EVIDENCE SUMMARY

PREVENTING RELAPSE TO SMOKING: A REVIEW OF THE EVIDENCE

The Program Training and Consultation Centre conducts applied research in partnership with the Propel Centre for Population Health Impact at the University of Waterloo.

PTCC
PROGRAM TRAINING & CONSULTATION CENTRE
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The Program Training and Consultation Centre (PTCC), founded in 1993, is a resource centre of the Government of Ontario's Smoke-Free Ontario Strategy (SFO). PTCC acts as a knowledge broker between local public health departments, the research community, and government. Its strategic priorities are to:

- Build the capacity of Ontario's 36 public health departments to plan and implement evidence-based tobacco control programs
- Support moving evidence into action
- Strengthen program development and applied research efforts
- Build system capacity to support the Smoke-free Ontario Strategy renewal

Funded through Public Health Ontario, PTCC is a partnership between Cancer Care Ontario and the Propel Centre for Population Health Impact at the University of Waterloo. Propel supports PTCC's priorities through translating research evidence for practitioners, documenting practice-based knowledge and experiences, and conducting applied intervention research.

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Propel is a collaborative enterprise that conducts research, evaluation and knowledge exchange to move evidence into action, accelerating improvements in the health of populations in Canada and around the world.

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INTRODUCTION

Among people who smoke, the majority report a desire to stop, although few who try are successful in quitting over the long term (Borland, 2012). In Ontario, 9% of smokers report having quit for at least 30 days in the last year; however, data suggests that 79% of these recent quitters relapse to smoking within the year (Ontario Tobacco Research Unit, 2016). The proportion of Ontario's two million smokers who successfully quit each year (defined as 12-month abstinence) is 1.7% (Ontario Tobacco Research Unit, 2016), and on average it takes 30 attempts to quit successfully (Chaiton, 2016). These figures are reflective of the general acceptance of tobacco dependence as a chronic condition. For most, smoking cessation involves a dynamic process that includes quit attempts and then a return to smoking several times before achieving long-term abstinence (Brandon, 2007; Witkiewitz, 2004; Witkiewitz, 2007; Zhou, 2009; Peters, 2009). Referred to as relapse, this process of resuming smoking after a period of abstinence typically occurs in the first week (Hughes, 2004; Chaiton, 2012), and less often many months or even years after the quit date (Piasecki, 2002; Wetter, 2004).

Recognizing the need to support and encourage smoking cessation, the provincial government announced an Ontario Smoking Cessation Action Plan in 2016 (Ministry of Health and Long-Term Care, 2016). This plan involves creating a coordinated system of supportive, effective, and efficient cessation services that are easily accessible by tobacco users and their families. The plan aims to reduce smoking rates by increasing quit attempts among current smokers and supporting people who smoke throughout their quit trajectory. Research, however, shows that the mechanisms associated with smoking cessation treatment are distinctly different from those that help individuals to remain smoke-free (Zhou, 2009). For example, higher motivation and intent to quit predicts making a quit attempt but is not associated with the prevention of relapse (Zhou, 2009). As such, strategies employed in various tobacco treatment services may not be appropriate in preventing relapse after an individual has initially quit (Hajek, 2013). At this time, specific investments are needed to better understand the relapse process and support long-term smoking abstinence in those who have successfully quit, especially among underserved populations who experience higher relapse rates (Caraballo, 2014).

As an initial step, a search was completed to gather recent evidence from the scientific and grey literature including from databases[1] (PubMed, Scopus, and Cochrane Library), scientific books, and selected websites (The Ontario Tobacco Research Unit, the National Institute of Health, and the National Institute of Alcohol Abuse and Alcoholism). The goal of this search was not to provide an exhaustive review of the evidence. Rather, this paper is inclusive of representative studies (i.e. reflecting what is commonly stated in the literature) on relapse prevention including original and developing definitions and concepts, underpinning theories of relapse, as well as an overview of current and emerging interventions and programs to address relapse. In addition, where identified, relapse prevention opportunities are highlighted for specific populations, and for different points of time along the cessation continuum. Although the initial search focused on evidence published from 2011 onwards, additional relevant sources have also been included in cases where earlier work was cited and identified as being important in recent publications. Larger systematic review and meta-analysis studies were examined, when available. In addition, results from other smaller studies were examined when several studies presented conflicting results or when the authors used a methodology designed to better understand practice-based implications. Evidence relevant to alcohol addiction was also included in some sections based on the insights and opportunities that may be transferable and adaptable to the prevention of smoking relapse.

