TOBACCO HARM REDUCTION AND CESSATION PROGRAMS TARGETING UNDERSERVED MARGINALIZED COMMUNITIES

CURRENT BEST PRACTICES BY INTERNATIONAL AND PRIVATE ENTITIES LITERATURE REVIEW

Innovative Development Solutions

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1.0 Introduction & Background

1.1 Overview of Tobacco Use among Underserved Marginalized Communities

According to Global Adult Tobacco Survey 2022 conducted on patterns of tobacco use in 82 different countries, it was found that 1 billion individuals throughout the world smoked tobacco in the year 2020 and smokeless tobacco was used by approximately 336 million individuals. These tobacco users live predominantly in low-middle-income countries (LMICs). Unfortunately, it has been predicted that despite seeing a gradual decrease in the use of various forms of tobacco in the last two decades, LMICs will still face a high incidence of smoking with middle-income countries rising above 20% and low-middle-income countries rising above 12% [1].

One of the most common forms of tobacco used was combustible tobacco, however, the prevalence of smokeless tobacco has also increased to 7.7%. Tobacco is mostly used by individuals with low socioeconomic status and low educational level and the frequency of smoking is most likely high in such groups of cigarette smokers. In general, men smoke more cigarettes than women. It was revealed that in over 60 of these low- and middle-income nations, the rate of prevalence of smoking among women is less than 5% [1].

1.1.1 Low Socioeconomic Status Communities

'Low Socioeconomic communities tend to smoke more as indicated by research from Duncan et al “More than a quarter of people living below the poverty line smoke twice at the rate of those above the poverty line” [2]. According to the Global Adult Tobacco Survey 2003, approximately thirty-two percent of adults not having a diploma from high school, fifty percent of adults with a General Educational Development (GED) use tobacco every day or some days as compared to just ten percent of adults with an undergraduate degree and six percent with a graduate degree [3]. Furthermore, NATS, a telephone phone-based developed on tobacco product established conventions, reported that an overall 21.3% of adults used tobacco products every day or occasionally. Households earning less than $20,000 annually reported a prevalence of 32.2% whereas households earning more than $100,000 annually reported a prevalence of 12.1% [4]. A cluster feasibility trial was conducted in the UK in 2020. According to the findings, the unemployed and homeless particularly suffer from the tobacco epidemic and nearly three-

quarters of homeless individuals who smoke. The likelihood of smoking continuously is likewise higher for those with the lowest incomes. Smokers living below the poverty line have been less successful even after attempting to quit smoking at the same rates as compared to individuals with high economic status [5].

According to the European Community Household Survey conducted in 11 countries of the European Union in the year 1998, it is common to see smoking initiation occurring during adolescence despite the fact that individuals of this age group attend a school where the environment influences their daily life. School performance and peer pressure are related to taking up smoking and are likely linked to lower educational levels. Higher smoking rates are also linked with less education [6]. However, after completing basic schooling and entering a workplace, other socioeconomic factors such as income, have a stronger impact on startphone-based developed continuation. Researchers conclude that "policies regarding prices, school-based programs and support for smoking cessation by young adults should be focused on interventions to prevent smoking addiction among the lower educated group" [6].

1.1.2 Racial Minorities

According to National Youth Tobacco Survey conducted in 2017 in the USA, the trends reported for prevalence among adults of different races in the USA were as: Asian American (7.1%), white Spanish Americans (15 %), Black minorities (14.6 %) and Spanish American adults smoked (9.8 %) [7]. Moreover, the Morbidity and Mortality Weekly Report 2020 published by the Centre for Disease Control and Prevention (CDC), USA revealed that current smokers were 2.5% of high schoolers of American descent and 0.4% of these middle school children compared to overall 5.8% of high school going population and 2.3% of middle school goers in 2019 [8]. However, according to Morbidity and Mortality Weekly Report 2022 by CDC, USA marked socio- adults of different races and ethnicities by urban-rural designation was witnessed in 2020. Among adults, use of smokeless tobacco use is more common than other races/ethnicities. Asian American sub-populations also exhibit a diversity of tobacco use. The diversity is also evident in populations residing in different geographic locations for example "cigarette smoking among Black and White Non-Hispanic White Hispanic adults who lived in rural areas was higher than the urban areas racial and ethnic counterparts". Variations may be due to these significant differences in financial and living conditions, advertisement exposure and tobacco use attitudes [9].

1.1.3 LGBTQ Communities

A survey conducted by Francisco O. Buchting et al [10] using a questionnaire for assessing the use of tobacco among transgender populations found that LGBTQ communities face a disproportionate risk for using tobacco, leading to negative health outcomes. But even if this disparity does exist, it cannot be quantified without empirical data. A survey reported that 'transgender adults had twice the likelihood of using cigars and e-cigarettes as compared to cisgender adults" and "transgender children between the ages of 14 and 17 reported using multiple tobacco products three times more frequently than cisgender youth" [10]. E-cigarettes, cigarettes, cigars, hookah and smokeless tobacco were included in tobacco products. It was also observed that transgender youth use e-cigarettes 3 times, cigarettes 4 times and smokeless tobacco 3.5 times higher as compared to cisgender youth [10]. According to the report published by American Lung Association in 2010, no published studies on transgender cigarette smoking were witnessed, however, since 2010, a few have emerged [11]. A survey was conducted in Missouri using a questionnaire which showed that the rates were twice higher than transgender/gender queer (43%) for smoking cigarettes than heterosexual individuals (27%) [12]. Another survey in the USA revealed that approximately "83% of transgender women reported that they had smoked cigarettes in the previous month whereas 62.3% reported smoking daily" [13]. Similarly, a web-based electronic survey conducted in Massachusetts on transgender adults showed that around transgender adults (43.2%) residing at an "HIV hot spot" were current smokers as compared to transgender adults (34.3%) not living in a designated area [14]. According to National Transgender Discrimination Survey conducted in the USA in 2008, transgender respondents (30%) reported smoking daily or occasionally [15]. According to the Massachusetts Behavioral Risk Factor Social Survey conducted in 2016 in the USA, reported that 17.3% of cisgender while 36.2% of transgender were current smokers [16].

The Youth Risk Behavior Survey was conducted in 2015 in the USA to assess whether smoking disproportionately affects LGBT communities. The survey results showed that lesbian, homosexual, and bisexual youth were twice as likely to consume a cigarette before they turn 13 years old. In comparison to 1 in 6 heterosexual adults, about 1 in 4 lesbian, gay, and bisexual adults consumed cigarettes. "Overall, e-cigarettes and small-sized cigars use were nearly twice as common among lesbian, gay and bisexual persons as it was among straight adults". In addition, Youth sexual minorities were also observed to be more prone to use tobacco heavily in addition to increased rates of smoking [17]. The National Adult Tobacco Survey

conducted from 2005-2015 in the USA reported that chances for lesbians smoking cigarettes rose from 3.3-3.7 and 4.9-6.2 for bisexuals as compared to heterosexuals. From 2011-2015, LGB girls and boys had similarly high chances of heavy tobacco use compared to heterosexual girls and boys. Also, a study showed that "About 36% of LGBT smokers stated that they smoked cigarettes containing menthol, which were easier to use and harder to stop smoking than other types of cigarettes" [18].

1.1.4 Indigenous Population

A review conducted in 2017 of different studies published in Canada during 2003-2014 reported that 'in many indigenous societies, tobacco is considered sacred; nonetheless, using commercial tobacco for recreational purposes can be dangerous and highly addictive'. Excessive tobacco use has several negative health effects, including disproportionately high rates of death and morbidity as well as excessive tax burden on indigenous populations. Smoking is more prevalent among individuals with low socioeconomic status and jobless [19]. A review conducted in 2020 of different studies published in New Zealand, Canada and the USA during 2006-2016 reported three times higher smoking rates among Canadian Indigenous communities as compared to the general population. 'Similar discrepancies in tobacco use between native and non-native individuals exist in other high-income countries including Canada, New Zealand, and the United States' [20].

1.1.5 Mental Illness and Substance Abuse Disorders Patients

According to Oregon's statewide Client Process and Monitoring System report for the period 1999-2005, individuals diagnosed with serious mental disorders showed higher rates of smoking. 'Higher rates of smoking have been observed in people with mental illness than the general population (41 % versus 22.5 %, respectively)' [21]. Moreover, National Epidemiologic Survey on Alcohol and Related Conditions conducted from 2001-2002 in the USA found that alcohol and tobacco were used by around 46.2 million adults and nicotine and alcohol dependence was reported by 6.2 million adults [22]. A study published in the USA during 2004-2016 reported that the percentage of US adults who reported smoking in the past month was 1.8 times higher for those with any history of mental illness in the past year compared to those without (28.2% vs. 15.8%). 'Nearly half the cigarettes smoked in the United States (44-46 %) were consumed by people with co-occurring psychiatric or addictive disorders' [23]. A Case-Control study conducted in USA in 2008 revealed that for individuals suffering from depression, bipolar disorder or schizophrenia, the rates of prevalence

of smoking were higher (60-80%). The prevalence rates for smoking were found extremely higher among people with mental illness as up to 70% of persons with bipolar disorder and 60% of people with lifelong depression were either current or former smokers and up to 88 % of people with Africa using interview method reported prevalence of alcohol usage as 59%, tobacco usage as 39% and narcotics use as 31 % among psychiatric patients [25]. According to a survey conducted in Brazil using a questionnaire, psychiatric patients had a greater rate of current smoking (52.7%) than the general population [26]. According to Young-HUNT 3 survey carried out in Norway in 2014, teenagers with psychiatric illnesses were substantially more likely to be current smokers (20.3% vs. 13.2%) and to have experimented with illegal drugs (12.9% vs. 3.8%) than the general population [27].

1.2 Overview of Need Assessment for Study Tools Required to Assess Unique Needs of Marginalized and Underserved Smokers

The use of tobacco is highly common in marginalized groups and suffer from high socioeconomic disadvantages in high-income countries. These groups include Native Americans, the homeless, individuals who struggle with addiction or mental illness, persons from low socioeconomic backgrounds, and specific populations like LGBTQ+ and racial minorities. Smoking exacerbates the disadvantages that these populations already face in terms of their health and socio-economic inequities. The needs of these populations are not met by the approaches of controlling tobacco and the scientific approach used due to the increased disparities in rates of smoking. Marginalized underserved communities continue to make up a small fraction of published research on tobacco, despite the increased burden of smoking-related illness. There are only a few intervention studies that can serve as a reference for developing effective interventions for these smokers. Most of the research has been conducted in American Region focusing on best practices and randomized controlled trials of various products used for tobacco harm reduction and smoking cessation for this group [28].

Using strategies proven to reduce smoking may not necessarily result in a reduction in inequality, as certain strategies may have a negative effect on the most disadvantaged populations. Tailored interventions are needed for each population. The majority of research published, however, does not assess the efficacy of tobacco cessation interventions in various socio-cultural groups [29].

1.2.1 Need Assessment for Study Tools in Various Regions

The systematic review has highlighted that the unique needs of underserved and marginalized

communities regarding tobacco harm reduction and smoking cessation have been assessed using qualitative studies. The instruments usually used include focused group discussions with community leaders, individuals and healthcare professionals serving these communities. Interviews have also been used to explore and shed light on the needs of the people in these communities. However, the research has mostly been conducted in the American region followed by the European region. Limited studies have been conducted in the Western Pacific region while there is a scarcity of published literature in regions such as the Eastern Mediterranean, Southeast Asia and Africa.

1.2.1.a LGTBQ Communities

'Stressors related to their sexual orientation and/or gender identity, such as social stigma and discrimination, anxiety over being rejected by family and friends, a lack of access to culturally competent health care services, and, in some cases, internalized homophobia, are factors that make LGBT+ people more likely to smoke'. A review of the literature has identified various needs such as culturally suitable or tailored interventions for the LGBTQ+ community, reduced cost, time and accessible location, and should be encouraging and engaging. Focus group discussions with LGBTQ+ youth have been used for the assessment of unique needs for smoking cessation and tobacco harm reduction. To identify the critical components of cessation and prevention a study was conducted in the USA to identify important features of cessation and prevention interventions suitable for LGBTQ+ YYA populations. 'Three hypothetical intervention descriptions were given to the participants, and they were asked to report their thoughts, likes, and dislikes: 1) GCC; 2) social marketing (SM) campaign ideas with advertisements; and 3) social media mobile app. The descriptions of the hypothetical interventions were created in collaboration with community health centers that offer services to LGBTQ+ young adults and using findings from literature'. The participants expressed that interventions should be 'LGBTQ+ specific, should be inclusive and diverse, including peer support and services for counselling, incorporation of additional activities and provide rewards' [30]. Another study in the USA conducted in- depth semi-structured interviews with L G B T - friendly U S healthcare providers to suggest smoking cessation recommendations for LGBT and tobacco treatment practices for transgender smokers. The results showed that according to healthcare professionals 'community outreach and holistic cessation treatment services for LGBT people are required to address specific barriers faced by LGBT people' [31]. [4]. Another study was conducted in Switzerland to investigate smoking, quit-intention, and attitudes towards a gay-specific tobacco cessation program in gay smokers. The survey's subjects and

questions were derived from literature and theoretical considerations. It was comprised of five components: (i) Items on the consumption of tobacco, dependence on nicotine and difficult situations for avoiding smoking questions related to tobacco consumption, nicotine dependence and situations difficult to avoid smoking; (ii) smoking attitude assessed with a level of agreement with 8 statements iii) items regarding quitting preparedness, fears, quit attempt history and experiences of quitting, (iv) cessation programs preference and (v) social history of individuals. Based on the literature, questions about social networks, preferences for smoking cessation strategies, and agreement with smoking stereotypes were developed and discussed with international experts in several domains. The idea of social identity and self-categorization, as well as research on the influence of stereotypes on adolescent peer group smoking behavior, were used to help create the items for evaluating favorable and unfavorable stereotypes about smoking. The results indicated that 'men had failure fear and reputation loss and felt uncertain' [32].

