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Smoking-Cessation Interventions in People Living With HIV Infection: A Systematic Review

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Abstract

Tobacco smoking remains a prevalent behavior in people living with HIV infection (PLWHs) and is associated with impaired immune functioning, increased cardiovascular risk, and decreased response to antiretroviral therapy. This review presents a critique and synthesis of evidence on effective smoking-cessation interventions for PLWHs. A comprehensive search identified nine peer-reviewed intervention studies published between 1989 and 2012. The highest likelihood of smoking cessation (range of odds ratios 4.33–5.6) were in two randomized controlled trial interventions using cell phone technology. Clinically significant reductions in systolic blood pressure, weight gain, and increased CD⁴⁺ T-cell count were reported in participants who ceased smoking in three of the nine studies. Overall, multistrategy smoking-cessation interventions, delivered over multiple sessions, were effective. However, the most effective interventions were tailored to the unique individual needs of PLWHs, including assessment of and intervention for polysubstance abuse and mental health issues, as well as the inclusion of access-promoting elements.

Keywords

AIDS; HIV; smoking; smoking cessation intervention; tobacco

Disclosures

The authors report no real or perceived vested interests that relate to this article that could be construed as a conflict of interest.

Introduction

Compared to the current general U.S. smoking rate of 19%, the rate of cigarette smoking in people living with HIV infection (PLWHs) is substantially greater, with estimates ranging between 40% and 75% (Lifson et al., 2010; Lifson & Lando, 2012; Webb, Venable, Carey, & Blair, 2007), suggesting that smoking is 2 to 3 times greater in PLWHs (Burkhalter, Springer, Chhabra, Ostroff, & Rapkin, 2005; Minkoff et al., 2004; Niaura et al., 2000). Smoking is the most important modifiable risk factor for cardiovascular disease (CVD) and, given the high prevalence of cigarette smoking noted in PLWHs (van Wijk & Cabezas, 2012), smoking cessation should be a priority for HIV care providers. Several patient-related and social factors contribute to the high prevalence of smoking in PLWHs, including low education level; low socioeconomic status; illicit drug and alcohol use; age; concurrent depressive symptoms (Benard et al., 2007; Vidrine, Arduino, & Gritz, 2007); and lack of access to health services, housing, employment, and transportation (Krause, May, & Butler, 2012).

Considering the complexity of HIV management, smoking cessation may assume low priority for PLWHs despite reported detrimental effects on the immune system, response to antiretroviral therapy (ART; Miguez-Burbano et al., 2003), and risk of mortality (Helleberg et al., 2013; Niaura et al., 2000). Setting PLWHs apart from the general population, long-term smoking has been shown to increase the risk of developing active tuberculosis (Bates et al., 2007; Jee et al., 2009; Ramin, Kam, Feleke, Jacob, & Jha, 2008), and daily tobacco use significantly attenuates the immune and virological responses to antiretroviral therapies (Miguez-Burbano et al., 2003). Other detrimental effects of cigarette smoking in PLWHs include cancer, dental diseases, pulmonary disease, and CVD (Niaura et al., 2000). One study in 5,472 PLWHs showed that current smokers had a twofold increased risk for a major cardiovascular event (congestive heart failure, coronary artery disease, and/or peripheral vascular disease) compared with never-smokers (Lifson et al., 2010); this finding was also noted in another recent, large, population-based cohort study (Helleberg et al., 2013). While these risks are similar to those in tobacco users in the general population, the authors also found an increased risk of AIDS-related deaths among HIV-infected smokers compared to HIV-infected nonsmokers (Helleberg et al., 2013). Further, the average years of life lost by HIV-infected smokers compared with HIV-infected nonsmokers was 12.3 years, which was more than a twofold increase in the number of years lost by HIV infection alone (Helleberg et al., 2013).

Given the high prevalence of smoking in PLWHs and the magnitude of the effects of smoking on CVD, response to ART, and mortality, designing and implementing effective smoking-cessation strategies for this population is paramount. However, to date, no systematic literature reviews have focused on identifying smoking-cessation interventions that are effective in PLWHs. The purposes of our systematic review were to: (a) summarize and critique current evidence on effective smoking-cessation interventions for PLWHs; (b) highlight gaps in the literature and suggest recommendations for future research; (c) identify effective components of smoking-cessation intervention that clinicians can implement; and (d) present policy recommendations to facilitate smoking cessation.