DEFINITIONS AND CHARACTERISTICS OF RELAPSE IN THE LITERATURE

Although definitions differ across studies, common terms used to describe the process of smoking cessation and typical timeframes include:

Smoking cessation – the point at which a person attains abstinence (Collins, 2010).

Successful quit – a quit lasting one year or more since the last cigarette (Chaiton, 2016).

Lapse – a return to smoking after a period of abstinence (Piasecki, 2006). A lapse may be an isolated event followed by a return to abstinence or it may evolve into a relapse.

Relapse - a return to continuous smoking (over several days or more) after an attempt at, or a period of, abstinence (Piasecki, 2006).

Relapse prevention – maintaining abstinence until the implied relapse (Collins, 2010).

[1] Search terms included: Relapse AND Prevention, Relapse AND Smoking, Relapse AND Interventions, Relapse AND Addictions, Relapse Prevention AND (Interventions OR Strategies), Relapse Prevention AND Alcohol Relapse Prevention AND (Smoking OR Tobacco OR Alcohol OR Drugs), Relapse Prevention AND Quitting Relapse Prevention AND (Models OR Theories), Smoking Relapse AND Prevention Interventions, Smoking Cessation AND Relapse Prevention, RelapsePrevention, Smoking Relapse, Prevention Substance.

Within the field, there is a lack of agreement on how to separate and differentiate smoking cessation from relapse prevention, and which treatment outcomes are relevant to each. Inconsistent guidelines remain with respect to what events should be considered a lapse, which ones are a relapse, and how long an individual should be abstinent before they are "eligible" for a relapse classification (Collins, 2010). An additional complication is that the terms *smoking cessation* and *relapse prevention* are used in reference to both treatment outcomes (as defined above) and treatment approaches that help individuals attain or maintain abstinence (Collins, 2010). For example, interventions such as pharmacotherapy, cognitive-behavioural therapies, and combined approaches may all be used to achieve smoking cessation and / or prevent relapse to smoking.

Although relapse has been identified as the most likely outcome of all quit attempts (Piasecki, 2002), the way that studies operationalize relapse differs. Early work defined relapse by a dichotomous point prevalence measure of whether a person smoked at all (including even a single puff) in the past week or not (Piasecki, 2006). However, this definition has been criticized by some as being too liberal (it permits a person who has repeatedly smoked to be counted as abstinent if they stop smoking one week prior to measurement) and others as being too conservative (it could count a single isolated lapse as a relapse). As such, many have adopted measures of *continuous abstinence,* or *prolonged abstinence*.

Continuous abstinence - requires the participant be abstinent from smoking from the quit date to the follow-up endpoint for treatment success (Piasecki, 2006).

Prolonged abstinence - combines both point prevalence and continuous approaches. This measure may include isolated lapses early after cessation, usually in the first week of quitting, and then a lengthy period of continuous abstinence (Piasecki, 2006).

THEORIES AND MODELS OF RELAPSE

Early addiction research centred on the biology of relapse including genetic and neurobiological theories. Genetic theories presume a predisposition to addiction where neurobiological theories centre on the brain's accumulative addiction to substances. Within these theories, addiction is considered a disease and relapse is attributed to an individual wanting to satisfy any physiological cravings or stop any unpleasant withdrawal symptoms (Horvath, 2016). While these models play an important role in understanding addiction, over time, theories expanded to emphasize the influence of contextual factors (e.g. environmental stimuli and cognitive and behavioural processes) in relapse (Hendershot, 2011). Within these evolving cognitive-behavioural theories, relapse came to be understood as a fluctuating process involving multiple periods of abstinence followed by a return to an addictive behaviour, such as smoking, rather than the failure of treatment (Witkiewitz, 2004). This more optimistic approach views lapses as temporary setbacks, which, although common, represent opportunities for learning.