Another study was conducted in the USA to develop suggestions for culturally appropriate smoking prevention and cessation therapies for LGBT groups. A community meeting with 30 attendees and 4 focus groups with 36 people each were held. ‘Participants recommended offering people with low-income discounted cessation products, use of role models, and improving the reach of interventions’. [33]. Another study was carried out among LGBT smokers in the USA to "examine smoking cessation preparedness barriers and facilitators." The study consisted of ‘4 ninety-minutes focus groups on, self-identification as LGBT, current smoker, and interest in stopping smoking". A quick survey that examined other demographic details and smoking habits was also completed by participants. The subjects covered in this study included quitting experiences, attitudes and beliefs, obstacles and enablers to quitting, and cultural aspects of smoking behaviors. The guide for moderator was subsequently developed using the literature's findings and covered factors that were both generally applicable and culturally specific to the smoking habit, its context, social norms, quit experiences, barriers to and facilitators of smoking cessation and the connection between minority stress and smoking'. Participants in focus groups mentioned the price of cessation treatments as a key barrier to quitting smoking. Participants in focus groups highlighted that healthcare professionals often inquire about their smoking habits and provide advice on quitting [34]. Another study in the USA conducted in-depth interviews to evaluate tobacco harm reduction needs among sexual minority adults. 'Questions related to the background of participants and their daily routines, use of NT, health and wellbeing, and use of drug pathways'. To guarantee

that a thorough description of participants' practices of THR would emerge, some interview questions were specifically created using components of social practice theory (i.e., materials, competencies, and meanings). 'The data revealed four key themes that stood out in particular: (1) the ad hoc, individual-level THR techniques participants used to lessen harms linked with NT; (2) the significance of contextualizing NT use within the larger affects daily lives of SGM; (3) the requirement of being non-judgmental in THR efforts; and (4) approval based on individuals [35].

1.2.1.b Mental Illnesses

Smokers with mental health issues have a harder time accessing specialized smoking cessation services. Mental health facilities rarely recommend smoking cessation programs to their patients. ‘ Additionally, these smokers receive fewer quit-advice sessions in primary care than smokers who don't have mental health issues’ [36]. A study conducted in the USA conducted 10 focus group discussions with different stakeholders including mentally ill tobacco consumers, mental health clinicians and administrators and identified 'five thematic categories as (1) Barriers to treatment, (2) Resources and infrastructure, (3) Negative influences on smoking behavior, (4) Knowledge deficits, and (5) Treatment needs' [37].

1.2.1.c Low Socio-Economic Status Communities

Evidence-based smoking cessation programs are not fully accessible or appropriate for smokers of lower socioeconomic status (SES) to achieve long-term abstinence, which contributes towards socioeconomic inequalities. A study conducted in the Netherlands assessed the needs by conducting interviews with smokers from lower socioeconomic backgrounds and professional stakeholders as well as a review of the literature' [38]. Another study conducted in Australia explored the factors that impact the acceptability and feasibility of alternative approaches to smoking cessation. Focus group or in-depth telephone interviews were conducted. The findings revealed that 'guilt, humiliation, and stigmatization had a detrimental impact on treatment-seeking behavior, with the majority avoiding current quit programs. Pharmacotherapy costs and treatment adherence were frequently reported as impediments to treatment success. Because of the uncertainties surrounding their legal status and regulatory limits, electronic cigarettes were thought to be dangerous. Text-messaging quit help using technology was acknowledged as a better alternative to conventional behavioral treatment programs' [39].

1.2.1.d Racial Minorities

The literature on racial minorities is scarce. A study was conducted in the UK using focus group discussions and questionnaires to assess attitudes and prevalence of smoking in a Somali population. Focus group participants were recruited through community groups from the Somali population in Islington. Findings revealed that smokers had insufficient knowledge about local smoking cessation services and there was poor promotion of NHS cessation programs [40].

1.2.1.e Indigenous Populations

A systematic review evaluated whether cultural adaptation was required for effective treatments among indigenous peoples. The review indicated that there was no likely substantial difference in the efficacy of intervention between Indigenous and non-Indigenous groups, but there was a lack of evidence on whether culturally specific interventions were required. Another analysis stated that individual-level interventions like nicotine replacement therapy (NRT) and/or counselling were likely to be equally beneficial for Indigenous and non-Indigenous populations [41].

Indigenous males participated in focus groups and were key informants in semi-structured interviews to gain information about cultural adaptations to the smoking cessation program. 'Program recommendations included strategies to incorporate cultural values and practices to promote men's cultural knowledge, as well as the necessity for a flexible program design to increase feasibility and acceptance among varied Indigenous communities.' [42].

1.3 Overview of Tobacco Industry Targeting Underserved Marginalized Communities

The literature review showed that tobacco companies revealed that they strategically focused more on marketing their products to underserved marginalized communities. 'It was found that tobacco companies promoted their products to low-income women by sending food stamp coupons, giving discounts, inventing new brands, and marketing luxury images to low-income African American women' [43]. Additionally, due to the rapid growth of the population, the rising rates in their native countries, the growing power of the consumer, and the high brand loyalty to American products, these businesses observed high potential in marketing to Asian American'. 'Compared to other metropolitan neighborhoods, mostly Asian American communities have more cigarette advertising on billboards and in businesses, and they are less likely to have health warnings on their signage than predominantly white districts' [44].

Moreover, magazine advertisements in East Asian languages were promoted and they sponsored East Asian, Asian American and Pacific Islander community festivals [45].‘ The tobacco industry supports an environment where tobacco use is viewed as normal by enhancing advertising, offering price incentives, and providing access to tobacco retailers in low-income areas’. It has also been shown that menthol cigarettes are specifically marketed to Black non-Hispanic and Hispanic racial and ethnic groups [46].

When tobacco companies learned that sexual minorities had high smoking rates, they started marketing their products to this group as early as the 1990s. "Tobacco companies used a variety of tactics to target the LGBT community, including advertising, portraying tobacco use as a normal part of LGBT life, showing LGBT community support, giveaways, and hosting community outreach efforts' [47]. 'Now,' e-cigarette businesses have followed suit by sponsoring LGBT-friendly events, such as VaporFi's sponsorship of an annual gay pride festival in Miami, where they encouraged people to celebrate diversity while on the hunt for VaporFi e-cigarettes' [48]. Bisexual women were exposed to advertisements for cigarettes, e-cigarettes, and cigars. "Tobacco firms earn around $39 billion per year from the 175 billion cigarettes sold each year to individuals with psychiatric problems. Tobacco firms advertised cigarettes to patients suffering from mental illnesses by promoting that nicotine may 'alleviate negative mood,' offered free or low-cost cigarettes to psychiatric facilities, and funded efforts to prevent smoke-free psychiatric hospital rules [49].

2.0 Methodology

2.1 Literature Search Strategy

A comprehensive purpose-driven desk review was carried out to collect information, regarding best practices by International and private entities for tobacco harm reduction and cessation programs targeting underserved marginalized communities. A protocol of the literature review included the searching of the following electronic databases: Pubmed (incorporating Medline), Ovid (incorporating Embase), PsycINFO, Cochrane Library, Web of Knowledge, the ISRCTN registry and ClinicalTrials.gov. The following search terms were used “tobacco use”, “tobacco harm reduction”, “tobacco cessation”, “best practices for tobacco cessation”, “underserved communities”, “underprivileged communities”, “underserved marginalized communities”, “low socioeconomic groups”, “racial minorities”, “transgender”, “LGBTQ”,

"mental illness", "psychiatric disorders, "indigenous population", "clinical trials", "exploratory studies", "effect assessment" "exposure assessment" and "international & private entities. All the human studies that investigated best practices used for tobacco harm reduction and smoking cessation for underserved marginalized communities were analyzed and publication date limits to the last 20 years were applied. For this review, all possible clinical trials and exploratory studies were evaluated. Studies that evaluated tobacco use and cessation practices in the general population were excluded.

The objective was to look at the best practices used for tobacco harm reduction and smoking cessation targeting underserved and marginalized communities without confounding the effects of the general population. Moreover, commentaries, editorials, letters to the editor, conference proceedings and reviews (although systematic reviews were retained for background and comparison), studies not published in English and duplicate ones were excluded. In addition, articles on best practices were also identified from included studies reference lists, as well as the list of citations for these included studies according to Google Scholar and Science Hub.

2.2. Literature Search Guidelines

The guidelines of Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) were followed to accomplish this systematic review. The search keywords and methods were predefined and were not changed during the review process. After removing duplicates, all potentially eligible reports and studies were screened by title and abstract to exclude the irrelevant ones. The duplicate was removed and further filtered out by reviewing the whole text considering the following criteria:

2.2.1 Report/Article Type: Reports/articles that synthesized data from multiple data sources, to generate quantitative estimates of best practices for tobacco harm reduction and cessation programs that varied by time or geographic population.

2.2.2 Geographic Coverage: Reports/articles on best practices for tobacco harm reduction and cessation programs targeting underserved marginalized communities according to WHO region classification.

2.2.3 Types of Best Practices: Articles/Reports highlighting clinical trials and exploratory studies on best practices for tobacco harm reduction and cessation programs targeting underserved marginalized communities.

The data was compiled to examine based on the PRISMA checklist including a) goals of the study, b) experimental designs that were used, c) measures that were used, d) subject recruitment method, content and inclusion criteria, e) methods used for tobacco harm reduction/cessation.

2.3 Data Extraction & Analysis

Using the Oxford Centre for Evidence-Based Medicine framework a level of evidence category was assigned and methodological quality of clinical trials and observational cross-sectional studies were categorised as “good”, “fair” or “poor” using the National Institute for Health (NIH) Quality Assessment tool for clinical trial protocols and Quality Assessment Tool for Observational Cross-Sectional and Cohort Studies. The NIH quality assessment tool includes features for assessing the risk of bias, such as selection and reporting bias, with a "good” grade indicating a low risk of bias and a "poor" rating indicating a high risk of bias.

All research' findings were independently assessed, categorized, and compared to identify themes for developing a preliminary conceptual framework. A report on the available literature reviewed for current best practices by international and private entities for comprehensive tobacco harm reduction and cessation programs targeting underserved marginalized communities was compiled.

3.0 Results

A total of 200 records were retrieved from the databases after implementing the search. Of these, 50 were duplicates and were excluded. Moreover, 98 records were excluded based on the relevancy of titles or abstracts with the study objectives. A total of 52 articles/reports on best practices used for tobacco harm reduction and smoking cessation targeting underserved marginalized communities were selected as they met the inclusion criteria of this systematic review for full-text assessment (Figure 1).