Methods

Search Strategy

A systematic review of peer-reviewed literature on smoking cessation in PLWHs was undertaken. In consultation with a health librarian, the following databases and search engines were used: PubMed, *Cumulative Index to Nursing and Allied Health Literature*, PsychINFO, Cochrane, and Google Scholar. Medical Subject Headings (MeSH) and non-MeSH search terms used included: *tobacco use cessation*, *smoking cessation*, *bupropion*, *varenicline*, *nicotine replacement therapy (NRT)*, *smok**, *quit**, *ceas**, *cessat*, *hiv infections*, *hiv**, *human immune**, and *acquired immun**. A manual search of reference lists in selected articles was also undertaken.

Inclusion and Exclusion Criteria

Only peer-reviewed journal articles, written in English, that described a smoking-cessation intervention in PLWHs were included. The search was conducted in August 2012 and spanned literature published since 1989. Intervention studies that were not experimental or quasi-experimental (QE) or that were delivered to participants without HIV infection were excluded. One longitudinal descriptive study (Fuster et al., 2009) was included because it contained an embedded QE cessation intervention.

Procedure

Two reviewers (G.M.J. and Y.C.M.) independently reviewed the titles and abstracts of articles retrieved. Differences in inclusion articles were resolved through discussion. Both reviewers independently extracted data from included articles using a standardized extraction form developed by the reviewers. The primary outcomes of interest in this review were rates of cessation and smoking abstinence; however, data on additional outcomes were also extracted.

Results

The literature search yielded 535 potentially relevant articles. After duplicates were removed, 410 potentially relevant articles remained. Of these articles, only 9 (Cui et al., 2012; Cummins, Trotter, Moussa, & Turham, 2005; Elzi et al., 2006; Fuster et al., 2009; Ingersoll, Cropsey, & Heckman, 2009; Lloyd-Richardson et al., 2009; Moadel et al., 2012; Vidrine, Arduino, Lazev, & Gritz, 2006; Vidrine, Marks, Arduino, & Gritz, 2012) met our inclusion criteria and were relevant to the question addressed in this systematic review (Fig. 1).

Study Characteristics

Five randomized controlled trials (RCT) were included, all conducted in the United States (Table 1). Study sample sizes ranged from 33 to 474. Participants were of middle age (mean ages ranged from 42 to 48 years) and most were male (49%–82%). Overall, the nine studies were concentrated among PLWHs with a high rate of unemployment (41%–93%; Cummins et al., 2005; Elzi et al., 2006; Ingersoll et al., 2009; Lloyd-Richardson et al., 2009; Moadel et al., 2012; Vidrine et al., 2012) and a lower level of education (43%–77% with less than a

high school education; Elzi et al., 2006; Ingersoll et al., 2009; Lloyd-Richardson et al., 2009; Vidrine et al., 2012).

Among the studies conducted in the United States, more than half of the participants were of ethnic minority (Ingersoll et al., 2009; Lloyd-Richardson et al., 2009; Moadel et al., 2012; Vidrine et al., 2006; Vidrine et al., 2012). Cigarette dependence was variable across studies, with mean cigarettes smoked per day ranging from 17 to 28. Additionally, mean *Fagerström* Test for Nicotine Dependence (FTND) scores ranged from 4.98 to 5.82, where FTND scores of 4 to 6 denote moderate nicotine dependence (Heatherton, Kozlowski, Frecker, & Fagerström, 1991). While all studies included PLWHs, data on HIV severity were reported in only three studies (Cui et al., 2012; Elzi et al., 2006; Moadel et al., 2012). Furthermore, information about baseline CVD-risk profile characteristics was provided in only two studies (Elzi et al., 2006; Fuster et al., 2009).

Intervention Characteristics

Despite the heterogeneity of interventions, some commonalities were noted. All studies implemented multifaceted interventions and utilized a combination of motivational interviewing/counseling techniques and pharmacotherapy, usually NRT with varying degrees of intensity. Most studies included varying degrees of tailoring or individualization, motivational interviewing, and the distribution of smoking-cessation self-help materials (Cui et al., 2012; Elzi et al., 2006; Fuster et al., 2009; Ingersoll et al., 2009; Lloyd-Richardson et al., 2009; Moadel et al., 2012; Vidrine et al., 2006; Vidrine et al., 2012). The use of theory to develop smoking-cessation interventions was limited and used in only four of the studies (Elzi et al., 2006; Fuster et al., 2009; Ingersoll et al., 2009; Moadel et al., 2012).