Using many of the theoretical concepts found in cognitive-behavioural theories, Marlatt & George (1984) developed one of the most used models of relapse prevention for addictive behaviours. In 2004, they reformulated their original model to place greater emphasis on the dynamic relapse processes and address criticism of the linearity of their early work (Witkiewitz, 2004).

The model (see Figure 1) assumes that relapse events are preceded by a high-risk situation that makes the individual vulnerable to returning to the addictive behavior. Examples of high-risk situations include physiological states (e.g. withdrawal), cognitive states (e.g. diminished self-efficacy or negative affect), or environmental contingencies (e.g. conditioned cues). Whether the individual lapses or not, depends on their ability to respond with an effective cognitive-behavioural strategy (Hendershot, 2011), and varies across individuals and over time within the same individual (Witkiewitz, 2007). Cognitive factors play an important role in relapse probability. For example, successfully navigating a high-risk situation may increase an individual's self-efficacy (Bandura, 1994), and therefore decrease the likelihood of relapse. Conversely, experiencing a lapse can undermine self-efficacy and increase the risk of future lapses. Other factors such as outcome expectancies (the anticipated effects of smoking) and beliefs about the causes and meanings of a lapse can affect the probability of an individual experiencing a full relapse to smoking (Hendershot, 2011). This model assumes that relapse can occur suddenly and unexpectedly which aligns with, and is supported by, both clinical observations and learning models showing that recent behaviour change is unstable and easily swayed by context (Bouton, 2000).

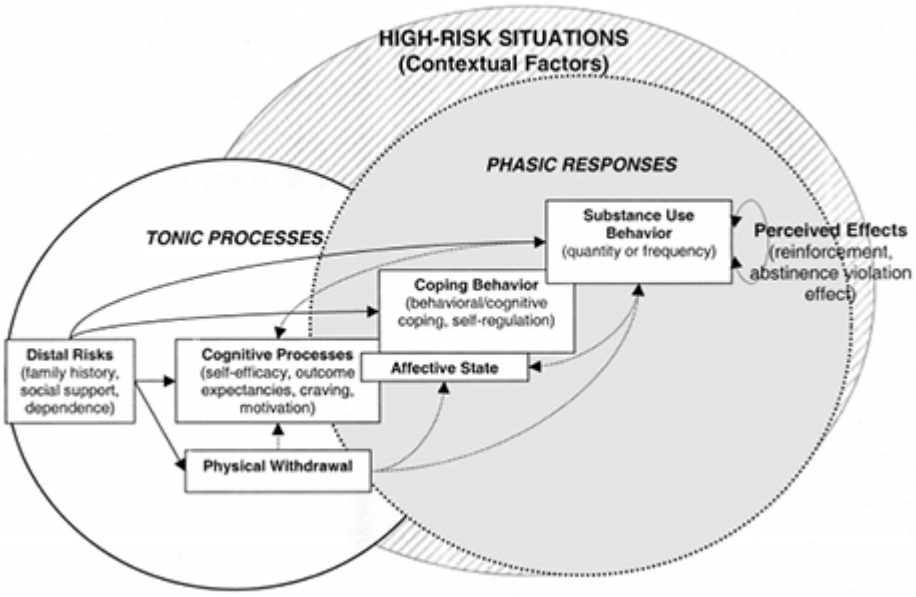

Figure 1: Dynamic model of relapse (Witkiewitz, 2004)

PREDICTORS OF RELAPSE

Many of the factors referenced in the relapse prevention model above have been studied and identified as predictors of smoking relapse across the literature. They include nicotine dependence (Zhou, 2009; Herd, 2009; Japuntich, 2011; Mhamdi, 2013), younger age (Mhamdi, 2013; Nakamura, 2014; Caraballo, 2014), lower income (Cui, 2006; Fernandez, 2006), lower education (Caraballo, 2014), social smoking cues (Zhou, 2009; Mhamdi, 2013; Buczkowski, 2014), depressive symptoms (Gokbayrak, 2015; Cooper, 2016), and lower self-efficacy[2] (Vangeli, 2010; Gokbayrak, 2015).