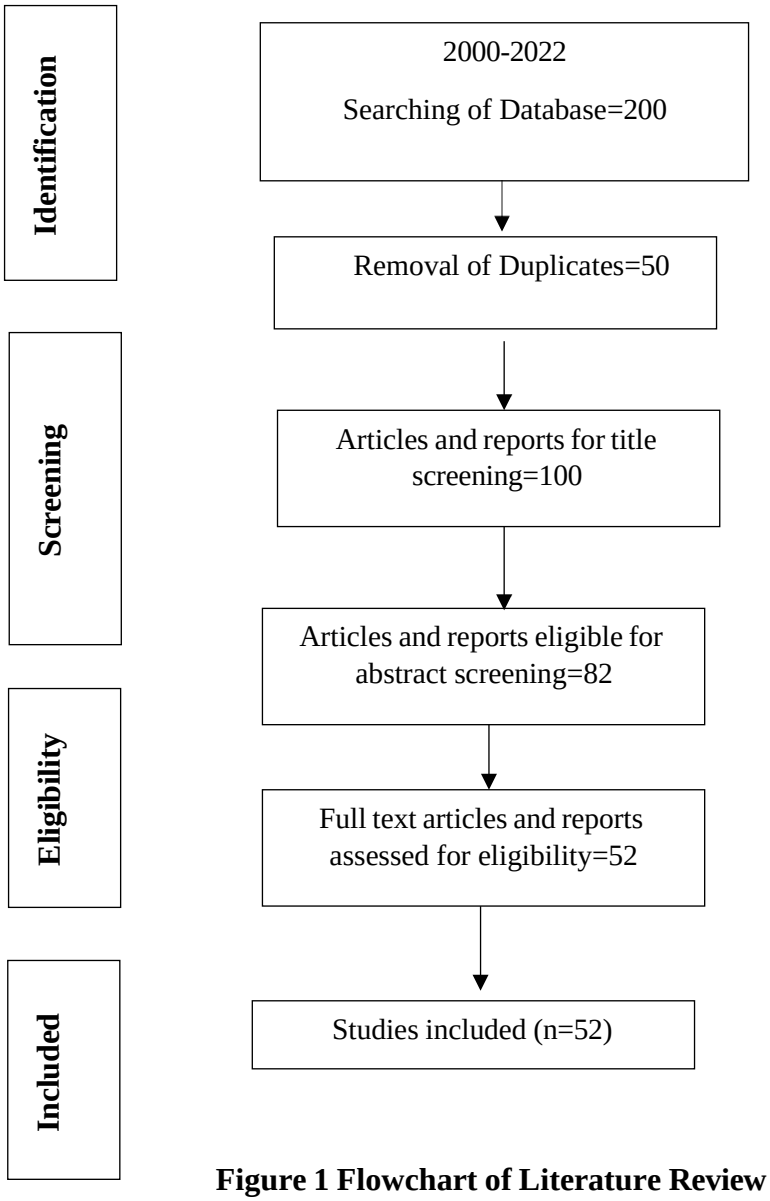

Figure 1 Flowchart of Literature Review

For each database, each of all of the key terms was independently searched and the resulting records were saved to file. The research findings were independently assessed, coded, and compared to generate a preliminary conceptual framework on current best practices for tobacco harm reduction and smoking cessation targeting underserved marginalized communities.

3.1 Characteristics of Studies

Table 1 provides a summary of baseline characteristics of the studies. A total of 52 studies among which 39 studies conducted in American region on different populations included were: low socioeconomic status (n = 9), racial minorities (n = 8), LGBTQ (n = 14), indigenous population (n = 1) and mentally ill individuals (n = 7). Out of these 39 studies, 24 were randomized controlled trials and 15 were cross-sectional studies. The THR and cessation strategies used in these 39 studies were: Nicotine Replacement Therapy alone (n =2), counselling alone as THR and cessation strategy (n = 27) and both NRT & counselling techniques (n = 10). Out of the total 39 studies, the effectiveness of the THR and cessation strategies was reported effective by 53 % (n = 21) of the studies. The most effective strategy reported was both NRT & Counseling (n = 8, 80 %) followed by only Nicotine Replacement Therapy (n =1, 50 %) and only counselling (n =13, 48 %).

On the other hand, a total of 4 studies conducted in the European region on marginalized communities were: low socioeconomic status (n = 2), LGBTQ (n = 1) and indigenous population (n =1). Of these 04 studies, 03 were randomized clinical trials and 01 was a cross-sectional study. Only 1 study used both NRT and counseling as THR and cessation strategy and reported it effective whereas 3 other studies used counseling as a THR strategy and reported effective strategy by all the studies.

Moreover, a total of 8 studies conducted in the Western Pacific region on different underserved communities were: low socioeconomic status (n = 4) and mentally ill individuals (n = 4). Two randomized controlled trials and 6 cross-sectional studies were conducted in the Western Pacific region. All 8 studies reviewed used counseling as an effective strategy for THR and cessation.

Only 1 study was conducted in the region of Africa which was a cross-sectional study using mentally ill individuals as respondents. The study showed the impact of counseling alone on tobacco harm reduction.

Moreover, a paucity of research on best practices for tobacco harm reduction and smoking cessation in underserved and marginalized communities in regions such as East Mediterranean, Southeast Asia and Africa was witnessed. The research studies conducted to date mainly focus on exploring the socio-demographic characteristics of smokers belonging to underserved communities, exploring smoking and tobacco use patterns, and knowledge and awareness of smoking cessation strategies and reviews. The description of the characteristics of all the studies is given in supplement Table 1.

Table 1. Summary of Baseline Characteristics of the Included Studies

Region	Total Studies	Characteristics			
		Study Respondents	**Study Design**	**THR and Cessation Strategy Used**	**Impact of strategy**
America	n = 39	Low Socioeconomic status (n=9) Racial minorities (n=8) LGBTQ (n=14) Indigenous population (n=1) Mental illness and substance abuse (n=7)	Randomized clinical trials (n =24) Cross-sectional (n= 15)	NRT alone (n =2) Counselling (n =27) Both (n =10)	Only THR products (n=1) Only counseling (n= 13) THR + Counselling Effective in quitting (n =8)
Africa	n = 1	Low Socioeconomic Status (n=0) Racial minorities (n=0) LGBTQ (n=0) Indigenous population (n=0) Mental illness and substance abuse (n=1)	Randomized clinical trials (n =0) Cross-sectional (n= 1)	NRT alone (n =0) Counselling (n =1) Both (n =0)	Only THR products (n=0) Only counseling (n= 1) THR + Counselling Effective in quitting (n =0)
Europe	n = 4	Low Socioeconomic Status (n=2) Racial minorities (n=0) LGBTQ (n= 1) Indigenous population (n= 1) Mental illness and substance abuse (n= 0)	Randomized clinical trials (n =3) Cross-sectional (n= 1)	NRT alone(n =0) Counselling (n =3) Both (n =1)	Only THR products (n= 0) Only counseling (n= 3) THR + Counselling Effective in quitting (n =1)
Western Pacific	n = 8	Low Socioeconomic status (n= 4) Racial minorities (n= 0) LGBTQ (n= 0) Indigenous population (n= 0) Mental illness and substance abuse (n= 4)	Randomized clinical trials (n =2) Cross-sectional (n= 6)	NRT alone (n =0) Counselling (n =8) Both (n =0)	Only THR products (n=0) Only counseling (n= 8) THR + Counselling Effective in quitting (n =0)
Total = 52					

3.2 Assessment of Quality of Studies Using NIH Quality Tool

The NIH quality assessment tool was used. Fifty-two studies were included. Of the total studies conducted, 56 % (n = 29) were randomized clinical trials and 44 % (n = 23) were cross-sectional studies. The rating of the quality of the total 29 reviewed randomized clinical trials was found as good (n = 23, 79 %), fair (n = 6, 21 %) and none as poor quality. While the rating of the quality of the total 23 cross-sectional studies was observed as: good (n = 15, 65 %), fair (n = 8, 35 %) and none as poor quality studies (Table 2). A detailed description of quality of all the randomized clinical trials and cross-sectional studies are given in supplement Table 2 and Table 3, respectively.

Table 2. Summary of Quality of the Studies Included according to NIH Tool

Region	Total Studies	Randomized Clinical Trial Quality Assessment n (%)			Cross-sectional Studies Quality Assessment n (%)		
		Good	Fair	Poor	Good	Fair	Poor
America	39	18 (75 %)	6 (25)	0	10 (66.6 %)	5 (33 %)	0
Africa	1	0	0	0	0	1 (100 %)	0
Europe	4	3 (75 %)	0	0	1 (25 %)	0	0
Western Pacific	8	2 (25 %)	0	0	4 (66.6 %)	2 (33.3 %)	0

*Quality was rated as 0 for poor (0–4 out of 14 questions), i for fair (5–10 out of 14 questions), or ii for good (11–14 out of 14 questions)

3.3 International and Private Entities for Comprehensive Tobacco Harm Reduction and Cessation Programs Targeting Underserved Marginalized Communities

3.3.1 Current Best Practices for Comprehensive Tobacco Harm Reduction and Cessation Programs Targeting Underserved Marginalized Communities in America

3.3.1.a Low Socioeconomic Status Communities

Despite the decline in the use of tobacco in the American region, the use of tobacco in communities with low socioeconomic status and racial minorities is still on the rise. Smokers with lower socioeconomic status also experience greater challenges in quitting for a variety of reasons, including limited access to care, misinformation about the risks and advantages of nicotine replacement therapy, a lack of social support, disadvantaged living conditions, discrimination, and other stressors in their daily lives. An RCT in the USA to evaluate the proactive tobacco cessation outreach program. The treatment program consisted of tele-counseling, 6 weeks of free nicotine replacement therapy, access to community-based referrals to address socio-contextual mediators of tobacco use and integration of this program with an individual's care team through the EHR. The study showed that Proactive, IVR-facilitated outreach enabled engagement with low-SES smokers. The use of counseling, nicotine replacement therapy, and access to community-based resources to address socio-contextual mediators among smokers was also found effective [50].

One of the main causes of the increased incidence of smoking among socioeconomically disadvantaged persons is lower rates of smoking cessation. Socioeconomically disadvantaged smokers may benefit from more extensive interventions because there are many serious barriers to quitting. A study conducted in the USA investigated the efficacy of a community health advocate-led, randomized smoking cessation intervention in public housing. Cessation materials as well as a single visit from a Tobacco Advocate who gave fundamental counselling was given to control site respondents. Multiple visits from a TTA including motivational interviewing, cessation counselling, and navigation (Smokers' Quitline and Clinic-based programs) were provided to the intervention group'. The study results showed that residents in public housing were more likely to use treatment

programs and quit smoking after receiving intervention from peer health advocates [51].

A study was conducted in the USA to "assess the effectiveness of a community-based participatory research (CBPR) model". Behavioral peer group meetings and nicotine replacement therapy were part of a twenty-four weeks intervention. At weeks 1, 6, 12, and 18, control neighborhoods received written cessation materials. The CBPR-developed intervention demonstrated promise for attracting smokers and lowering smoking rates among women in these areas of extreme poverty [52].

Smoking during pregnancy can lead to serious human health hazards and economic costs. There is a dire need of designing innovative smoking cessation and tobacco harm reduction strategies for pregnant women. A study was conducted in the USA to study the effectiveness of financial incentives given to low-income pregnant women to engage in smoking cessation treatment. The same smoking cessation advice was given to every participant on contact. 'Participants in the incentive condition received rewards for participating in prenatal and postpartum care: $25 for each of the six prenatal provider visits, $25 to $40 for each of the four postpartum home visits at weeks 1, 2, and 6 (a total of $130), $20 for each of the five postpartum counselling calls, and $40 for biochemically verified abstinence at the Week 1 and 6-month visits'. Participants in the control condition received just $40 for attending the appointments at week 1 and six months after delivery ($40 each). Participants in the incentive condition had a higher abstinence rate at six months after giving birth than controls [53]. Mobile phone delivered interventions can be used to support traditional strategies used for tobacco harm reduction and smoking cessation practices. A study conducted in the USA evaluated the smoking cessation programs delivered via mobile phone for those with low socioeconomic status. 'Smoking cessation interventions included nicotine replacement therapy (NRT), NRT plus text messaging, and NRT plus text messaging plus proactive counseling via mobile phone. The results of the study highlighted that assigning smokers from low socioeconomic status to a text messaging-only intervention may not improve quit rates. Yet, proactive counselling together with texting might be an effective choice' [54]. Socioeconomically disadvantaged smokers underuse evidence-based tobacco cessation treatments. The effectiveness of free nicotine replacement therapy and telephone counseling for smokers from socioeconomically disadvantaged backgrounds was assessed in a study conducted in the USA. 'The intervention consisted of proactive outreach (tailored phone calls and mailings) and free cessation

treatment (nicotine replacement therapy and intensive, telephone counselling). The standard of care included having access to a primary care physician, insurance coverage for FDA-approved smoking cessation drugs, and the state's toll-free quit line. The study concluded that among smokers who were socioeconomically disadvantaged, 'population-based proactive tobacco treatment increased involvement in evidence-based treatment and was successful for long-term smoking cessation' [55].

Another study conducted in the USA assessed 'multicomponent smoking cessation treatment including mobile contingency management among homeless veterans'. Twenty homeless veteran smokers who had smoked at least ten cigarettes per day for at least a year and had a baseline Carbon Monoxide (CO) level below ten ppm took part in a multi-pronged smoking cessation intervention that included four weeks of mobile-based contingency management following a one-week training period (mCM). Every smoker received four counselling sessions, nicotine replacement therapy, and bupropion (if medically eligible). Participants could earn an amount of USD 815 for using the mobile app and showing desired CO levels. The results showed that participants earned a mean compensation of $286 for the mCM component. Throughout the 1-week training period and the 4-week treatment period, video transmission compliance was found to be good. At four weeks, bioverified 7-day point prevalence abstinence was 50% [56]. 'Another study conducted in the USA through a community-based participatory research approach developed, harm-reduction treatment for smoking (HaRT-S) chronic homeless individuals. Interventionists in this program also embody a compassionate, advocacy-oriented "heart-set." The outcomes demonstrated that ENDS users had a further 44% decrease in intensity of smoking [57].