Differences across interventions were also noted. Four studies tailored smoking-cessation materials and information to the benefits of smoking cessation for PLWHs (Ingersoll et al., 2009; Lloyd-Richardson et al., 2009; Moadel et al., 2012; Vidrine et al., 2006). Although some studies reported brief interventions, all studies included a follow-up component after the intervention period. Intervention setting and delivery personnel differed across studies. Some interventions were delivered in HIV clinics and community-based clinics, while two studies implemented primarily technology-based interventions, with counseling sessions delivered via a cell phone (Vidrine et al., 2006; Vidrine et al., 2012). Between these two cellphone intervention studies, 8 and 11 counseling sessions were delivered over a 2- to 3-month period, with front-loaded counseling sessions delivered close to the participant's predetermined quit date. Additional support between calls was obtained through access to a quit line staffed by cessation counselors (Vidrine et al., 2006; Vidrine et al., 2012).

Interventionists also varied from health professionals (nurses or physicians) to trained counselors and research assistants. The study by Moadel et al. (2012) was the only one to use a peer counselor who was an HIV-infected ex-smoker to deliver the intervention.

Effectiveness of Interventions on Primary Outcome: Smoking Cessation

Randomized control trials—Of the five RCTs, three reported significantly increased smoking-cessation rates among participants in the intervention groups compared with those

in the control groups (odds ratio [OR] range = 1.97–5.6; Moadel et al., 2012; Vidrine et al., 2006; Vidrine et al., 2012). Interventions using cell-phone technology produced the greatest likelihood of smoking cessation (OR range = 4.33–5.6; Vidrine et al., 2006; Vidrine et al., 2012). Finally, two interventions significantly reduced smoking-cessation rates utilizing motivational interviewing techniques (Ingersoll et al., 2009; Lloyd-Richardson et al., 2009); however, Lloyd-Richardson et al. (2009) found a significantly higher rate of abstinence only at 6 months among Hispanic Americans compared with Whites (OR = 2.53, 95% confidence interval [CI] [1.33–5.67]).

Quasi-experimental studies—All QE studies (Cui et al., 2012; Cummins et al., 2005; Elzi et al., 2006; Fuster et al., 2009) found smoking-cessation rates of 39% to 50% among intervention participants after the intervention phase, and one study also found that participants in the intervention group were 6.2 times (95% CI [2.8–14.3]) more likely to have remained abstinent from smoking at 12 months after the end of intervention compared with the control group (Elzi et al., 2006). Across all QE studies, smoking-cessation rates were lower at the end of the follow-up period than at the end of the intervention period.

Effectiveness of Intervention on Secondary Outcomes

In addition to smoking cessation, secondary outcomes such as reduction in CVD risk (Cui et al., 2012; Elzi et al., 2006; Fuster et al., 2009), HIV severity (Cui et al., 2012), psychosocial comorbidities (Fuster et al., 2009), and adverse events of the pharmacotherapy (Cui et al., 2012) were examined. Clinically significant reductions in systolic blood pressure (Fuster et al., 2009) and weight gain (Cui et al., 2012) were reported among participants who ceased smoking. A significant increase in CD⁴⁺ T-cell count was also noted in one study (Cui et al., 2012). Significantly lower anxiety-scale scores were noted among participants who stopped smoking (Fuster et al., 2009), and the most common adverse events experienced by participants while taking varenicline were nausea (33%), abnormal dreams (31%), affect lability (19%), and insomnia (19%; Cui et al., 2012).

With respect to psychosocial outcomes, statistically significant increases in self-re-evaluation, emotions about smoking behavior, use of social support, substitution of alternatives to smoking, and re-engineering of the smoking environment (all $p < .05$) were noted (Ingersoll et al., 2009). These psychosocial processes are theoretically related to behavioral change.

Discussion

Interventions to reduce smoking rates in PLWHs can be effective, but this review suggests that interventions may be more effective when components are tailored to the unique needs of the target population. Similar to previous smoking-cessation studies in PLWHs (Kwong & Bouchard-Miller, 2010), this review highlights the need for interventions that utilize multiple strategies and deliver interventions at multiple sessions (Cummins et al., 2005; Elzi et al., 2006; Moadel et al., 2012; Vidrine et al., 2006; Vidrine et al., 2012). Notably, the high rate of recidivism among smokers highlights the importance of follow-up to ensure continuous smoking cessation in PLWHs. Incorporating cell-phone technology into smoking-cessation interventions for PLWHs may decrease socioeconomic barriers

associated with face-to-face interventions and reduce the fears of stigma or discrimination that often plague this population.

Implications for Practice, Research, and Policy

Practice—The success of a smoking-cessation intervention is partly dependent on a patient's readiness to quit smoking. Clinicians should become familiar with behavioral change theories/frameworks and tailor smoking-cessation interventions to each individual's stage of change. As noted in smoking-cessation literature and as supported in this review, effective interventions should follow the "5 A's" of smoking-cessation counseling (ask, advise, assess, assist, and arrange; U.S. Preventive Services Task Force, 2009).

