Oximetry, QUIT+HE: Internet-Administered Smoking Cessation Treatment with Health Education; QUIT+CBT: Internet-Administered Smoking Cessation Plus CBT For Weight Concerns; ATC: Addiction Treatment Center; CM: Contingency Management

Introduction

The use of nicotine through cigarette smoking is the foremost cause of preventable death in the United States [1]. with more than 8.7 million people globally succumbing yearly to tobacco-associated issues [4] Diseases related to smoking include cancer, respiratory issues, and vascular diseases which are major causes of increased mortality. Effective smoking cessation strategies help those who are ready to quit therefore reducing the risk of disease and early death [3]. Despite the strategies available for smoking cessation, there is inadequate literature regarding which strategy has the most promising outcomes. A meta-analysis of several research studies and clinical trials was conducted, but little is known about the emerging and most frequently used strategies. To this end, the present research prompted the following hypotheses: Does the delivery and experience of current and emerging smoking cessation strategies have an impact on the effectiveness and success of cessation and becoming a non-smoker?

Methods

The inclusion criteria for this study focused on smoking cessation strategies and their impact on the effectiveness and

success of becoming a non-smoker. Participants were male and female between the ages of 18 and 85, including all ethnicities, with a history of smoking. The database results revealed manuscripts from January 1, 2018, through January 31, 2023, apart from the history, to retrieve a full background on tobacco and its use. The reference lists of selected studies were reviewed to retrieve any articles that were appropriate for this analysis. A meta-analysis consisting of the statistical evaluation of smoking cessation research studies were performed to combine the results of comparable studies and clinical trials. The following details were extracted: The strategy approach, participant type, and conclusions of each study.

Results

Of the 117,214 studies that were obtained and examined, 25 were defined as potentially appropriate for inclusion. Of those studies initially selected, only 11 met the inclusion criteria [2]. [4-12] Important information from the included studies is detailed in (Table 1). The primary causes for study exclusion were studies that showed withdrawal symptoms, number of attempts, and interest in quitting without participant outcomes. A total of 264,133 participants were included in this review. The studies ranged from small to substantial sample sizes, which ranged from 15 - 218,915 participants. Sample sizes in studies of Pharmacological Nicotine Replacement Therapy (NRT) were commonly larger than those of Non-pharmacological Nicotine Replacement Therapy.

The sample size for Pharmacological Cessation Strategies studies ranged from 54 - 218,915 participants, while Non-Pharmacological Cessation Strategies ranged from 15-4,927 participants. Sample sizes in studies that used both Pharmacological and Non-Pharmacological Cessation Strategies ranged from 54 - 218,915. Smoking cessation outcomes are presented in (Table 1) (Figure 1 & 2).

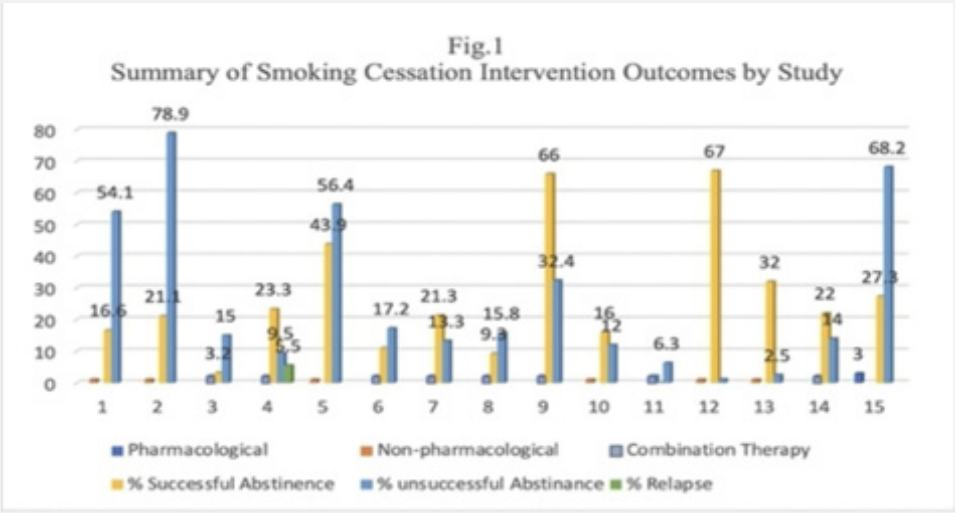

Figure 1: Summary of smoking cessation intervention outcomes by study.