3.3.1. b Racial Minorities

Despite the availability of evidence-based smoking cessation treatments, harm due to tobacco is more pronounced in racial minorities and low-income communities. A study conducted in the USA assessed the 'effects of a brief motivational smoking intervention among non-treatment seeking black smokers'. Respondents were randomly assigned to Enhanced Care (EC) or Treatment as Usual (TAU) groups. 'The EC group attended a 30-minute workshop that included personal smoking comments, information on health effects, tobacco advertising that targets black smokers, and starter kits for nicotine replacement therapy (NRT)'. The Program also involved the provision of self-help books. 'The study concluded that a brief motivational intervention improved knowledge, use, and behaviors

related to quitting smoking among black non-treatment-seeking smokers and enhanced motivation to modify smoking behavior [58]. A study was carried out in the USA to assess the effectiveness of a culturally tailored tobacco cessation intervention among African American Quitline participants. Culturally specific, video-based, adjunct to standard quitline care was provided. The trial proved the usefulness of a 'culturally relevant video intervention as a population-level tobacco intervention' [59].

Mindfulness interventions have shown promising results in improving smoking cessation. During the COVID-19 Pandemic, a randomized controlled trial was carried out in the USA for 'mobile delivery of mindfulness-based smoking cessation treatment to low-income adults'. The participants received treatment for eight weeks using either iQuit mindfully as a fully automated standalone intervention or iQuit mindfully combined with therapist-led in-person group therapy. 'This study endorsed using text messaging and teleconferencing to deliver mindfulness and smoking cessation services to underserved populations during pandemics' [60]. Another study in the USA tested 'video-text tobacco cessation intervention among African American adults. Adults who wanted to stop smoking received 2 weeks of NRT, a brief behavioral counselling session, and either Path2Quit or Smokefree TXT from the National Cancer Institute (NCI)'. According to the study's findings, a culturally tailored mobile health intervention had a positive impact on NRT use and brief abstinence [61]. Another study conducted in the USA tested the effectiveness of mindfulness and mobile health for quitting smoking among African American Adults with low socioeconomic status. The intervention consisted of eight weekly group sessions of smoking cessation based on a technique of mindfulness and iQuit mindfully text messages sent in between sessions. The study found that among primarily African American adults with low socioeconomic status, text messaging was acceptable and practical for enhancing mindfulness-based smoking cessation treatment. Participants expressed satisfaction with the text messages and said that the tips provided for quitting smoking, including encouragement, social support, and specific methods, were helpful [62]. Furthermore, a study to assess "culturally specific smoking cessation interventions for American Indian communities" was carried out. On the basis of smoking status (current/former smoker), sex, and elder status, six focus group discussions were held. American Indian community organizations were utilized for focus group discussions. The results showed that participants were of the view that 'programs should give participants

the chance to interact with other American Indians who are trying to quit smoking and promote healthy lifestyles. Free medication, such as nicotine replacement therapy (NRT), modest rewards, and quit-smoking messages that emphasize the value of health were all desired treatment methods' [63]. Another study conducted in the USA evaluated cessation of smoking factors among African American (AA) and Latinx smokers who were enrolled in a trial in those assigned to e-cigarettes or smoking as usual. Participants were randomly assigned to receive JUUL electronic cigarettes for 6 weeks or to keep smoking cigarettes as usual. According to the findings, smoking was reduced by an average of 82.4 to 15.5 cigarettes per week during the course of the six-week study. By week six, use of more JUUL pods indicated a greater reduction in smoking [64].

3.3.1 c LGBTQ Communities

Literature review revealed that ' due to high tobacco use rates, tobacco-related health disparities are higher among LGBTQ communities including lesbian, gay and bisexual persons'. Despite these known and persistent disparities, few of the intervention studies focused on LGBT individuals for tobacco prevention and control strategies and smoking cessation. Due to the high prevalence of smoking among this group, LGBTQ smokers ought to be the top priority for smoking cessation interventions. A study was conducted in Chicago, USA to compare the 'effectiveness of an LGBT culturally targeted versus non-targeted smoking cessation intervention'. 'Six weekly sessions starting 2 weeks before the designated quit date and proceeding through four weeks after the quit date were given'. The results of the study showed that 'LGBT smokers who received the CTQ intervention experienced smoking cessation success rates that were comparable to those seen in other demographic groups. Cultural targeting increased the intervention's acceptability but had no additional benefits for the outcomes of smoking cessation. The overall quit rate was 31.9% at one month, 21.1% at three months, 25.8% at six months, and 22.3% at twelve months. Secondary smoking cessation outcomes improved after one month and remained stable at the 12-month mark'. The CTQ-CT intervention was considered more effective than CTQ intervention in terms of program effectiveness, intervention techniques and treatment manual [65]. Another study was conducted in San Francisco with the objective of comparing the efficacy of extended, non-tailored smoking cessation treatments among sexual and gender minority and nonminority smokers. The randomized trials included 12 weeks of counselling, nicotine replacement therapy, and bupropion, followed

by randomization to an extended treatment. The study results highlighted that 'smokers appeared as likely to abstain as nonminority smokers through such strategies '[66].

One of the obstacles to the LGBTQ population quitting smoking is the lack of basic health services and programs that are culturally appropriate for them. In a Canadian study, the salient aspects of LGBTQ+ interventions were examined from the viewpoints of LGBTQ+ youth and young adults. Group counselling, social marketing, and a mobile phone app were three interventions. The study's findings revealed that social media campaigns and mobile apps were identified that could include all the necessary components' [67]. Another study conducted in the USA treatment outcomes and baseline characteristics for bisexual smokers compared to lesbian or gay smokers'. 'Participants were enrolled and randomly assigned to receive acceptance or commitment therapy, the other the standard care treatment model (found on the Smokefree.gov website of the National Cancer Institute)'. Following randomization, participants had twelve months to use the assigned intervention. Participants also received text messages daily for 28 days in addition to the web program. The results of the study found no evidence of a difference in cessation outcomes between SM and non-SM [68].

The burden of tobacco use is high within the LGBT community with an estimated rate double than that of the general population. Lack of knowledge and limited access to resources for quitting smoking are just a couple of the factors that encourage persistent smoking. The Illinois Tobacco Quitline (ITQL) offers smoking cessation treatments for people who identify as lesbian, gay, bisexual, or transgender. A study carried out in Chicago, USA, evaluated the 'content of an intervention aimed at promoting uptake of smoking cessation treatments offered by the ITQL among LGBT identified smokers." Focus group discussions were held to gather opinions on the readability, acceptability, and motivational relevancy of a targeted and non-targeted proactive outreach letter. The findings revealed that the revised intervention letter received higher ratings than the original one. In addition, more participants reported that the letter than the original version encouraged them to accept a call from a Quitline counsellor'. 'The participants had positive perceptions of the study protocol and intervention materials' [69].

Tobacco use among lesbian, gay, bisexual, transgender, or queer (LGBTQ) community members is consistently higher than the general population. Future smoking cessation programs should give marginalized communities a priority, especially in areas with limited

access to health care and implementation strategies that could maximize the value of cessation services [70]. Another study conducted in the USA evaluated the 'effectiveness and feasibility of a pharmacist-led culturally-tailored tobacco cessation program for transgender and gender diverse patients'. For this study, the “Breathe Out program” was created, focusing on techniques that are frequently used and have been scientifically proven to be effective, "as part of the standard of care for smoking cessation through a lens that emphasizes factors specific to transgender and gender diverse individuals." According to preliminary findings, a culturally tailored program was successful in encouraging transgender community members to stop smoking for a short period of time [71].

While targeting LGBTQ+ people of all ages, group cessation classes were the main component of the interventions in the past. For this subpopulation, Health interventions offer a different and contemporary intervention platform, and young LGBTQ+ adults, in particular, may find them interesting. A qualitative study conducted in the USA explored smoking cessation apps aimed at LGBTQ+ youth and young adults. According to study results, LGBTQ+ YYA were eager to use culturally specific mobile apps for quitting smoking. Issues with personal privacy, mobile usability, user interest, app's marketing strategy, and inaccurate user reporting were few of the concerns reported [72].

Sexual gender minority '(SGM) individuals having no solid support system in their own communities may benefit from the opportunity to access services and communicate with other sexual gender minority (SGM) individuals through digital smoking cessation intervention'. A study was conducted for ‘ developing and testing the acceptability of a social media intervention for young adults who identified themselves as sexual and gender minorities. Ninety Facebook posts were part of the intervention. The findings revealed that the majority of SGM young adult smokers actively participated and gave the intervention's Facebook smoking cessation program a positive review’ [73].

The ‘Empowered, Queer, Quitting, and Living (EQQUAL) program is a web-based acceptance and commitment therapy (ACT) program for young adults at all stages of readiness to quit tobacco use. It is targeted at cultural, linguistic, sexual, and gender minorities. In the USA, a program for young adults who identify as sexual and gender minorities and who are smokers was tested. The rate of abstinence among sexual and gender minority young adults that was biochemically confirmed was three times higher’

[74]. A Facebook intervention for young sexual and gender minority smokers was evaluated in a study. ‘Interventions were given to participants in Facebook groups once a week through live counselling sessions and 90 daily Facebook posts. The findings revealed that POP participants had higher reduction rates in smoking at three months’ [75].

3.3.1 d Indigenous Population

Strategies targeted for tobacco harm reduction and smoking cessation among indigenous communities can contribute towards reducing tobacco caused health disparities. A study was conducted in the USA with an aim to assess the ‘effectiveness of a social media intervention to connect Alaska native smokers with resources and support to quit smoking. Phase 1 consisted of semi-structured phone interviews, while Phase 2 consisted of an online survey. The study's findings were refined to include images of Alaska Native people participating in native activities and content personifying characteristics that were thought to be the most appealing. As a result, social media content directed at demographic groups, like American Indians and Alaska Natives, must be culturally appropriate’ [76].

3.3.1 e Mental Illness and Substance Abuse Disorders Patients

Smoking is a significant public health issue for mental illness individuals. Some smokers with severe mental illnesses receive short-term assistance from general smoking cessation interventions, but many relapses. The effectiveness of two psychosocial interventions among patients with serious mental illness was investigated in a study carried out in the USA. For the cessation of smoking, behavioral treatment was used. 'Each group meeting began with breath carbon monoxide monitoring, with participants receiving a small monetary reward for values less than ten ppm. Each meeting addressed a specific topic through discussion, education, and assistance with quitting planning. According to the study's findings, sixteen participants achieved abstinence (11.8%) and the majority reported making a quit attempt’ [77].

Smokers with mental illnesses like schizophrenia show lower success rates with traditional methods of quitting smoking. A study conducted in New Jersey, USA tested two manualized behavioral counselling approaches, namely Treatment of Addiction to Nicotine in Schizophrenia (TANS) or Medication Management (MM). Mental health professionals in mental health facilities also offered nicotine patches and individual counselling sessions. The two treatments had different levels of intensity and session frequency. According to the findings, ‘21% of participants had maintained abstinence for 12 weeks after their intended

quit date, which did not differ significantly between the conditions. Smokers in both groups significantly decreased their daily cigarette consumption and carbon monoxide levels' [78]. Another US study assessed the effectiveness of home visits (HV) and combination extended treatment (COMB-EXT) in schizophrenic smokers. 'The COMB-EXT program included 26 weekly visits of group cognitive-behavioral therapy (CBT), bupropion, nicotine patches, and nicotine lozenges which was started within two weeks. HV involved making biweekly home visits to assess secondhand smoke exposure and conduct brief behavioral therapy sessions. TAU was composed of the group CBT along with single- or multiple-medication. The findings showed that smokers with schizophrenia who received COMB-EXT decreased their daily cigarette intake more than those who received TAU' [79].

A Web-based intervention called Let's Talk about Smoking was developed with smokers who've had severe mental illnesses. 'Users were guided through modules by a video host they chose who identified themselves as an ex-smoker with a mental illness. A handout describing the prevention of cancer and other smoking-related diseases, risk factors and protective factors, as well as smoking cessation therapies, was given to participants assigned to NCI Education'. The study results showed that treatment initiation outcomes were not different between intervention conditions for Let's Talk about Smoking for NCI Education [80]. Another US study compared 'Smokefree.gov and web-delivered A&C therapy for smokers with bipolar disorder to determine which was more effective'. Two web-based smoking cessation interventions-ACT-based WebQuit Plus and Smokefree.gov were used over a 10-week treatment period. Participants were given nicotine patches to wear for 8 weeks. The results of the study showed that average logins were double for WebQuit Plus (10.3 vs. 5.3) and program skills were higher rated for WebQuit Plus (75% vs. 29%). Abstinence at the end of 7-day was 12% in WebQuit Plus versus 8% in Smokefree.gov. According to the study's findings, "WebQuit Plus' estimated effect size and acceptability were more favorable than those of Smokefree.gov and support continued program refinement and evaluation' [81].

It is estimated that more than half of those with serious mental illness smoke tobacco regularly. A study was conducted to assess the efficacy of maintenance treatment with varenicline for smoking cessation in Schizophrenia and Bipolar Disorder patients. Participants were given 12-weeks' open-label varenicline and cognitive behavioral therapy.

The findings highlighted that "maintenance pharmacotherapy with varenicline and cognitive behavioral therapy improved prolonged tobacco abstinence rates as compared with cognitive behavioral therapy alone' [82].