A successful intervention should also tailor cessation information to the specific needs of PLWHs. In this review, most studies tailored interventions to PLWHs by educating patients about the health benefits of smoking cessation, with an emphasis on specific benefits for PLWHs (i.e., improved immune function and decreased cardiovascular events risk). Furthermore, interventions that were most successful also asked patients about previous or current drug use and history of mental illness (e.g., depression and anxiety; Moadel et al., 2012) and tailored interventions to those needs. Studies have suggested that a history of intravenous drug addiction is associated with a higher rate of smoking addiction (Hershberger, Fisher, Reynolds, Klahn, & Wood, 2004); therefore, addressing cigarette smoking in isolation without considering other addictive behaviors may result in suboptimal outcomes. Successful interventions in this review also provided an individualized smoking-cessation plan that included a support buddy, addressed social issues, and offered feasible smoking-cessation programs (i.e., choice of attending a day or night program, or cellphone delivery; Moadel et al., 2012; Vidrine et al., 2006). It is important for PLWHs to live in a supportive environment that empowers them to quit smoking.

Although not addressed in any of the interventions identified in this review, health professionals may be another potential barrier to effective smoking-cessation counseling strategies. Recent research has reported that HIV care providers failed to identify patients who were current smokers during the history-taking and physical examination (Crothers et al., 2007) and lacked the training and confidence required to initiate smoking-cessation therapy (Shuter et al., 2012). One recent study addressed this barrier by training HIV care providers on smoking-cessation counseling, including identifying smokers, nicotine dependence, behavioral-change frameworks, counseling methods, and pharmacotherapeutic support (Huber et al., 2012). The intervention led to significantly increased smoking-cessation rates (OR 1.23, $p = .004$) and fewer relapses (OR .75, $p = .007$) in PLWHs who saw trained providers compared with those who saw untrained providers (Huber et al., 2012). This finding suggests that the success of a smoking-cessation intervention may also depend on a provider's knowledge and confidence to deliver the intervention and, as such, should be evaluated.

Research—Despite the effectiveness of some interventions, the nine studies in this review highlighted the need for additional research on smoking-cessation interventions for PLWHs and specific interventions that: (a) are uniform with respect to the interventions implemented

and reporting of components of intervention; (b) discuss how interventions are tailored to PLWHs; and (c) contain consistent reporting of primary and secondary outcomes. This research will enable providers to better identify and determine which components of intervention are most effective.

According to Michie, Hyder, Walia, and West (2011), uniform taxonomy in behavioral-change interventions is the first step in determining which specific components of intervention (individual or in combination) will make up the most effective smoking-cessation interventions. Michie et al. (2011) identified 43 behavioral-change techniques and developed a taxonomy for components of smoking-cessation intervention, which could be a starting point for standardizing future smoking-cessation interventions for PLWHs.

In addition to a uniform taxonomy, there is a need for additional studies that tailor interventions to the needs of PLWHs, and researchers should discuss which specific components of intervention are tailored to this population. Of the nine studies in this review, only two specifically discussed how information was tailored to an individual patient's needs and circumstances beyond providing information on the health benefits of smoking cessation for PLWHs (Moadel et al., 2012; Vidrine et al., 2006). Researchers should address and highlight how techniques, resources, and considerations for PLWHs have been tailored from smoking-cessation interventions for the general smoking population. Furthermore, with high rates of recidivism and intervention dropout rates, additional intervention studies should address strategies and techniques for keeping this population engaged in treatment.

Finally, despite education about the health benefits of smoking cessation in PLWHs (Ingersoll et al., 2009; Lloyd-Richardson et al., 2009; Moadel et al., 2012; Vidrine et al., 2006), only two studies reported changes in health-status indicators and cardiovascular risk factors as outcomes (Elzi et al., 2006; Fuster et al., 2009). Additional studies, specifically longitudinal studies, should investigate the intermediate- and long-term impact of smoking cessation on cardiovascular risk factors, considering the documented impact of smoking on years of life lost in PLWHs (Helleberg et al., 2013). These studies should also monitor for the adverse effects of pharmacological smoking-cessation therapies in this population.