APPROACHES TO RELAPSE PREVENTION

Within the relapse prevention approach, there is a recognition of the unique processes and contingencies found in the initiation, and the maintenance stages of behaviour change (Rothman, 2000). Therefore, different strategies are often required to effectively maintain initial abstinence and then minimize risk of relapse over the long-term. Strategies for relapse prevention fall into two main categories. The first aim is to help individuals anticipate high-risk situations and effectively cope with them, and may include interventions that enhance self-efficacy (e.g., by setting realistic behavioural goals), eliminate myths (e.g., by challenging misperceptions about the effects of smoking), and re-frame the meaning of events such as lapses. The second includes broader strategies to balance lifestyle, which may also serve to improve self-efficacy (e.g., by incorporating stress-reducing activities into daily routines). The results of recent relapse prevention intervention studies are presented below and include treatments aimed at populations, groups, and individuals.

POPULATION-BASED APPROACHES TO RELAPSE PREVENTION

Public health practitioners, advocates, and others have focused much energy on population approaches to public health issues including tobacco control. Initially, policies were successfully enacted to control and eliminate smoking in indoor public places. A link between such policies and relapse prevention has also been explored in a study that compared data from the American National Longitudinal Survey of Youth (1997-2009) to state-level scores for the strength of the smoke-free air laws (Shang, 2015). The study found the 100% smoke-free air law in bars significantly deters smoking relapse (Shang, 2015). More recently, in Ontario, attention has shifted to policies that restrict smoking in outdoor spaces including in parks and playgrounds, beaches, and on restaurant and bar patios. Chaiton et al. (2016), found that smokers who were exposed to smoking on patios were more likely to relapse after making a quit attempt than those who visited a patio but were not exposed to smoking (adjusted HR=2.40; 95% CI 1.07-5.40). This evidence indicates that instituting smoke-free laws in bars and restaurants and on patios may help smokers avoid relapse after quitting.

[2] Self-efficacy is concerned with people's beliefs in their ability to influence events that affect their lives. This core belief is the foundation of human motivation, performance, accomplishments, and emotional well-being. (Bandura, 1994) In this context, self-efficacy refers to the level of confidence in oneself to abstain from smoking.

There is additional evidence to support effects from other policies. Nonnemaker et al. (2011) completed a longitudinal population-based study and found the presence of other smokers in the home is associated with greater relapse to smoking. This result is likely due to the presence of greater cues to smoke and easier access to cigarettes, and supports the call for more smoke-free housing policies to aid smokers in maintaining their smoke-free status after quitting.

Other population-based approaches suggest a positive impact in preventing relapse including tobacco price increases (Liu, 2009), and the use of tobacco-control mass media campaigns (Biener, 2006). Wakefield et al. (2013) found greater exposure to mass media campaigns reduces the likelihood of relapse among recent quitters. Media messages in the period soon after quitting may serve to remind quitters of the health benefits of quitting, reinforce the value of having quit and help them resist urges to smoke (Nonnemaker, 2011). Media campaigns may also help to improve long-term abstinence rates by enhancing other population-based approaches such as policies aimed at increasing the number of smokers in the population trying to quit (e.g., smoke-free laws, tobacco tax increases, and pictorial health warnings or plain packaging of cigarettes) (Alday, 2010; Dunlop, 2011; Wakefield, 2011).

GROUP-BASED APPROACHES TO RELAPSE PREVENTION

The most commonly identified group based approach to relapse prevention comes from the area of alcohol addiction with twelve-step facilitation programs such as Alcoholics Anonymous (AA). AA is a self-help group, organized through an international organization of recovering alcoholics that offers emotional support and a model of abstinence for people recovering from alcohol dependence using a 12-step approach (Ferri, 2006). There are also other alternative interventions, some self-help and some professionally led, all of which are generally referred to as 12-step facilitation (TSF). The opportunity for members to give and receive advice, as well as meet others who have experienced similar problems is common across all of these groups. Members can expand their social circles with other like-minded, non-drinking individuals. Inclusive in the 12 steps is a belief in a higher power, like God, which helps in recovery.