3.3.2 Current Best Practices for Comprehensive Tobacco Harm Reduction and Cessation Programs Targeting Underserved Marginalized Communities in Western Pacific

3.3.2.a Low Socioeconomic Status Communities

Disadvantaged communities are important target groups for smoking cessation interventions. Socially disadvantaged groups such as Indigenous people and homeless people have higher smoking rates. A study was conducted in Australia to assess the effectiveness of smoking cessation interventions delivered by social service organizations for a diverse population of disadvantaged smokers. The intervention, 'Call it Quits', was a pragmatic, parallel randomized trial of a case-worker-delivered smoking cessation intervention. Adult smokers who needed financial assistance were randomized to receive either usual care or the five-session Call it Quits intervention. The findings showed that the trial was ineffective at achieving abstinence but increased attempts to stop'[83]. Health promotion campaigns stressed "engagement with family and community," "knowing the risks of smoking," "giving up vs. cutting down," and "culture in language and the arts' [84]. A review from New Zealand studied interventions that decreased smoking among indigenous and low-income groups. These included tobacco taxes, thematically relevant media campaigns, and suitable quit-smoking support programs [85].

3.3.2 b Mental Illness and Substance Abuse Disorders Patients

Cigarette smoking is very prevalent in people with psychotic disorders, but clinicians rarely address this issue. A study conducted in Australia assessed the efficacy of an 8-session regular smokers trial suffering from a psychotic disease. The results of the study showed that two-thirds reported maintenance or improvement in their smoking reduction status relative to 1 year [86]. Another randomized controlled trial was conducted for the 'acceptability and effectiveness of videos promoting smoking cessation among Australians experiencing mental illness'. Mentally ill smokers in Australia who participated in the study completed a pre-interview survey with 12 questions to assess their knowledge of quitting smoking, watched six videos on smoking cessation created by the research team and participated in semi-structured interviews to discuss the videos' quality, content, and

format. Lastly, they completed a post-interview survey that was the same as the pre-interview survey to assess changes in their knowledge of smoking cessation. The findings from the semi-structured interviews supported the participants' overall high level of acceptance of the videos' quality, content, and format' [87].

People with mental illness have disproportionately higher smoking rates and adverse health outcomes than the general population. A study was conducted in Australia in which a ‘ Smoking Cessation Champion (SCC) was chosen to oversee staff training and resources for quitting smoking (e.g., pharmacotherapy, leaflets, etc.)’. The findings demonstrated the viability of implementing evidence-based smoking cessation interventions in an inpatient mental health unit. T he prescription of smoking cessation treatments and routine smoking screening had modest improvements' [88].

3.3.3 Current Best Practices for Comprehensive Tobacco Harm Reduction and Cessation Programs Targeting Underserved Marginalized Communities in Europe

3.3.3.a Low Socioeconomic Status Communities

The need for innovative strategies to help and engage smokers, particularly from low socioeconomic status groups is urgently required to reduce mortality and morbidity linked with tobacco use. A study conducted in the UK evaluated the efficacy of Internet-based smoking cessation intervention (StopAdvisor) in individuals with low and high socioeconomic status'. Study demonstrated that StopAdvisor was more effective compared to information only websites among smokers of low socioeconomic status [89]. A Pilot Cluster RCT evaluated the effectiveness of WCQ (group support + nicotine replacement therapy) and individual support delivered by health professionals. The results showed that 'WCQ was relatively more feasible to deliver by trained facilitators and indicated a positive increase in abstinence rates' [90].

3.3.3.b LGBTQ Communities

A literature review showed that smoking prevalence is higher for gay men than heterosexuals in European communities. A Swiss study adapted from a smoking intervention from Britain was adapted for gay men in Switzerland. Seven weekly closed group sessions lasting 2.5 hours each constructed up the program. ‘A letter stating the participants' participation in the program and requesting a prescription for NRT or another prescription drug was made

available to the participants in order to assist them in seeking medication'. The third session (also known as "quit day") required all participants to quit smoking. From "quit day" in session 3 onward, the social aspect of the program was given top priority. The study's findings revealed that two-thirds of participants had quit smoking by the program's conclusion. The 'participants' self-reported abstinence was confirmed by the low CO levels (3 ppm) seen at the final session. More than 25% of participants at the six-month follow-up reported quitting smoking the week before' [91].

3.3.3 c Mental Illness and Substance Abuse Disorders Patients

'People with severe mental illnesses such as schizophrenia are three times more likely to smoke than the general population'. A randomized controlled trial was conducted in the UK with the aim of testing the 'effectiveness of a combined behavioral and pharmacological smoking cessation intervention targeted specifically at people with severe mental illness'. Participants were randomly assigned to a bespoke smoking cessation intervention or usual care. 'The intervention was comprised of behavioral support from a mental health smoking cessation practitioner and pharmacological aids for smoking cessation'. The study results concluded that the bespoke intervention was a candidate model of smoking cessation for clinicians and policy makers to address the high prevalence of smoking. The most popular medication used in both groups as part of nicotine replacement therapy was nicotine patches. E-cigarette use was slightly more prevalent among participants in the control group than among those in the intervention group. According to the study, those who received the tailored smoking cessation intervention had a greater likelihood of quitting successfully at 6 months than those who received usual care' [92].

A review of the literature highlighted that research on best practices for tobacco harm reduction and smoking cessation has mostly been published for smokers belonging to low socioeconomic class, LGBTQ and smokers suffering from mental illnesses. THR strategies have still not been developed for racial minorities and indigenous populations in Europe.

3.3.4 Current Best Practices for Comprehensive Tobacco Harm Reduction and Cessation Programs Targeting Underserved Marginalized Communities in Africa, Eastern Mediterranean and Southeast Asia

The review of literature revealed a paucity of research on best practices for tobacco harm reduction and smoking cessation in underserved and marginalized communities in Africa,

the Eastern Mediterranean and South East Asian region. The research studies conducted in Africa have focused so far on the characteristics of smokers belonging to underserved communities and their intention to quit smoking. A review of strategies adopted by South Africa for tobacco harm reduction in mentally ill individuals concluded that 'although effective smoking cessation interventions for PWMI should be prioritized, there is a dearth of research on these programs in South Africa'. [93]. On the other hand, the research studies conducted to date in the Eastern Mediterranean region mainly focused on exploring the socio-demographic characteristics of smokers and their knowledge and awareness of smoking cessation strategies while similar studies were conducted in the Southeast Asian region focusing on exploring the socio-demographic characteristics of smokers belonging to underserved communities, smoking and tobacco use patterns, knowledge and awareness of smoking cessation strategies and reviews on different tobacco products and alternative nicotine devices use. Reports published by International and National entities have highlighted general population tobacco cessation strategies which can be implemented to control tobacco use in countries included in this region.

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Supplementary Material

Supplement 1: Characteristics of Studies

Most of the studies [1-14] examined best practices for tobacco harm reduction in LGBTQ population in American region, while seven studies [15-21] explored practices among mentally ill and substance abuse individuals in American region. Out of thirty-nine studies conducted in American region, only one study [22] examined best practices for tobacco harm reduction among indigenous population and nine studies [23-31] explored practices among groups belonging to low socioeconomic classes. A few of studies [32-39] examined best practices among racial minorities in American Region. Only one study [40] examined THR practices among mentally ill individuals in African region. Out of four studies conducted in Europe region, one study [41] was conducted among LGBTQ, one study [42] among mentally ill and two studies [43-44] among low socioeconomic groups. Four studies [45-48] examined THR practices among mentally ill in Western Pacific region whereas four studies [49-52] explored tobacco harm reduction practices in low socioeconomic groups. A detailed description is given (Supp Table 1).

Supplement Table 1: Characteristics of Studies

S.No	Study	Country (Sample Size)	Year of Data Collection	Study Title	Duration of Study/ Follow Up Duration	Study Respondents	Study Design	THR and Cessation Strategy Used	Authors Conclusion
Region: America									
1	Matthews etal, 2018	USA (n=345)	2012 and 2015	Evaluation of a Randomized Clinical Trial Comparing the Effectiveness of a Culturally Targeted and Nontargeted Smoking Cessation Intervention for Lesbian, Gay, Bisexual, and Transgender Smokers	12 months	Lesbian, Gay, Bisexual, and Transgender Smokers	Randomized Controlled Trial	CTQ program which is a semi structured and manualized smoking cessation intervention including a progression of topics incorporating evidence-based behavioral, cognitive, and motivational smoking cessation strategies as outlined in the US Public Health Service Clinical Practice Guidelines for Treating Tobacco Use and Dependence	LGBT smokers receiving the CTQ intervention achieved smoking cessation outcomes in the range reported for other demographic groups. Cultural targeting improved the acceptability of the intervention but did not confer any additional benefit for smoking cessation outcomes.
2	Grady etal, 2014	USA (n=777)	2003-2005	Smoking Cessation Outcomes Among Sexual and Gender Minority and Nonminority Smokers in Extended Smoking Treatments	104 weeks	LGBT	Secondary data analysis using data from two randomized clinical trials	A standard 12-week treatment including group counseling, nicotine replacement therapy (NRT), and bupropion sustained release (SR), after which they were randomized to one extended treatment group.	Sexual and gender minority smokers appear as likely to quit or abstain as nonminority smokers in extended, nontailored interventions including standard 12-week treatment including group counseling, nicotine replacement therapy (NRT), and bupropion sustained release (SR).
3	Baskerville etal, 2018	Canada (n=406)	2015	A qualitative study of tobacco interventions for LGBTQ+ youth and young	104 weeks	LGBTQ+	Qualitative study, focused group discussion	Three descriptions of interventions tailored for LGBTQ+ YYA (group cessation counselling, social marketing, and a mobile phone app with social	LGBTQ+ YYA focus group participants expressed a desire for an intervention that can incorporate these key elements including

				adults: overarching themes and key learnings			s	media incorporated), were shared with LGBTQ+ YYA via 24 focus groups. Open-ended questions focused on their feelings, likes and dislikes, and concerns about the culturally modified intervention descriptions were asked.	LGBTQ+ − specific; be accessible in terms of location, time, availability, and cost; be inclusive, relatable, and highlight diversity; incorporate LGBTQ+ peer support and counselling services; integrate other activities beyond smoking; be positive, motivational, uplifting, and empowering; provide concrete coping mechanisms; and integrate rewards and incentives. The mobile phone app and social media campaign were noted as potential interventions that could include all the essential elements.
4	Matthews, Alicia K., et al, 2019	USA (n=30)	Not mentioned	Adaptation of a Proactive Smoking Cessation Intervention to Increase Tobacco Quitline Use by LGBT Smokers.	Not mentioned	LGBT	Qualitative study, focus groups and in-depth interviews	Feedback on the readability, acceptability, and motivational salience of a targeted and nontargeteed proactive outreach letter	Based on feedback, the revised intervention letter was rated more positively than the initial version, with 80% of participants indicating that they found the information in the letter to be useful. Further, more participants reported that the letter would motivate them to accept a call from a quitline counselor compared with the initial version. The development and testing of population-based and cost-effective interventions is critical to the reduction of LGBT smoking disparities. The study protocol and intervention materials were

									well-received by participants.
5	Heffner etal, 2020	USA (n=2637)	2014-2015	Long-Term Smoking Cessation Outcomes for Sexual Minority Versus Nonminority Smokers in a Large Randomized Controlled Trial of Two Web-Based Interventions	12 months	Lesbian, gay, or bisexual	Randomized controlled trial	Participants were enrolled and randomized to receive one of two web-based cessation interventions: one grounded in acceptance and commitment therapy and the other in the standard care treatment model (the National Cancer Institute's Smokefree.gov Web site). Participants had access to their assigned intervention for 12 months following randomization. In addition to the web program, participants received up to four intervention text messages per day for 28 days.	Cessation outcomes did not differ significantly for SM versus non-SM smokers or across SM subgroups, and there were no interactions with treatment group assignment.
6	Covey etal, 2009	USA (n=297)	Not mentioned	A comparison of abstinence outcomes among gay/bisexual and heterosexual male smokers in an intensive, non-tailored smoking cessation study	8 weeks	Gay/bisexual and heterosexual male smokers	Cross-sectional study	8-week open treatment with nicotine patch, bupropion, and counseling.	During the first 2 weeks after quit day, abstinence rates were higher among GB smokers; abstinence rates converged subsequently, becoming nearly identical at the end of treatment.
7	Williams etal, 2020	USA	Not applicable	If We Build It, Will They Come? Challenges of Adapting and Implementing a Smoking Cessation Program for the LGBTQ Community in Southcentral	Not applicable	LGBTQ	Review article	The Last Drag is a tobacco cessation program developed and implemented in 1991 in San Francisco, California, that has shown promise in assisting LGBTQ members with tobacco cessation.	Future smoking cessation programs that prioritize marginalized communities, particularly in regions where health care access may be limited, should consider implementation approaches that will maximize the utility of cessation services.