Policy—Smoking cessation for PLWH is a public health problem as it is associated with excess mortality above HIV infection alone (Helleberg et al., 2013). None of the studies included in this review addressed the cost-effectiveness of the interventions; however, earlier studies showed that, in the general population, tobacco-use cessation is more cost-effective compared with other common CVD-prevention interventions, including hypertension and hyperlipidemia control (Cummings, Rubin, & Oster, 1989; Wasley, McNagny, Phillips, & Ahluwalia, 1997). Future smoking-cessation intervention studies should incorporate a cost-effectiveness evaluation given that PLWHs are a unique population with needs that are different from those of the general smoking population. In the meantime, strategies that build a financial infrastructure for promoting smoking cessation in PLWHs should be promoted. These strategies include promoting access to smoking-cessation interventions by including smoking-cessation counseling in health-benefit plans, providing reimbursement for delivered smoking-cessation interventions and policies to ensure the affordability of smoking-cessation aids. Considering the high rates of

unemployment and low levels of education of the PLWHs noted in this review, comprehensive social services should also be made available to PLWHs to address social factors that may increase stress and hamper attempts at smoking cessation.

Strengths and Limitations of Reviewed Studies

Study design limitations included the use of convenience sampling, small sample sizes, few RCTs, and the use of self-reported smoking-cessation measures. While each included study contained similar interventional components, each smoking-cessation intervention was different with respect to counseling techniques and length of follow-up period post-intervention. Most of the studies included a short follow-up period. The inclusion of PLWHs with high unemployment rates and a low level of attainment of education across studies may limit the ability to generalize findings to other socioeconomic groups; however, low levels of education and a lack of access to employment have been cited as patient-related and social factors contributing to the high rates of smoking in PLWHs (Krause et al., 2012; Vidrine et al., 2007). Access-promoting elements noted in the interventions—including transportation, financial assistance, cultural considerations, literacy levels, compensation of participants, and other ethical issues—were not disclosed, and, across studies, reporting of components of intervention and primary outcomes were insufficient and inconsistent. Finally, nonsignificant findings for the primary outcome, smoking cessation, in two RCT studies (Ingersoll et al., 2009; Lloyd-Richardson et al., 2009) may have been related to potential bias introduced in the control group, a study effect caused by asking participants about their smoking habits at baseline or an unknown effect of history. Nonetheless, nonsignificant findings in both studies supported the benefit of any versus no smoking-cessation counseling by HIV care providers.

There were a few strengths in the included studies. Five of the nine studies used an RCT design. Six of the nine studies also used biochemically (carbon monoxide [CO] and serum cotinine) verified smoking status to enhance the validity of the results. In addition, two of the studies used technology-based intervention as an access-promoting element. Technology-based interventions for PLWHs can overcome historical barriers to interventions, including interventionist-related issues, such as discomfort with discussing topics; incomplete implementation of the intervention; and participant-related obstacles, including transportation, insurance, physical limitations, and the need for child care.

Strengths and Limitations of this Review

The ability to make generalizations about effective smoking-cessation strategies for PLWHs depends on both the quality and quantity of studies reviewed. The main limitations of this review were the inclusion of only accessible, peer-reviewed literature and the exclusion of gray literature not published in English. These limitations led to a small number of smoking-cessation intervention studies and to the possible exclusion of potentially relevant studies.

Despite these limitations, this review had multiple strengths. Peer-reviewed articles were systematically identified through a comprehensive search strategy, and relevant data were extracted using a standardized extraction checklist, with discussion of the findings between authors. Furthermore, the results of all studies were equally considered in the synthesis of

findings across studies. Finally, secondary outcomes, such as the impact of smoking cessation on cardiovascular health, risk factors for major cardiovascular events, as well as psychosocial and behavioral outcomes were explored and reported.

Conclusions

Our review presents information to guide clinical practice in regard to smoking-cessation counseling for PLWHs, but it also highlights the need for additional research. Overall, our review supports counseling that focuses on the “5 A’s” of smoking-cessation counseling but is tailored to the unique needs of PLWHs. Tailoring should include not only discussions of the specific health benefits of smoking cessation for PLWHs but also the assessment and inclusion of strategies to address other drug use and mental health issues; promotion of social support and a healthy smoking-cessation environment; and access-promoting elements, such as day and night sessions or the use of “tele-health” technology (e.g., cell phones). Despite these findings, the limited number of studies support the need for additional research. Future research should include similar components of intervention, which can be facilitated by using the taxonomy for behavioral-change interventions developed by Michie et al. (2011), as well as consistent reporting of both primary and secondary outcomes.

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Key Considerations

1. Smoking-cessation interventions that use the “5 A’s” of smoking-cessation counseling (ask, advise, assess, assist, and arrange) are effective.
2. Individualized smoking-cessation interventions that assess and tailor interventions to psychosocial comorbidities and polysubstance abuse are effective.
3. Incorporation of access-promoting elements that decrease socioeconomic barriers, such as using cell-phone technology, may reduce smoking-cessation rates in PLWHs.
4. For PLWHs, a combination of strategies, including counseling/patient education, pharmacotherapy, and self-monitoring, may lead to greater benefit than a single strategy.
5. Future research should standardize reporting of interventions to inform design and delivery of smoking-cessation services.