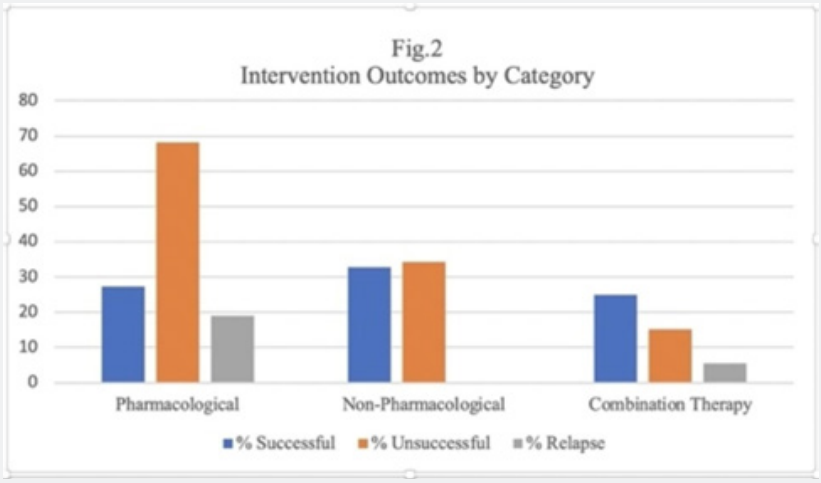

Figure 2: Intervention outcomes by category.

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Table 1: Summary of Smoking Cessation Strategies and their Outcomes.

First Author	Study Period	Number of Participants	Pharmacological or Non-pharmacological	% Abstinence Success	% Unsuccessful	% Relapse
Brinker [12]	19 days	464	Non	16.6	54.1	---
Rodriguez-Alvarez [4]	24 months	361	Non	21.1	78.9	---
Barton [20]	8 weeks	73	Both	---	---	---
Buitenhuis [9]	12 weeks	73	Both	23.3	---	5.5
Cho [10]	8 years	4927	Non	43.59	56.4	---
Fennell [8]	26 months	218915	Both	0.07	0.04	---
Jackson [14]	12 months	18884	Both	21.3	---	---
Joyce [18]	12 weeks	106	Both	---	---	---
Kotz [7]	3 years	38751	Both	66	32.4	---
Lennes [15]	12 months	39	Non	16	---	---
McDermott [17]	5 years	1155	Both	43.8	---	---
Noorani [11]	12 months	15	Non	67	---	1
Shakil [13]	24 months	48	Non	36	---	---
White [14]	14 days	54	Both	22	---	---

Nicotine replacement therapy (NRT)

The goal of a study from 20205 was to provide a characteristic investigation of the percentage of smokers who try smoking cessation at least once per year, the use of evidence-based methods, other methods of smoking cessation, and possible associations of the use of such methods with the level of tobacco dependency with socioeconomic geographies. Data from a Smoking Behavior Questionnaire from June/July 2016 to June/July 2019, were investigated. Current smokers and recent ex-smokers (<12 months without smoking) were asked about their cessation attempts in the past year and the strategies used. Of the 38,751 participants, 66% remained abstinent and 32.4% were unsuccessful.