				Texas					
8	Caldwell etal, 2022	USA	Not applicable	Promoting Smoking Cessation Among Lesbian and Bisexual Women: Lessons Learned From a Location-Based Media Campaign in Western North Carolina	Not applicable	LGBTQ	Practice notes	The campaign used a digital approach based on cell phone locations and marketing profiles to deliver messages across 4 years	Although this was effective at reaching LB women, messages in the beginning of 2019 were flagged and rejected by Google due to a policy restriction based on "personalized advertising." The problem related to using the second person pronoun "yours" in the copy
9	Miller etal, 2021	USA (n=5)	Not mentioned	BreatheOut: Effectiveness and Feasibility of a Pharmacist-Led Culturally-Tailored Tobacco Cessation Program for Transgender and Gender Diverse Patients	12 weeks	LGBTQ	Interventional	BreatheOut is a new program designed for this study that delivers commonly used and researchvalidated techniques as part of the standard of care for smoking cessation through a lens that emphasizes factors specific to transgender and gender diverse individuals.	Preliminary results suggest that a culturally-tailored program was effective in promoting short-term smoking cessation.
10	Baskerville etal, 2016	USA (n=204)	2015	Perceptions Toward a Smoking Cessation App Targeting LGBTQ+ Youth and Young Adults: A Qualitative Framework Analysis of Focus Groups	Not mentioned	LGBTQ	Qualitative study	Participants reflected on how an app might support LGBTQ+ persons with smoking cessation.	Study findings suggested that LGBTQ+ YYA were eager about using culturally tailored mobile apps for smoking cessation. Accessibility, monitoring and tracking, connecting with community members, tailoring, connecting with social networks, and personalization were key reasons that were valued for a mobile app cessation program.However, concerns were raised about individual privacy and that not all

									individuals had access to a mobile phone, users might lose interest quickly, an app would need to be marketed effectively, and app users might cheat and lie about progress to themselves.
11	Vogel etal, 2019	USA (n=27)	2017	Development and acceptability testing of a Facebook smoking cessation intervention for sexual and gender minority young adults	1 month	LGBTQ	Interventional study	The intervention included 90 Facebook posts delivered in private groups tailored to readiness to quit smoking (Ready to quit in 30 days/Not Ready; 180 posts total; 101 posts SGM-tailored by content/image).	The majority of participants agreed or strongly agreed with statements about the intervention's helpfulness and clarity. SGM young adult smokers were highly engaged in an SGM-tailored smoking cessation intervention on Facebook and rated the intervention positively.
12	Heffner etal, 2021	USA (n=22)	2020	An Avatar-Led Digital Smoking Cessation Program for Sexual and Gender Minority Young Adults: Intervention Development and Results of a Single-Arm Pilot Trial	2 months	LGBTQ	Single-Arm Pilot Trial	The Empowered, Queer, Quitting, and Living (EQQUAL) program is a cultural, linguistic, and sexual and gender minority–targeted adaptation of Flexiquit, a web-based acceptance and commitment therapy (ACT) program designed for young adults at all stages of readiness to quit tobacco use	The rate of abstinence, which was biochemically confirmed, was 3 times higher than that of the only other digital program to date that has targeted sexual and gender minority young adults and 6 to 13 times higher than those of nontargeted digital smoking interventions among sexual and gender minority young adults.
13	Vogel etal, 2020	USA (n=165)	2018	The Put It Out Project (POP) Facebook Intervention for Young Sexual and Gender Minority Smokers: Outcomes of a	3 months	LGBTQ	Randomized controlled trial	Interventions delivered weekly live counseling sessions and 90 daily Facebook posts to participants in Facebook groups.	POP participants were more likely than TSP-SGM participants to report smoking abstinence at 3 and 6 months and reduction in smoking at 3 months.

				Pilot, Randomized, Controlled Trial					
14	Kidd etal, 2021	USA	1985-2019	A scoping review of alcohol, tobacco, and other drug use treatment interventions for sexual and gender minority populations	Not applicable	LGBTQ	Review article	Scoping review of prevention and drug treatment intervention studies for alcohol, tobacco, and other drug use that were conducted with SGM adults.	Findings highlight the need for intervention research focused on sexual minority women and gender minority individuals and on cannabis and opioid use. There is also a need for more research that evaluates dyadic, population-level, and medication interventions.
15	Bennett etal, 2015	USA (n=178)	Not mentioned	Smoking Cessation in Individuals With Serious Mental Illness: A Randomized Controlled Trial of Two Psychosocial Interventions	12 weeks	Mental illnesses patients	Randomized controlled trial	Behavioral Treatment of Smoking Cessation was used. Each group meeting started with breath carbon monoxide monitoring in which participants received a small financial reward for values less than 10 ppm. Each meeting included a topic (e.g., support for quitting; harm from smoking; smoking as a habit; barriers and confidence) that was addressed via discussion, education, and assistance with planning to quit.	Sixteen participants achieved abstinence (11.8%), smoking quantity was significantly reduced, and most reported making a quit attempt.
16	Williams etal, 2019	USA (n=107)	2004-2008	Comparison of Two Intensities of Tobacco Dependence Counseling in Schizophrenia and Schizoaffective Disorder	26 weeks	Mental illness patients	Randomized controlled trial	Individual counseling sessions were provided by mental health clinicians in mental health settings, along with nicotine patch.	Smokers in both groups significantly reduced smoking as measured by cigarettes per day and expired carbon monoxide. Findings support that mental health clinicians can be trained to effectively help smokers with SCZ maintain tobacco abstinence.
17	Brody etal, 2016	USA (n=34)	Not mentioned	Combination Extended Smoking Cessation	26 weeks	Mental illness patients	Randomized controlled trial	Cigarette smokers with schizophrenia completed either COMB-EXT with HV, COMB-EXT without HV, or treatment as	Smokers with schizophrenia who received COMB-EXT (with or without HV) had greater reductions in

				Treatment Plus Home Visits for Smokers With Schizophrenia: A Randomized Controlled Trial				usual (TAU) (random assignment). COMB-EXT consisted of group cognitive-behavioral therapy (CBT), bupropion, nicotine patch, and nicotine lozenge, which were initiated within 2 weeks and continued for 26 weekly visits. HV consisted of biweekly visits to the home with assessment of secondhand smoke (SHS) exposure and brief behavioral therapy with participants and others in the home environment. TAU consisted of group CBT plus serial single or combination medication trials as per standard care.	cigarettes per day than those treated with TAU.
18	Brunette etal, 2020	USA (n=162)	2014-2015	Brief, Web-Based Interventions to Motivate Smokers With Schizophrenia: Randomized Controlled Trial	6 months	Mental illness patients	Randomized Controlled Trial	Let's Talk About Smoking is a Web-based intervention tailored for smokers with severe mental illnesses and designed to increase motivation to quit smoking using evidence-based Treatment. The program is linear, modularized, and interactive, taking 30 to 90 min to complete. Users choose a video host who identifies him/herself as an ex-smoker with mental illness and guides users through modules, each with assessments and exercises used in motivational interviewing and health decision aid systems. Participants assigned to NCI Education received a computerized version of the NCI patient educational handout [36], which	Treatment initiation outcomes were not different between intervention conditions for Let's Talk About Smoking for NCI Education. . Quit attempts and abstinence were not significantly different between intervention conditions. Both tailored digital interventions resulted in levels of treatment engagement and quit attempts that were similar to findings from previous studies of in-person interventions, confirming the potential role of digital interventions to educate and motivate smokers with schizophrenia to use cessation treatment

								provides information about risk factors and protective factors for cancer and other smoking-related diseases, quitting smoking as a prevention factor, and smoking cessation treatments (both counseling and drug treatments, including nicotine replacement therapy, bupropion, and varenicline). This static intervention was delivered by a laptop computer in a format similar to Let's Talk About Smoking: large black font on a white background with no distracting images; one concept per page in a short paragraph or bulleted sentences.	and to quit smoking.
19	Heffner etal, 2020	USA (n=51)	Not mentioned	Pilot Randomized Controlled Trial of Web-Delivered Acceptance and Commitment Therapy Versus Smokefree.gov for Smokers With Bipolar Disorder	10 weeks	Mental illness patients	Randomized Controlled Trial	Two web-based smoking cessation interventions-ACT-based WebQuit Plus or Smokefree.gov over a 10-week treatment period. All participants received nicotine patch for 8 weeks.	The mean number of logins was twice as high for WebQuit Plus (10.3 vs. 5.3). The usefulness of program skills was rated higher for WebQuit Plus (75% vs. 29%). Biochemically confirmed, 7-day abstinence at end of treatment was 12% in WebQuit Plus versus 8% in Smokefree.gov. At follow-up, abstinence rates were 8% in both arms.
20	Vilardaga etal, 2020	USA (n=62)	2017-2018	Pilot Randomized Controlled Trial of a Novel Smoking Cessation App Designed for	16 weeks	Mental health patients	Randomized Controlled Trial	Preliminary efficacy of Learn to Quit versus QuitGuide, an app designed for the general population was evaluated. All participants received nicotine replacement therapy and technical assistance.	Compared to QuitGuide, Learn to Quit participants had similar number of days of app use, but larger number of app interactions, longer durations of app use, and higher usability scores.

				Individuals With Co-Occurring Tobacco Use Disorder and Serious Mental Illness					At week 16, Learn to Quit led to greater reductions in cigarettes per day. Thirty-day point prevalence abstinence was verified in 12% of Learn to Quit participants versus 3% of QuitGuide participants.
21	Evins etal, 2014	USA (n=247)	2008-2012	Maintenance Treatment With Varenicline for Smoking Cessation in Patients With Schizophrenia and Bipolar Disorder A Randomized Clinical Trial	76 weeks	Mental illness patients	Randomized controlled trial	12-weeks' open-label varenicline and cognitive behavioral therapy	Among smokers with serious mental illness who attained initial abstinence with standard treatment, maintenance pharmacotherapy with varenicline and cognitive behavioral therapy improved prolonged tobacco abstinence rates compared with cognitive behavioral therapy alone after 1 year of treatment and at 6 months after treatment discontinuation.
22	Merculieff etal, 2020	USA (n=70)	2018-2019	Developing a Social Media Intervention to Connect Alaska Native People Who Smoke with Resources and Support to Quit Smoking: The Connecting Alaska Native Quit Study	6 months	Indigenous population	Randomized controlled trial	Phase 1 included semi-structured telephone interviews with 30 AN people who smoke and ten stakeholders. They provided feedback on existing content from the Centers for Disease Control and Prevention Tips campaign and AN digital stories. Phase 2 included an online survey with a new group of 40 AN smokers who provided feedback on existing content via a measure of perceived effectiveness and cultural relevance.	Content embodying characteristics perceived to be most appealing, effective, and culturally relevant were selected for the private Facebook group content library with refinements made to incorporate images of AN people engaged in AN activities. Social media content targeting specific population sectors, such as American Indian/AN people for tobacco cessation needs to be culturally tailored.
23	Haas etal,	USA (n=707)	2011-2013	Proactive tobacco	9 months	Low-SES adult smokers who	Randomized	Treatment program consisted of: (1) telephone-based motivational	Proactive, IVR-facilitated outreach enables

	2015			cessation outreach to smokers of low socioeconomic status: a randomized clinical trial		described their race/ethnicity as black, Hispanic or white	Controlled Trial	counseling, (2) 6-weeks of free nicotine replacement therapy (NRT), (3) access to community-based referrals to address sociocontextual mediators of tobacco use, and (4) integration of this program with an individual's care team through the EHR.	engagement with low-SES smokers. Providing counseling, nicotine replacement therapy, and access to communitybased resources to address socio-contextual mediators among smokers reached in this setting is effective.
24	Brooks etal, 2018	USA (n=250)	2010-2012	Twelve-Month Outcomes of a Group-Randomized Community Health Advocate-Led Smoking Cessation Intervention in Public Housing	12 months	Socioeconomically disadvantaged smokers	Randomized community trial	Participants at control sites received standard cessation materials and a one-time visit from a TTA who provided basic counseling and information about cessation resources. Participants at intervention sites were eligible for multiple visits by a TTA who employed motivational interviewing, cessation counseling, and navigation to encourage smokers to utilize cessation treatment (Smokers' Quitline and clinic-based programs).	Intervention participants were more likely than control participants to both utilize treatment programs and 7-day and 30-day point prevalence abstinence.
25	Andrews etal, 2016	USA (n=409)	2009-2013	Effect of a smoking cessation intervention for women in subsidized neighborhoods: A randomized controlled trial	12 months	Women living in subsidized housing neighborhoods	Randomized community trial	A 24-week intervention with 1:1 community health worker contact, behavioral peer group sessions, and nicotine replacement.	This CBPR developed intervention showed potential to engage smokers and reduce smoking among women in these high-poverty neighborhoods
26	Baker etal, 2018	USA (n=1014)	2012-2015	A Randomized Controlled Trial of Financial Incentives to Low Income Pregnant Women to	6 months	Low Income Pregnant Women	Randomized Controlled Trial	All participants were offered identical smoking cessation counseling at contacts. Incentive condition participants received incentives for attending pre- and postbirth treatment contacts: $25 for	Incentive condition participants had a higher biochemically confirmed abstinence rate at 6-month postbirth than controls (14.7% vs. 9.2%). This effect was