Figure 1.

Literature review flowchart. *Reasons for excluding articles included: not a smoking-cessation intervention, intervention not delivered to people living with HIV infection, and descriptive study.

Table 1

Study and Participant Characteristics

First Author, Year, Country, Study Design, Sample Size	Theory	Participants' Characteristics	Interventions				Outcomes	Significant Results
			Components of Intervention	Dosing	Setting	Delivered By		
Cui et al., 2012 Canada QE N = 36	N/A	Age, <i>M</i> (<i>SD</i>) = 46 (8) years; sex, 97% male; ethnicity, 92% White Smoking characteristics: CPD, <i>M</i> (<i>SD</i>) = 19 (10); FTND score, <i>M</i> (<i>SD</i>) = 5.4 (2.2) HIV characteristics: ART, 86%	All: titrated varenicline dose ×12 weeks, reading materials, counseling (in-person, phone, e-mail), quit date set	Group 1: once weekly for first 12 weeks, then biweekly for 12 weeks; Group 2: once weekly for first 4 weeks, then at weeks 8, 12, 16, and 24	HIV clinics	MD/trained counselor	1. Outcome: 4-week CAR, 42%, 95% CI [26%–58%]; 2. Outcomes: 15- week CAR, 28%, 95% CI [13%– 42%]; 7-day PP, 42% at 24 weeks; common AEs, nausea (33%), abnormal dreams (31%), affect lability (19%), insomnia (19%); CD4+ T-cell count at 24 weeks, <i>M</i> (<i>SE</i>) = 69 (20) cells/mm ³ <i>p</i> = .001; DBP at 24 weeks, <i>M</i> (<i>SE</i>) = 4 (2) mm/Hg, <i>p</i> = .0049; weight gain, <i>M</i> (<i>SE</i>) = 2.8 (0.7) kg at 24 weeks, <i>p</i> < .001	1. Outcome: 4-week CAR, 42%, 95% CI [26%–58%]; 2. Outcomes: 15- week CAR, 28%, 95% CI [13%– 42%]; 7-day PP, 42% at 24 weeks; common AEs, nausea (33%), abnormal dreams (31%), affect lability (19%), insomnia (19%); CD4+ T-cell count at 24 weeks, <i>M</i> (<i>SE</i>) = 69 (20) cells/mm ³ <i>p</i> = .001; DBP at 24 weeks, <i>M</i> (<i>SE</i>) = 4 (2) mm/Hg, <i>p</i> = .0049; weight gain, <i>M</i> (<i>SE</i>) = 2.8 (0.7) kg at 24 weeks, <i>p</i> < .001
Cummins et al., 2005 Australia QE N = 45	N/A	Age range, 20–60+ years; sex, 98% male; unemployment, 56% Smoking characteristics: FTND score (<i>M</i>): ceased smoking, 4.9; reduced smoking, 5.2; did not complete program, 5.3 HIV characteristics: ART, 70%	IG: NRT distribution over 8–12 weeks with monitoring, counseling with social worker, smoking-cessation diary, a QUIT kit from the NSW QUIT Campaign, contact telephone number, F/U every 6 weeks for four sessions after SCP ended	ALL: 8–12 weeks + 5-month F/U	Outpatient clinic and primary care community service	Social worker and nursing staff	1. Outcome: % smoking cessation	1. Outcome: 44% (<i>n</i> = 12) ceased smoking
Elzi et al., 2006 Switzerland QE N = 417	TTM	Age range, 23–63 years; sex, 69% male; unemployment,	IG: individual counseling sessions + NRT CG: NRT	ALL: 24 months IG: 30-min counseling session once weekly	Outpatient clinic	Nurses	1. Outcome: smoking-cessation rate 12 months 2. Outcome:	1. Outcome: IG 6.2 times more likely to remain abstinent, 95% CI