Although widely studied over many years, there is much conflicting evidence of the effectiveness of TSF. A 2006 Cochrane review and additional studies have found no evidence of AA/TSF effectiveness compared with other treatments or no treatment at all (Group, 1998; Ferri, 2006; Mueller, 2007). In 2009, Kaskutas (Kaskutas, 2009) completed a focused review of the literature on AA effectiveness, recognizing that research on the effectiveness up to that time was controversial and subject to widely divergent interpretations. The most common debate centred around the quality of the evidence. Kaskutus organized her study according to six criteria required for establishing causation to judge the "totality of the evidence" to address this.

Results showed strong support for five out of six criteria: rates of abstinence are about twice as high among those who attend AA compared to those who do not (criterion 1-magnitude); higher levels of attendance are related to higher levels of abstinence (criterion 2-dose-response); these relationships are found for different samples and follow-up periods (criterion 3-consistency); prior AA attendance is predictive of subsequent abstinence (criterion 4, temporal); and mechanisms of action predicted by theories of behaviour change are evident at AA meetings and through the AA steps and fellowship (criterion 6, plausibility) (Kaskutas, 2009). These included psychological and spiritual mechanisms (e.g. changes in religious beliefs and spiritual experiences), social influences (e.g., enhanced friendship networks and having AA friends supportive of abstinence), and social learning and behavioural mechanisms (e.g., improved self-efficacy and effective coping and relapse prevention skills) (Kaskutas, 2009). There was not sufficient support for the final criterion of specificity. AA was found to be equally, or in some cases, less effective in promoting abstinence than other interventions in studies where patients were randomly assigned to a variety of treatment groups (Kaskutas, 2009).

Nicotine Anonymous (NA) is a free 12-step program for people who are nicotine dependent (Glasser, 2010). Similar to AA, NA includes a spiritual dimension, an approach in which some heavy smokers have shown particular interest (Gonzales, 2007). Although NA has been in existence since 1985, it has received far less attention that AA and there are a lack of publications to refute or support the program's role in relapse prevention (Glasser, 2010).

INDIVIDUAL-BASED APPROACHES TO RELAPSE PREVENTION

Individual-based cessation treatments are distinguishable across three dimensions: structure, pharmacotherapy, and behaviour content.

STRUCTURAL CONSIDERATIONS OF INTERVENTIONS FOR RELAPSE PREVENTION

Structural variables refer to different treatment delivery factors such as the number of sessions, the length of treatment, the counselling format, and the treatment provider. Although these variables may be particularly important in accounting for the variability that exists in relapse rates across different studies (Piasecki, 2001), structural variables are not commonly addressed in the existing literature. The results of one meta-analysis show a dose-response relationship between the abstinence rate and the amount of contact the smoker has with the treatment provider (which includes measures of level of contact, total amount of

contact time, or number of sessions). Abstinence rates increase with extended contact as well as with the number of treatment formats within a treatment (e.g., different types of counselling and psychoeducational interventions), but are not affected by the type of clinician or the counselling format (Piasecki, 2006). These results appear to support extended contact as an effective approach to decreasing relapse rates; however, there has not been consideration of the overall cost effectiveness (Piasecki, 2006).

INDIVIDUAL-BASED PHARMACOLOGICAL INTERVENTIONS FOR RELAPSE PREVENTION

Pharmacological approaches to smoking relapse prevention have centred on three treatments: Nicotine Replacement Therapy (NRT), varenicline and bupropion, with some inconsistent evidence around the effectiveness of these approaches across studies. Several meta-analysis and systematic review studies of pharmacotherapies show NRT, varenicline and bupropion are all more effective than placebos at promoting smoking abstinence over the short- and long-term (Eisenberg, 2008; Agboola, 2010; Mills, 2012).