				Engage in Smoking Cessation Treatment: Effects on Post-Birth Abstinence				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 and $40 for biochemically verified abstinence at the Week 1 and 6-month visits. Control condition participants received only $40 for attendance at the Week 1 and 6-month postbirth visits ($40 each).	mediated by incentive condition participants' greater acceptance of postbirth home visits and counseling calls.
27	Vidrine etal, 2019	USA (n=624)	2011-2017	Efficacy of Mobile Phone-Delivered Smoking Cessation Interventions for Socioeconomically Disadvantaged Individuals: A Randomized Clinical Trial	6 months	Socioeconomically disadvantaged individuals	Randomized Clinical Trial	Smoking cessation interventions included (1) nicotine replacement therapy (NRT), (2) NRT plus text messaging, and (3) NRT plus text messaging plus proactive counseling via mobile phone. Nicotine replacement therapy consisted of transdermal nicotine patches.	Findings indicate that assignment to an intervention consisting of text messaging alone may not increase cessation rates for socioeconomically disadvantaged smokers. However, text messaging plus proactive counseling may be an efficacious option.
28	Fu etal, 2015	USA (n=2406)	2011-2013	Proactive tobacco treatment offering free nicotine replacement therapy and telephone counselling for socioeconomically disadvantaged smokers: a randomised clinical trial	6 months	Low-income population	Randomized Clinical Trial	Intervention comprised proactive outreach (tailored mailings and telephone calls) and free cessation treatment (nicotine replacement therapy and intensive, telephone counselling). Usual care comprised access to a primary care physician, insurance coverage of Food and Drug Administration-approved smoking cessation medications, and the state's telephone quitline	Population-based proactive tobacco treatment increases engagement in evidence-based treatment and is effective in long-term smoking cessation among socioeconomically disadvantaged smokers.

29	Asfar etal, 2022	USA (n=59)	2019-2020	HIV patients' perceptions of a potential multi-component mindfulness-based smoking cessation smartphone application intervention	Not mentioned	Low socioeconomic class	Qualitative study	Conducted 8 focus groups among PLWH smokers (n = 59; 47.5% females; ≥18 years) to gain insight into participants' perceptions about the app, MT, and the feasibility and acceptability of adding two additional strategies (CM: Contingency Management; self-monitoring of anti-retroviral therapies intake [ART]) to further optimize the app.	Participants considered it easy to learn the app and thought that MT is helpful in reducing stress and motivating quit attempts and were supportive of adding CM and recommended providing $20-$50 weekly cash incentives to help in quitting.
30	Carpenter etal, 2015	USA (n=20)	2013-2014	Multicomponent Smoking Cessation Treatment Including Mobile Contingency Management in Homeless Veterans	6 months	Low socioeconomic class	Interventional study	Following a 1-week training period, 20 homeless veteran smokers (≥ 10 cigarettes daily for 1 year or more and a CO baseline level ≥ 10 ppm) participated in a multicomponent smoking cessation intervention including 4 weeks of mCM. All smokers received 4 smoking cessation counseling sessions, nicotine replacement, and bupropion (if medically eligible).	Mean compensation for the mCM component was $286 of a possible $480. Video transmission compliance was high during the 1-week training (97%) and the 4-week treatment period (87%). Bioverified 7-day point prevalence abstinence was 50% at 4 weeks.
31	Collins etal, 2018	USA (n=44)	Not mentioned	Harm reduction treatment for smoking (HaRT-S): findings from a single-arm pilot study with smokers experiencing chronic homelessness	14 weeks	Chronic homelessness	Single arm pilot study	In HaRT-S, interventionists embody a compassionate, advocacy-oriented "heart-set" and deliver manualized components: a) participant-led tracking of smoking-related outcomes, b) elicitation of harm-reduction goals and progress made toward them, c) discussion of relative risks of nicotine delivery systems, and d) distribution and instructions on use of safer nicotine products	Participants who used ENDS experienced an additional 44% reduction in smoking intensity and a 1.2-point reduction in dependence compared to participants who did not. Harm-reduction counseling plus ENDS shows promise for smokers experiencing chronic homelessness.
32	Brett etal, 2021	USA (n=204)	2017-2018	Effects of a Brief Motivational Smoking	6 months	Racial minorities	Randomized Controlled	Participants were randomized to enhanced care (EC) or treatment as usual (TAU). The EC group	A brief motivational intervention for Black non-treatment-seeking smokers

				Intervention in Non-Treatment Seeking Disadvantaged Black Smokers			Trial	received a 30-minute session with personal feedback on smoking, education on health outcomes and tobacco advertising targeting Black smokers, and nicotine replacement therapy (NRT) starter kits. TAU included provision of self-help materials.	increased motivation to change smoking and resulted in improvements in NRT knowledge, use, and quit-relevant behaviors.
33	Hooper etal, 2018	USA (n=1050)	Not mentioned	Effects of a culturally specific tobacco cessation intervention among African American Quitline enrollees: a randomized controlled trial	6 months	Racial minorities	Randomized Controlled Trial	Culturally specific, video-based, adjunct to standard quitline care	This study will answer questions regarding the implementation and effectiveness of integrating a culturally specific video intervention into a real-world, population-level tobacco intervention. It will also aid our understanding of individual-difference variables that are associated with success. If an incremental benefit is found, this trial will have implications for increasing the responsiveness of tobacco quitlines for African Americans, reducing tobacco cessation disparities, and best practices for improving minority health.
34	Mhende etal, 2021	USA (n=23)	Not mentioned	Mobile Delivery of Mindfulness-Based Smoking Cessation Treatment Among Low-Income Adults During the COVID-19 Pandemic: Pilot	10 weeks	Racial minorities	Randomized controlled trial	8 weeks of iQuit Mindfully as a fully automated standalone intervention or iQuit Mindfully in combination with therapist-led in-person group treatment.	This study supports the promise of text messaging and the use of teleconferencing to provide mindfulness and smoking cessation services to underserved populations during a pandemic.

				Randomized Controlled Trial					
35	Hooper etal, 2021	USA (n=119)	Not mentioned	Randomized controlled trial testing a video-text tobacco cessation intervention among economically disadvantaged African American adults	6 weeks	Racial minorities and low socio economic status	Randomized controlled trial	Adults who sought to quit smoking received either Path2Quit or the National Cancer Institute's (NCI) SmokefreeTXT, both combined with a brief behavioral counseling session plus 2 weeks of NRT.	A culturally specific mHealth intervention demonstrated positive effects on NRT use and short-term abstinence.
36	Daniels etal, 2022	USA (n=32)	Not mentioned	Mindfulness and Mobile Health for Quitting Smoking: A Qualitative Study Among Predominantly African American Adults with Low Socioeconomic Status	8 weeks	Racial minorities and low socio economic status	Qualitative study	8 weekly group sessions of Mindfulness-Based Addiction Treatment for smoking cessation and between-session iQuit Mindfully text messages.	Text messaging is acceptable and feasible for enhancing mindfulness-based smoking cessation treatment among predominantly African American adults with low socioeconomic status. Participants indicated positive experiences with the text messages and reported that the encouragement, social support, and specific strategies offered were useful in their attempts to quit smoking.
37	Asvat etal, 2014	USA (n=1494)	2008-2012	Feasibility and Effectiveness of a Community-Based Smoking Cessation Intervention in a Racially Diverse, Urban Smoker Cohort	6 weeks	Racial minorities	Intervention study	6-session full or 3-session short versions of CTQ	CTQ is moderately successful in the short term as delivered in community-based settings for urban-dwelling, largely minority smokers.
38	Fu etal,	USA	2009	Designing and	Not	Racial	Qualitativ	Six focus groups were conducted	Participants desired the

	2014	(n=45)		evaluating culturally specific smoking cessation interventions for American Indian communities	mentioned	minorities	e study	based on smoking status (current/former smoker), sex, and elder status (55 years and older or younger). Meetings were held at local American Indian community organizations. This project was accomplished in partnership with the American Indian Community Tobacco Projects.	following: (a) programs led by trained American Indian community members, (b) the opportunity to connect with other American Indian smokers interested in quitting, and (c) programs promoting healthy lifestyles. Strategies desired for treatment included (a) free pharmacotherapy, including nicotine replacement therapy (NRT); (b) nominal incentives, e.g., gift cards for groceries; and (c) culturally specific program components such as American Indian images, education on traditional tobacco use, and quit-smoking messages that target the value of family and include narratives or story telling in recruitment and program materials.

39	Rubenstein etal, 2021	USA (n=187)	Not mentioned	Predictors of smoking reduction among African American and Latinx smokers in a randomized controlled trial of JUUL e-cigarettes	6 weeks	Racial minorities	RCT	Participants were randomized to receive 6 weeks of JUUL e-cigs or continue smoking cigarettes as usual.	Over the six-week study, cigarette smoking decreased from an average of 82.4 to 15.5 cigarettes per week. Greater numbers of JUUL pods used predicted a greater smoking reduction by week 6. AA and Latinx smokers reduced their cigarette consumption while using JUUL e-cigs. Higher e-cig use during an intervention to switch to e-cigs to reduce harm may facilitate a transition to smoking fewer cigarettes, offering an opportunity to narrow smoking-related health disparities.
Region: Africa									

40	Morar and Robertson, 2022	South Africa	Not mentioned	Smoking cessation among people with mental illness: A South African perspective	Not applicable	Mental illness	Review article	-	Smoking cessation among PWMI should be considered a priority intervention. However, there is a lack of research on effective smoking cessation interventions among PWMI in South Africa.
Region: Europe									
41	Spillmann etal, 2018	Switzerland (n=70)	2009-2010	Queer quit: A pilot study of a smoking cessation programme tailored to gay men	6 months	Gay men	Pilot Study	Modified version of a British smoking intervention programme consisting of seven weekly closed group sessions.	Using a modified version of a British smoking intervention programme tailored to gay men in Switzerland, this smoking cessation programme produced rates of point prevalence abstinence that were similar to interventions for non-gay groups. Point prevalence abstinence significantly increased throughout the study. At six months, 28.6% reported smoking abstinence over the previous 7 days.
42	Gilbody etal, 2019	UK (n=526)	2015-2016	Smoking cessation for people with severe mental illness (SCIMITAR+): a pragmatic randomised controlled trial	12 months	Heavy smokers with bipolar disorder or schizophrenia	Pragmatic, randomised controlled study	The bespoke smoking cessation intervention consisted of behavioural support from a mental health smoking cessation practitioner and pharmacological aids for smoking cessation, with adaptations for people with severe mental illness—such as, extended pre-quit sessions, cut down to quit, and home visits. Access to pharmacotherapy was via primary care after discussion with the smoking cessation specialist.	This bespoke intervention is a candidate model of smoking cessation for clinicians and policy makers to address high prevalence of smoking. . Among nicotine replacements therapies, nicotine patches were the most used medication in both groups. E-cigarettes were used by participants in both groups as a smoking cessation aid, with slightly more

									participants in the control group reporting use of e-cigarettes than those in the intervention group did. The chances of successful quitting at 6 months after randomisation among those who received the bespoke smoking cessation intervention were more than twice those who received usual care. The incidence of quitting at 6 months shows that smoking cessation can be achieved, but the waning of this effect by 12 months means more effort is needed for sustained quitting.
43	Brown etal, 2014	UK (n=4613)	2011-2013	Internet-based intervention for smoking cessation (StopAdvisor) in people with low and high socioeconomic status: a randomised controlled trial	6 months	Low and high socio economic status	Randomised controlled trial	Treatment with StopAdvisor or an information-only website	StopAdvisor was more effective than an information-only website in smokers of low, but not high, socioeconomic status.
44	Hayes etal, 2022	Ireland (n=194)	2017-2019	Peer-Delivery of a Gender-Specific Smoking Cessation Intervention for Women Living in Disadvantaged Communities in Ireland We Can Quit2 (WCQ2)—	6 months	Women Living in Disadvantaged Communities	Cluster Randomized Controlled Trial	Districts were independently randomized to WCQ (group support + nicotine replacement therapy), or to individual support delivered by health professionals	WCQ was feasible to deliver by trained facilitators and indicated a positive direction in abstinence rates.