First Author, Year, Country, Study Design, Sample Size	Theory	Participants' Characteristics	Interventions				Outcomes	Significant Results
			Components of Intervention	Dosing	Setting	Delivered By		
		62%; education, 43% <HS Smoking characteristics; CPD (range), 1–80 HIV characteristics: ART, 59%		during 1st month and once monthly thereafter for 12 months, with 3- and 12-month F/U after intervention phase CG: 3- and 12-month F/U after intervention phase			prevalence of CVD morbidity and mortality	[2.8–14.3] 2. Outcome: 2 of 34 IG participants and 4 of 383 CG participants experienced Myocardial Infarction, 1 in CG died of CVD
Fuster et al., 2009 Spain OE N = 33	TTM	Age, M (SD) = 46 (6.9) years; sex, 78.5% male Smoking characteristics: CPD, M = 21, 95% CI [15.5– 32.5]; FTND score, M (SD) 5 5.5 (3.0) HIV characteristics: ART, 75.8%	IG: medical advice; psychological support; pharmacological treatment with bupropion, varenicline, and/or NRT	ALL: four to six 1-hour visits over 2 months	Outpatient clinic	Specialized nursing personnel	1. Outcome: smoking-cessation rate measured by CO levels 2. Outcomes: change in CVD risk and psychosocial morbidity	1. Outcome: smoking cessation (n [%]), 13 (39.4%) at 3 months, 10 (30.3%) 6 months, 8 (25%) at 12 months 2. Outcome: $\downarrow$ SBP (mm Hg), M = 15.3, 95% CI [4.9– 25.3]; significant decrease from baseline in anxiety scale scores, $p < .237$
Ingersoll et al., 2009 United States RCT N = 40	TTM	Age, M (SD) = 42 (6.1) years; sex, 55% male; unemployment, 93%; education, 57% <HS; ethnicity, 95% AA Smoking characteristics: CPD, M = 17.3; FTND score, M = 4.98	MI: MI with counselor tailored to HIV+ status, NRT patch (1-month supply), SGC: SG reading packet developed by NCI entitled <i>You can Quit</i> <i>Smoking</i> , with guidance on use explained by counselor + NRT patch (1-month supply)	ALL: initial session + 1- and 3-month F/U	Infectious disease clinic in an urban university hospital	Counselor with master's degree or postdoctoral fellow in psychology	1. Outcome: smoking abstinence verified by CO level 2. Outcome: FTND, Processes of Change measures	1. Outcome: NS between-group differences in CO levels; pooled CO level, M (SD) = 10.9 (6.1) 2. Outcomes (pooled analysis; M [SD]): nicotine dependence score, 3.8 (2.3); % of days smoking, 57.9% (37.3); and CPD, 6.2 (5.9), all, $p < .01$; Process of Change measures (M [SD]): self- reevaluation, 6.7 (2.1); emotions about smoking behavior, 5.9 (2.6); use of social support, 5.8 (2.9); substitution of alternatives to

First Author, Year, Country, Study Design, Sample Size	Theory	Participants' Characteristics	Interventions					Significant Results
			Components of Intervention	Dosing	Setting	Delivered By	Outcomes	
Lloyd- Richardson et al., 2009 United States RCT N =444	N/A	Age, <i>M</i> (<i>SD</i>) = 42.1 (7.9) years; sex, 63% male; unemployment, 79%; ethnicity, 52% White; education, 69% HS Smoking characteristics: CPD, <i>M</i> (<i>SD</i>) = 18.27 (9.81); FTND score, <i>M</i> (<i>SD</i>) = 5.91 (2.33)	ALL: participants willing to set quit date given 8-week supply of NRT SC: NRT + brief SC intervention (5-min sessions with HE for baseline assessment, quitting plan, question/ answer + self-help quitting materials) ME: NRT + more intensive, motivationally enhanced counseling intervention tailored to HIV status (30-min intervention sessions + quit day counseling call + tailored smoking materials for PLWH	ALL: F/U at assessments at 2, 4, and 6 months SC: 2 brief counseling sessions ME: four 30-min intervention sessions	Outpatient HIV clinics and primary care medical offices	Physician and health educator	1. Outcome: biochemically verified 7-day abstinence rates at 2-, 4-, and 6-month F/U	1. Outcome: NS differences in abstinence rates at 2, 4, and 6 months; all, <i>p</i> > .70; 6-month ITT abstinence rates positively associated with low nicotine dependence (<i>p</i> = .02), high motivation to quit (<i>p</i> = .04) and Hispanic American race/ ethnicity (<i>p</i> = .02) smoking, 5.6 (2.0); re-engineering smoking environment, 4.1 (2.7); all, <i>p</i> < .05
Moadel et al., 2012 United States RCT N = 145	SCT	Age, <i>M</i> (<i>SD</i>) = 48.6 (7.0) years; sex, 49% male; ethnicity, 85% AA; unemployment, 88% Smoking characteristics: FTND score, <i>M</i> (<i>SD</i>) = 5.0 (2.1); CPD, <i>M</i> (<i>SD</i>) = 12.0 (8.8)	ALL: NRT (3-month supply) SC: quit-smoking brochure, brief advice to quit (<5 min) IG: 8 (weekly) 90-min group- counseling sessions emphasizing social support and tailored to the needs of PLWHs	ALL: 3 months IG: ~8 weekly counseling sessions	Not mentioned	Peer (ex-smoker with HIV) and professional (ex-smoker and graduate students in psychology)	1. Outcome: biochemically confirmed 7-day self-reported PP abstinence at 3 months post quit date	1. Outcome: IG more likely to be abstinent (biochemically confirmed PP); complete-case OR = 2.63, 95% CI [0.98–7.01], <i>p</i> = .05; ITT OR = 1.97, 95% CI [0.85–4.60], <i>p</i> = .11
Vidrine et al., 2006	N/A	Age, <i>M</i> (<i>SD</i>) = 42.8 (8.1) years; sex,	RSOC: MD advice, set quit date within	ALL: 2 months	Inner-city HIV/ AIDS	Physician for RSOC group and research	1. Outcome: smoking status	1. Outcome: IG more likely to be