A 2009 Cochrane Review showed mixed results for pharmacological interventions to prevent relapse. The length of abstinence prior to the start of pharmacotherapy and the type of pharmacological intervention appeared to influence their effectiveness. NRT was effective for relapse prevention in two large trials where participants were abstinent for only 24-48 hours prior to starting the pharmacotherapy treatment. However, in two smaller trials, when participants were abstinent for much longer prior to randomization, NRT did not prove effective for relapse prevention (Hajek, 2009). A follow-up review in 2013 supported these findings, suggesting that short-term abstainers have lower chances of relapse with oral NRT (Hajek, 2013). Both reviews found bupropion was not effective in reducing relapse rates; extended use of varenicline does show a positive role in preventing relapse (Hajek, 2009; Hajek, 2013).

Some have challenged the generalizability of these clinical trials to the community setting, citing contrasting results to cross-sectional population studies with observed ORs of 0.31 (Fiore, 1990) and 0.79 (Chapman, 2009). These studies show less relapse among those not using cessation medications. Still other representative population studies showed no beneficial effect of using NRT on long-term abstinence compared with unaided cessation (Walsh, 2008). Recent research includes a 2013 prospective cohort study (Alpert, 2013) designed to examine the population effectiveness of NRT either with or without professional counselling. Results showed that study participants (probability sample that included 787 adult smokers who had recently quit smoking) relapsed at equivalent rates whether or not they used NRT to quit. A 2014 retrospective study compared several pharmacological treatments and found NRT was more effective at promoting abstinence from smoking than varenicline and bupropion with relapse rates highest for those using bupropion (Ulcar, 2014).

Overall, the majority of evidence suggests improved cessation results with the use of some pharmacotherapies including NRT and varenicline. With NRT, this benefit appeared most often early in the quitting process. However, use of medications alone still results in rates of relapse greater than 50% (Collins, 2010). As a result, best-practice recommendations suggest combining medication with counselling to boost the effect (Fiore, 2008). Researchers have uncovered many determinants of relapse. For example, when the results of one study showed lack of determination and social pressure as the most common factors leading to relapse, the authors concluded that the ability of pharmacotherapy to prevent relapse is limited (Ulcar, 2014). The other area of significant research in relapse prevention comes from cognitive-behavioural interventions.

INDIVIDUAL-BASED PHARMACOLOGICAL INTERVENTIONS FOR RELAPSE PREVENTION

In the late 1970's, cognitive-behavioural approaches[3] were being developed as an extension of more traditional behaviour therapy programs to address a variety of clinical issues. These approaches incorporate coping skills enhancement, development of self-efficacy, harm reduction techniques, motivational approaches, and contingency management. Skills-based therapy, where patients learn to identify high-risk situations and then use cognitive behavioural strategies to cope, has been commonly studied. Fewer studies have looked at other psychological treatments which are often combined with a skills approach including imaginary cue exposure, writing tasks, aversive smoking, role-play, social support, and exercise.

A 2009 Cochrane systematic review which considered behavioural interventions found "insufficient evidence to support the use of any specific intervention for helping smokers who have successfully quit for a short time to avoid relapse" (Hajek, 2009). This finding applied to people who had quit on their own either with or without support and smokers who were randomly assigned to behavioural interventions before their quit date. Authors of the most recent Cochrane review reported similar findings showing no support for behavioural interventions to prevent relapse, either for people who quit on their own or with the help of treatment (Hajek, 2013). The authors identified that many trials conducted so far have not been of a strong enough design to detect possible small effects.

[3] Cognitive-behavioural approaches refers to a family of interventions that combine a variety of cognitive, behavioral, and emotion-focused techniques (Hofmann, 2012).

During this time, other studies were completed using alternative methods and reported results that are inconsistent with those from the Cochrane reviews. Song et al. (2010) recognized the psycho-educational interventions for smoking relapse prevention are complex and noticed the mechanisms underlying the interventions in the Cochrane review had not been examined. For a comprehensive understanding of these complex interventions, they conducted an exploratory meta-analysis to understand how the intervention causes change. Most of the included studies evaluated interventions for relapse prevention which employed a cognitive behavioural approach to coping skills training.[4] The effectiveness of coping skills training for relapse prevention depends on (1) the delivery and receipt of interventions, (2) the acquisition of coping skills by quitters and (3) the application of such skills in high-risk situations. Although the studies were identified as having a moderate to high risk of bias, the authors found coping skills training for smoking relapse prevention is effective for individuals who are highly motivated to stay abstinent. Coping skills training was most effective for those who had quit smoking for a minimum of one week rather than for those in the early days of smoking cessation. In addition, results showed that self-help materials might be as effective as, and more cost effective than, face-to-face counselling.