Combination therapy

A study conducted by Fennell [6], Ask-Advise-Connect was initiated by qualified professional nurses who recorded the smoking status of patients at all appointments in the electronic health record (EHR) at the time vital signs were collected, delivered brief guide to all smokers for cessation strategies, and offered to immediately send each smoker's name, telephone number, and language preference to the Quitline so that they could be contacted and offered treatment. The smoking status of 218,915 patients was evaluated and recorded in the EHR. Smoking prevalence was 8.4% among patients preferring Spanish and 27.0% among those preferring English. Spanish-preferring patients were less likely to enroll in treatment (10.7% vs 12.0%. Of the 218,915 participants, 0.07% were successful with abstinence and 0.04% were unsuccessful [6].

Non-pharmacological

Cohabiting couples who had been in a romantic relationship for at least one year were examined, of which one spouse had to be a regular smoker while the other was a non-smoker [7] The first step in the intervention was for the non-smoker to put in writing moments when the smoker usually smokes a cigarette. The partner could help by giving cessation suggestions. The second step was to produce implementation objectives for these anticipated difficult moments. The couples were asked to note implementation intentions on how to prevent smoking at those moments. Lastly, the couples revealed each plan and how reasonable they thought it was to accomplish. The involvement of a non-smoking partner in the planning did not increase its effectiveness. Of the participants, there was a 63% abstinence rate[7].

The Korean National Health and Nutrition Examination Survey (KNHANES) initiated by Cho [8] was a national analysis representing the non-institutionalized, civilian population in South Korea. The aspects of the data are comparable to the National Health and Nutrition Examination Survey (NHANES) administered in the US. The data in the survey were compiled by interviewers and examiners and consisted of three sub-surveys: a health interview, a health examination, and a nutrition survey [8]. The study revealed that unsuccessful smoking cessation was related to work schedules and those permanent overnight workers are the most susceptible populace. The different effects on smoking cessation from permanent overnight work and night-included rotation work were reviewed with several objective pieces of evidence. Of the 4,927 participants, 56.4% were

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unsuccessful and 43.59% were successful with abstinence [8].

In a study conducted by Noorani [9], participants were administered psychedelics and attended four weekly counseling meetings. The meetings consisted of standardized treatment for smoking cessation and specialized planning for psilocybin sessions. Participants emphasized that the psilocybin experiences surpassed any short-term withdrawal symptoms and reported a variety of ongoing positive changes beyond smoking cessation, including increased social behavior. Of the 15 participants, 67% were successful with abstinence [9]

Participants for a study involving spirometry were randomly assigned to a control group (CG) or intervention group (IG) [4]. At the baseline visit the participants were given brief, structured counseling on quitting smoking and were provided structured feedback on spirometry results. The length of the visit was approximately 15min. Lastly, participants completed a questionnaire to collect data on affiliation, sociodemographic, medical history, chronic medication, smoking habits, motivation, dependency, cessation phase, and respiratory symptoms. At one year of follow-up, only the intervention group repeated the spirometry and received feedback on the results and the impact on their health. Patients who reported quitting smoking underwent a co-oximetry (CO) test; they were considered nonsmokers if they had a co-oximetry level of <10ppm. At this visit and the two-year visit, patients who had not smoked for one year or more were considered abstinent smokers [4]. Of the 361 participants, 21.1 were successful in quitting and 78.9% were not successful.

The development of a 3-dimensional face-aging app Smoker Face by Brinker [10] shows the user how their face would look in 15 years with or without cigarette smoking. The tablet was placed with the app running on a table in the middle of a waiting room and was connected to a large monitor attached to the wall. During a 19-day period, 464 patients visited the waiting room, of whom 187 (40.3%) tried the app and 179 (38.6%) completed the questionnaire. Of the 464 participants, 16.6% were successful with abstinence, and 54.1% were unsuccessful [10]. A study was carried out to find out the effectiveness of clinical hypnosis as an intervention for smoking cessation. A four-session hypnosis intervention for smoking cessation was discussed in detail. The sessions were based on hypnotic inductions, individualized hypnotic suggestions, self-hypnosis, and the development of a trustworthy interpersonal relationship with clients and self-hypnosis. Of the 48 participants, 36% were successful with abstinence [11].