First Author, Year, Country, Study Design, Sample Size	Theory	Participants' Characteristics	Interventions				Outcomes	Significant Results
			Components of Intervention	Dosing	Setting	Delivered By		
United States RCT <i>N</i> = 95		77.9% male; ethnicity, 71.6% Black, 8.4% Hispanic Smoking characteristics: CPD (<i>M</i> [<i>SD</i>]): IG, 19.5 (13.8); RSOC, 20.6 (12.0)	7 days, 10-week supply NRT, personalized quit- smoking plan, general self-help pamphlet, tip sheet IG: RSOC + prepaid cell phone, 8 scheduled proactive cell phone-delivered counseling sessions tailored to needs of HIV+ smokers, access to hotline phone sessions	ALL: 3 months	care center and home	assistant trained in smoking cessation for CPI group	(biochemically confirmed PP abstinence and sustained abstinence) 2. Outcomes: quit attempt (i.e., remaining abstinent for at least 1 period of 24 h) and longest period of abstinence	abstinent (biochemically confirmed PP); complete-case OR = 5.6, 95% CI [1.4–22.4], <i>p</i> = .016; ITT OR = 3.8, 95% CI [1.1– 13.4], <i>p</i> = .040 2. Outcome: IG group 9.7 times more likely to have made a quit attempt, RR = 9.7, 95% CI [1.3–72.5]
Vidrine et al., 2012 United States RCT <i>N</i> = 474	N/A	Age, <i>M</i> (<i>SD</i>) = 44.8 (8.1) years; sex, 70% male; unemployment, 79%; ethnicity, 76.6% AA; education, 76.4% <HS Smoking characteristics: CPD, <i>M</i> = 19.2; FTND (<i>M</i> [<i>SD</i>]): IG, 5.82 (2.26); CG, 5.73 (2.26)	UC: brief advice to quit smoking from a health care provider, self-help written materials, and NRT IG: UC + prepaid cell phone, 11 proactive cell- phone counseling sessions, access to additional support hotline between sessions	ALL: 3 months	HIV clinic or home- based	Unspecified counselor, cell- phone based	1. Outcome: 7-day PP abstinence at 3 months 2. Outcomes: 24-h abstinence, 30-day abstinence, and CAR: self- reported quit attempt for at least a 24-h period, and length of abstinence	1. Outcome: CPI group, 4.33 times more likely to be abstinent, 95% CI [1.92–9.82], <i>p</i> < .001 2. Outcomes: all statistically significant (<i>p</i> < .05) except quit attempt

Note: AA = African American; AC = available case; AE = adverse events; ART = antiretroviral therapy; CAR = continuous abstinence rate; CG = control group; CI = confidence interval; CO = carbon monoxide; CPD = cigarettes per day; CPI = cell-phone intervention; CVD = cardiovascular disease; DBP = diastolic blood pressure; FTND = Fagerström Test for Nicotine Dependence; F/U = follow-up; HE = health educator; HS = high school; IG = intervention group; ITT = intent-to-treat; LD = longitudinal-descriptive; *M* = mean; MC = motivational counseling + nicotine-replacement patch; MD = physician; ME = motivationally enhanced; MI = motivational interviewing + patch; MNWS = Minnesota Nicotine Withdrawal Scale; NRT = nicotine-replacement therapy; NSW = New South Wales; OR = odds ratio; PP = point-prevalence; QE = quasi-experimental; RCT = randomized control trial; RR = relative risk; RSOC = recommended standard of care; SBP = systolic blood pressure; SC = standard care; SCP = Smoking Cessation Program; SCPT = standard of care + patch; *SD* = standard deviation; SE = standard error; SG = self-guided; SGC = self-guided counseling + nicotine-replacement patch; TTM = transtheoretical model; UC = usual care.