In the same year, Agboola et al. (2010) conducted a systematic review using the same search criteria as the Cochrane review and restricted inclusion to studies that delivered relapse prevention interventions to abstinent smokers only. They took this approach rather than including interventions delivered to abstinent and non-abstinent smokers to better align results with how relapse prevention interventions would be implemented in practice. They also examined interventions based on the mode of delivery and found self-help cognitive-behavioural therapy interventions increased long-term abstinence (pooled OR: 1.52, 95% CI: 1.15-2.01 based on three studies). Similar to the coping skills training discussed above, self-help education interventions were designed to teach skills to identify and respond to high-risk situations for returning to smoking. A randomized controlled trial by Maskrey et al. (2015) found conflicting results. Participants who received self-help booklets after receiving behavioural and pharmacological treatment did not develop any additional coping skills and were no more likely to remain abstinent by 12 months.

TELEPHONE AND WEB-BASED INTERVENTIONS

Additional delivery modes such as telephone, mobile, and web-based interventions have also been studied as approaches to sustain abstinence in those who have quit smoking. Individuals have been taught skills to cope with the temptations of smoking relapse using these modes of communication in addition to, or as an alternative to, more traditional treatment modes. Although there is insufficient evidence to support long-term effects of programs delivered solely by mobile phone, participants who received a combined internet and mobile phone program were more successful at abstaining from smoking for up to 12 months compared to a control group (RR 2.03, 95% CI 1.40 to 2.94) (Whittaker, 2016). Also, individuals who received follow-up telephone counselling in addition to face-to-face counselling showed improved rates of abstinence compared with those who received face-to-face counselling only (Wu, 2016). Less positive results emerged from a 2011 randomized controlled trial where ex-smokers received extended callback counselling at 1-month post-cessation (Segan, 2011). The telephone counselling intervention was designed to help patients proactively adapt to the future challenges of life as a non-smoker, but was unsuccessful at reducing rates of long-term relapse (Segan, 2011).

E-CIGARETTES (ECS)

The evidence published thus far on the efficacy and safety of e-cigarettes in reducing relapse to cigarette smoking is limited. A 2016 Cochrane review reported a lack of confidence in findings due to a small number of trials and wide confidence intervals (Hartmann-Boyce, 2016). Evidence was based on the pooled results from two trials (Bullen, 2013; Caponnetto, 2013), and showed that ECs with nicotine, compared with placebo ECs helped smokers to stop smoking over the long-term. One trial predicted ECs might lead to 6-month quit rates similar to those achieved with NRT. As this is a new field of study and EC products are evolving, more research is needed, particularly evidence of the effects of newer devices, which may have better nicotine delivery.

MINDFULNESS-BASED THERAPY

Mindfulness training, which is increasingly being used in the treatment of substance misuse, involves purposefully paying attention in the moment to experiences without passing judgement (Kabat-Zinn, 2003). Researchers have suggested several ways in which this enhanced cognitive awareness may modify risk mechanisms that underlie addictive behaviours, cravings and relapse. Although additional research is needed, results of a recent systematic review and meta-analysis show mindfulness treatments were effective in increasing rates of abstinence from cigarette smoking post-treatment compared to other treatments (Li, 2017).

[4] Coping skills training – participants learn to identify high-risk situations for smoking relapse (e.g. feeling stressed, going out with friends), and develop skills to cope with these situations.