Participants were 54 overweight and obese smokers aged 18-65 years. Eligible participants were randomized in equal provision to one of two conditions: Internet-administered smoking cessation treatment with health education (QUIT+HE) or Internet-administered smoking cessation plus CBT for weight concerns (QUIT+CBT). All participants received the 21mg nicotine patch daily for 10 weeks, beginning in the second week of treatment. All participants received, via website access, a standardized smoking cessation treatment. Breath carbon monoxide (CO) was assessed for all participants at clinic evaluations. CO was used to confirm subject eligibility at baseline and to verify abstinence at post-treatment and follow-up assessments. Of the 54 participants, 22% were successful with abstinence [12].

Project Reach was a tailored risk-based smoking cessation intervention, delivered following screening via four telephone sessions. Thirty-nine adult smokers were registered between February 2015 and February 2016, who had undergone lung screening or were seen in a multidisciplinary pulmonary nodule clinic [13] Of the 39 participants, there was a 16% abstinence rate. The review of studies on smoking cessation strategies consisted of mostly combined pharmaceutical and non-pharmaceutical methods, which had a higher success rate than non-pharmaceutical strategies alone. Overall, there was a 23.6% successful abstinence rate including the reviews that did not give outcomes of their studies.

Discussion

This investigation sought the answer to emerging and current smoking cessation strategies and whether the method of delivery and experience have an impact on the effectiveness and success of becoming a non-smoker. A study conducted by Lennes [14] explored the feasibility and efficacy of a telephone-based smoking cessation strategy, Project Reach. Four telephone-tailored risk-based smoking cessation sessions were delivered to adult participants. There was a 16% abstinence rate. McDermotts [15] study emphasizes the effectiveness of the use of E-cigarettes as a cessation strategy. The result showed that there was an increase in the odds of successful abstinence when using E-cigarettes.

A study performed by Joyce [16] assessed the effectiveness of the Somatix Smoke Beat program which uses a smartwatch as a smoking cessation strategy. The participants of this study were Medicaid-eligible, pregnant, or recently postpartum smokers, and were conducted with and without incentives. The use of the Smoke Beat program did not significantly improve abstinence. Aniruddh Ajith [17] conducted a study that explored the experiences of cigar-smoking cessation and assistance received from healthcare providers among young black adult cigar smokers. This study suggests that there is a low interest in quitting cigar smoking. In a project by Barton [18], attendance data were compared for five patient cohorts that received an 8-week-manualized group treatment for smoking cessation to seven cohorts that received the same group treatment for smoking cessation plus attendance-based.

Groups occurred in the Addiction Treatment Center (ATC) at VA Puget Sound, a large urban medical center serving Veterans in the Seattle area. This quality improvement project did not find any improvement in total sessions attended or consecutive sessions attended with the addition of attendance-based contingency

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management (CM) for a tobacco cessation group held within a VA clinic [18]. Of the existing methods for effective smoking cessation, the evidence reveals behavioral and pharmacologic interventions: nicotine replacement therapy, and bupropion, combination therapy counseling by various healthcare providers delivered by competent healthcare professionals seem to infer additional benefits and implicate the best success rate for smoking cessation.

Conclusion

This investigation sought the answer to: Do emerging and current smoking cessation strategies and the method of delivery and experiences have an impact on the effectiveness and success of becoming a non-smoker? Studies investigated adult smokers and recent non-smokers, veterans, pregnant women, patients with lung issues, non-Hispanic Black/African American adults, homeless, and overweight/obese adults. This investigation revealed the dominance of combined interventions over individual smoking cessation strategies to have the most impact on becoming a non-smoker. Of the existing methods for effective smoking cessation, evidence supports the effectiveness of various behavioral and pharmacologic interventions. In addition, combination therapy seems to grant additional benefits. Moreover, A combination of behavioral support and pharmacotherapy to treat nicotine dependence maximizes the chances of successful long-term cessation. Combination nicotine replacement therapy is the most effective form of pharmacotherapy.

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