				A Pilot Cluster Randomized Controlled Trial					
Region: Western Pacific									
45	Baker etal, 2010	Australia (n=247)	Not mentioned	Cigarette Smoking And Psychosis: Naturalistic Follow up 4 Years After an Intervention Trial	12 months	Mental illnesses patients	Interventi on trial	Eight-session individually administered trial for regular smokers with a psychotic disorder	Two-thirds of those who completed the 1 year assessment were followed up at 4 years, of whom 79.2% reported maintenance or improvement in their smoking reduction status relative to 1 year.
46	Kumar etal, 2021	Australia (n=29)	Not mentioned	The Acceptability and Effectiveness of Videos Promoting Smoking Cessation Among Australians Experiencing Mental Illness	Not mentioned	Mental illness patients	Randomiz ed controlled trial	Australian smokers living with MI completed a preinterview survey including 12 questions assessing knowledge about smoking cessation, watched six videos developed by the research team providing information about smoking cessation, took part in semistructured interviews about the videos' quality, content, and format, and then completed a postinterview survey identical to the preinterview survey to assess changes in smoking cessation-related knowledge	Participants indicated an overall high level of acceptability of the videos' quality, content, and format, and findings from the semistructured interviews reflected these favorable views. This study's findings provide a new understanding of the effectiveness and acceptability of customized video-based education to promote smoking cessation among people living with MI, and can be used to inform the content and focus of video resources aimed at increasing knowledge about smoking cessation for people experiencing MI.
47	Lappin etal, 2020	Australia (n= 214)	2018	Targeted Intervention to Reduce Smoking among People with Severe	3 months	Mental illness patients	Pre-post interventio n study	Smoking cessation champion (SCC) was appointed to coordinate staff education and smoking cessation activities and resources (e.g., pharmacotherapy,	Evidence-based smoking cessation interventions can be successfully implemented on an inpatient mental health unit. Modest

				Mental Illness: Implementation of a Smoking Cessation Intervention in an Inpatient Mental) Health Setting				leaflets, etc.). A clinical nurse consultant (SB) provided dedicated time (0.4 full time equivalent) to act in the role of the SCC	gains were made in routine screening for smoking and in smoking cessation treatment prescription.
48	Metse etal, 2014	Australia (n=800)	Not applicable	Evaluating the efficacy of an integrated smoking cessation intervention for mental health patients: study protocol for a randomised controlled trial	12 months	Mental illness patients	Interventional study	The 'Supported Care' intervention will consist of a brief motivational interview and a package of self-help material for abstaining from smoking whilst in hospital, and, following discharge, 16 weeks of motivational telephone-based counselling, 12 weeks of free nicotine replacement therapy, and a referral to the Quitline	If shown to be effective, the study will provide evidence in support of systemic changes in the provision of smoking cessation care to patients following discharge from psychiatric inpatient facilities.
49	Bonevski etal, 2018	Australia (n=618)	Not mentioned	Smoking cessation intervention delivered by social service organisations for a diverse population of Australian disadvantaged smokers: A pragmatic randomised controlled trial	6 months	Low socioeconomic status Adult smokers	Pragmatic randomised controlled trial	Call it Quits was a pragmatic, parallel randomised trial of a case-worker delivered smoking cessation intervention conducted in a non-government community social service organisation in New South Wales (NSW), Australia. Adult smokers requiring financial assistance were randomly assigned to the five-session Call it Quits intervention or usual care control group.	A multi-component smoking cessation intervention delivering motivational interviewing-based counselling and free NRT by a trained case-worker within a community social service setting was not effective at achieving abstinence in a highly disadvantaged sample of smokers but increased attempts to stop and led to a reduction in number of cigarettes smoked daily.
50	Flemington etal , 2021	Australia	Not applicable	Smoking Cessation Messages for Pregnant Aboriginal and	Not applicable	Low socio economic class and racial minorities	Review article	This review summarized literature about knowledge, attitudes, and beliefs of Aboriginal and Torres Strait Islander women from Australia	Empirical studies highlighted women sought holistic care that incorporated nicotine replacement therapy,

				Torres Strait Islander Women: A Rapid Review of Peer-Reviewed Literature and Assessment of Research Translation of Media Content				who smoke during pregnancy, then examined the extent that existing health promotion materials and media messages aligned with evidence on smoking cessation for pregnant Aboriginal and Torres Strait Islander women.	engaged with their family and community and the potential for education about smoking cessation to empower a woman. Health promotion campaigns had a strong focus on 'engagement with family and community', 'knowledge of risks of smoking,' 'giving up vs cutting down' and 'culture in language and arts'.
51	Wilson etal, 2006	New Zealand	Not applicable	What potential has tobacco control for reducing health inequalities? The New Zealand situation	Not applicable	Low socioeconomic status	Review	-	There is some evidence, from New Zealand and elsewhere, for interventions that reduce smoking by low-income populations and indigenous peoples. These include tobacco taxation, thematically appropriate mass media campaigns, and appropriate smoking cessation support services. But there are as yet untried interventions with major potential. A key one is for a tighter regulatory framework that could rapidly shift the nicotine market towards pharmaceutical-grade nicotine (or smokeless tobacco products) and away from smoked tobacco.
52	Robertson etal, 2012	Australia (n=82)	Not mentioned	Translation of tobacco policy into practice in disadvantaged and marginalized	Not mentioned	Marginzalized population	Qualitative study	-	These results from interviews with local and operational-level participants indicate that current tobacco policies in

				subpopulations: a study of challenges and opportunities in remote Australian Indigenous communities					Australia targeting Indigenous smoking are sound and comprehensive. However, for remote Indigenous Australian communities, local and operational-level participants' views point to an 'implementation gap'. Their views should be heard because they are in a position to provide practical recommendations for effective policy implementation faithful to its design, thereby translating sound policy into meaningful action.
Region: East Mediterranean and South East Asia									
The review of literature revealed that there is a paucity of research on best practices for tobacco harm reduction and smoking cessation in underserved and marginalized communities in regions such as East Mediterranean, South East Asia and Africa. The research studies conducted till date mainly focus on exploring the socio-demographic characteristics of smokers belonging to underserved communities, exploring smoking and tobacco use patterns, knowledge and awareness of smoking cessation strategies and reviews on use of various tobacco products and alternative nicotine devices. Reports published by International and National entities have highlighted general population tobacco cessation strategies which can be implemented to control tobacco use in countries included in these regions.									

Supplement 2: Assessment of Quality of Studies Using NIH Quality Tool

NIH quality assessment tool was used. A total of 52 studies were included. Of the total studies conducted, 29 were randomized clinical trials and 23 were cross sectional studies. Of the total randomized clinical trials, 23 were rated as good, 6 as fair and 0 as poor-quality studies. While of the total cross-sectional studies, 15 were rated as good, 8 as fair and none as poor quality studies. A detailed description on quality of all the randomized clinical trials and cross-sectional studies are given in supplement Table 2 and Table 3, respectively.

Supplement Table 2 Assessment of Randomized Controlled Trials using NIH Quality Tool

Sr.No	Study	Was the study described as randomized, a randomized trial, a randomized clinical trial, or an RCT?	Was the method of randomization adequate (i.e., use of randomly generated assignment)?	Was the study described as a controlled trial?	Was the control group matched on relevant variables (age, gender, education, disorder)?	Was the overall drop-out rate from the study at endpoint 20% or lower of the number allocated to the interventio n?	Was the differential dropout rate (between groups) at endpoint 15 percentage points or lower?	Was there high adherence to the intervention protocols for each treatment group? (defined as 75 % attendance or more)	Were other interventions avoided or similar in the groups?	Were outcomes assessed using valid and reliable measures?	Were outcomes measured consistently across all study participants?	Did the authors report that the sample size was sufficiently large to be able to detect a difference in the main outcome between groups with at least 80% power?	Were outcomes reported or subgroups analyzed prespecified (i.e., identified before analyses were conducted)?	For RCTs: were all randomized participants analyzed in the group to which they were originally assigned, i.e., did they use an intention-to-treat analysis?	For controlled studies: was a recognized statistical method employed? (recognized methods defined as dif-in-dif, regression discontinuity, propensity score matching, instrumental variables)	Summ Qual
1	Matthews etal , 2018	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	ii
2	Grady etal, 2014	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✗	✓	NR	✓	ii
7	Williams etal, 2010	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	NR	✓	ii
5	Heffner etal, 2020	✓	✓	✓	✓	✗	✓	✗	✓	✓	✓	✓	✓	NR	✓	ii
15	Bennett etal, 2015	✓	✓	✓	✓	✗	✓	✗	✓	✓	✓	✓	✓	NR	✓	ii
17	Brody etal , 2016	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	NR	✓	ii

18	Brunette etal, 2020	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	NR	✓	ii
19	Heffner etal, 2020	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	NR	✗	ii
20	Vilardaga etal, 2020	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	NR	✓	ii
23	Haas etal, 2015	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	NR	✓	ii
24	Brooks etal , 2018	✓	✓	✓	✓	✗	✓	✗	✓	✓	✓	✓	✓	NR	✓	ii
25	Andrews etal, 2016	✓	✓	✓	✓	✗	✗	✓	✓	✓	✓	✓	✓	NR	✓	ii
26	Baker etal, 2018	✓	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	NR	✓	ii
27	Vidrine eta, 2019	✓	✓	✓	✓	✗	✓	✗	✓	✓	✓	✓	✓	NR	✓	ii
28	Fu etal , 2015	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	NR	✓	ii
32	Brett etal, 2021	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	NR	✓	ii
33	Hooper etal, 2018	✓	✓	✓	✗	NR	NR	NR	✓	✓	✓	✗	✓	✗	✓	i
34	Mhende etal, 2021	✓	✓	✓	✓	✗	✓	✗	✓	✓	✓	✓	✓	NR	✓	ii
35	Hooper eta, 2021	✓	✓	✓	✓	NR	NR	NR	✓	✓	✓	✓	✓	NR	✓	i
30	Carpenter etal, 2015	✗	✗	✓	✓	CD	CD	CD	✓	✓	✓	✓	✓	NR	✓	i
21	Evins etal, 2014	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	NR	✓	ii

12	Heffner etal, 2021	✗	✓	✓	✓	✗	CD	✓	✓	✓	✓	✓	✓	NR	✓	i
13	Vogel etal, 2020	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	NR	✓	ii
42	Gilbody etal, 2019	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	NR	✓	ii
43	Brown etal, 2014	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	NR	✓	ii
44	Hayes etal, 2022	✓	✓	✓	✓	✗	✓	✗	✓	✓	✓	✓	✓	NR	✓	ii
41	Spillmann eta, 2018	✓	✓	✓	✓	CD	✓	✓	✓	✗	✓	✓	✓	NR	✓	ii
45	Baker etal, 2010	✗	✓	✓	✓	✗	✓	CD	✓	✓	✓	CD	✓	NR	✓	i
49	Bonevski etal , 2018	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	NR	✓	ii
48	Metse etal, 2014	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	NR	✓	ii

*Quality was rated as 0 for poor (0–4 out of 14 questions), i for fair (5–10 out of 14 questions), or ii for good (11–14 out of 14 questions)

Supplement Table 3 Assessment of Cross-Sectional Studies using NIH Quality Tool

S. No	Study	Was the research question or objective in this paper clearly stated?	Was the study population clearly specified and defined?	Was the participation rate of eligible persons at least 50%?	Were all the subjects selected or recruited from the same or similar populations?	Was a sample size justification, power description, or variance and effect estimates provided?	For the analyses in this paper, were the exposure(s) of interest measured prior to the outcome(s) being measured?	Was the timeframe sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed?	For exposures that can vary in amount or level, did the study examine different levels of the exposure?	Were the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	Was the exposure(s) assessed more than once over time?	Were the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	Were the outcome assessors blinded to the exposure status of participants?	Was loss to follow-up after baseline 20% or less?	Were key potential confounding variables measured and adjusted statistically for their impact on the relationship? between exposure(s) and outcome(s)?	Summary Quality
3	Baskerville etal, 2018	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	NR	✓	ii
4	Matthews, Alicia K., et al, 2019	✓	✓	✗	✓	✓	✓	✓	✓	✓	✗	✓	✓	NR	✗	i

6	Covey etal, 2009	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	NR	✓	ii
22	Merculieff etal , 2020	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	NR	✓	ii
36	Daniels etal, 2022	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	NR	✓	ii
7	Williams etal , 2020	✓	✓	NA	✓	✓	✓	NA	✗	✗	✓	✗	✗	NR	NA	i
8	Caldwell etal, 2022	✗	✓	NA	NA	NA	NA	NA	NA	NA	✗	NA	NA	NR	NA	i
9	Miller etal , 2021	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	NR	✓	ii
10	Baskerville etal, 2016	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	NR	✓	ii
29	Asfar etal, 2022	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	NA	NA	ii
11	Vogel etal, 2019	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	NA	✓	ii
37	Asvat	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	NA	ii

	etal , 2014															
28	Fu etal, 2015	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	NA	NA	ii
14	Kidd etal , 2021	✓	CD	NA	✓	CD	✓	✓	✓	✓	✗	NA	✗	NA	NA	i
40	Morar and Robertson, 2022	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	NA	✓	NA	NA	i
46	Kumar etal, 2021	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	NA	✓	ii
47	Lappin etal , 2020	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	✗	✓	ii
	Robertson etal, 2012	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	NA	✓	ii
50	Flemington etal , 2021	✓	✓	NA	✓	✓	✓	✓	✓	NA	✗	✓	✓	NA	NA	i
51	Wilson etal, 2006	✓	✓	NA	✗	✗	✓	✓	✓	✓	✗	✓	✓	NA	NA	i

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