IMPLICATIONS THROUGHOUT THE CESSATION PROCESS AND ACROSS DIFFERENT SUBPOPULATIONS

As researchers uncover evidence related to the distinct mechanisms associated with different milestones in the cessation process, appropriate treatment strategies can be offered at different times to encourage greater success in relapse prevention. For example, many demographic and contextual variables (e.g., smoking cues or stressors) appear to affect initial milestones in the cessation process such as obtaining abstinence and lapsing. During the early stages, specific counselling techniques such as cue avoidance and coping skills training have proven effective in helping individuals counter threats to abstinence (Fiore, 2008), such as exposure to smoking, life stress or low social support (Japuntich, 2011). These contextual variables appear to have less effect after an individual has lapsed when different mechanisms play a more significant role in the transition from lapse to relapse (Conklin, 2008; Japuntich, 2011). After a lapse, strategies such as increasing NRT to counter the nicotine dependence reaction may be the most successful approach to prevent relapse (Baker, 2006). Nicotine dependence also plays a significant role in the initial abstinence period, another time when increased NRT may be an effective treatment strategy (McCarthy, 2006; Japuntich, 2011).

There is also a growing body of research to uncover interventions that match the needs of specific smoker sub-populations such as pregnant and postpartum women, individuals with psychological disorders and patients with cardiovascular disease. For example, interventions for pregnant and postpartum patients have often integrated education with relapse-based psychotherapy, pharmacotherapy, and other approaches. Although many studies to date have focused on initial smoking cessation and short-term abstinence rates, a meta-analysis of 15 studies involving pregnant women showed self-help interventions doubled the odds of maintaining abstinence and preventing relapse compared with standard care (Naughton, 2008).

DISCUSSION

We know that smoking cessation is a dynamic process and most smokers will make numerous attempts before successfully remaining abstinent over the long-term. Irrespective of the strategies used to quit smoking, relapse prevention approaches place an emphasis on the post-treatment maintenance of the behaviour change. Because individuals are ever changing, as are their circumstances and environments, there is no "one size fits all" approach to relapse prevention. Different types of treatments and modes of delivery have been developed to address this challenge. For instance, research has started to examine the role of technology-based interventions for relapse prevention. Because both mobile phones and the internet have become a regular part of daily life in many populations, it makes sense to use these means of communication in the design of interventions to treat relapse. They have advantages over more traditional treatment modes because they are cost-effective and can be delivered anywhere, anytime, confidentially, and directly to the individual with minimal contact (Whittaker, 2016; Gulliver, 2015). This "24/7" availability allows access at key times when individuals may face increased risk of relapse or high motivation to change (Tait, 2012). In addition, automation ensures treatment is delivered consistently and as intended, and these interventions have the potential to be scaled up cost effectively (Munoz, 2012). These characteristics may be appreciated by some groups who feel judged for their smoking behaviour or otherwise prefer more anonymous interactions such as young people, pregnant/postpartum individuals, or patients facing various physical or mental health challenges. Further research in the area of emerging technologies such as these, as well as new products (e.g., e-cigarettes) and mindfulness training, are required to determine their potential impact on preventing relapse.

Based on the results of this review, some additional gaps in the evidence were identified. For example, there is a need for greater consistency in how critical events (i.e., abstinence, lapse, and relapse) are defined and measured. Further, research that focuses on the implementation of interventions will explain how intervention delivery factors affect outcomes. More longitudinal studies are also required for a better understanding of the quit trajectory including relapse, and what interventions (or combination of interventions) work at what time point, for whom, in what contexts, how, and why. Studies might focus on certain populations that experience high rates of relapse, such as women (McKee, 2003), younger people (Mhamdi, 2013; Nakamura, 2014; Caraballo, 2014), and individuals with depressive symptoms (Gokbayrak, 2015; Cooper, 2016).

This review shows some benefit for interventions at all levels independently (i.e., the population level, group approaches, and individual-level approaches); however, there may be an added benefit when individuals are simultaneously exposed to interventions at multiple levels of influence. For example, individuals who are learning coping skills to effectively navigate high-risk situations for relapse will further benefit from policies that reduce their overall exposure to smoking cues on a daily basis. The information provided in this review, as well as that which will come from further study, can be used to inform the development of integrated smoking cessation systems such as the Ontario government's Cessation Action Plan. This evidence highlights the need to ensure relapse prevention supports are incorporated as a distinct focus and that health providers are educated about how to effectively guide smokers to quit, and stay quit.

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