



Preventing Smoking Progression in Young Adults: the Concept of Prevescalation

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Abstract

As adolescents cross the threshold to young adulthood, they encounter more opportunities to engage in or accelerate previously discouraged or prohibited behaviors. Young adults, therefore, are more apt to initiate cigarette smoking and, more importantly, to accelerate their use if they tried and experimented as an adolescent. Preventing the escalation and entrenchment of smoking in the young adult years is critically important to reducing tobacco's long-term health toll. However, traditional interventions for youth have focused on preventing smoking initiation, and interventions for adults have focused on smoking cessation; both have failed to address the needs of young adults. We introduce the concept of "prevescalation" to capture the need and opportunity to prevent the escalation of risk behaviors that typically occur during young adulthood, with a focus on the example of cigarette smoking. Prevescalation negates the notion that prevention has failed if tobacco experimentation occurs during adolescence and focuses on understanding and interrupting transitions between experimentation with tobacco products and established tobacco use that largely occur during young adulthood. However, since risk behaviors often co-occur in young people, the core concept of prevescalation may apply to other behaviors that co-occur and become harder to change in later adulthood. We present a new framework for conceptualizing, developing, and evaluating interventions that better fit the unique behavioral, psychosocial, and socio-environmental characteristics of the young adult years. We discuss the need to target this transitional phase, what we know about behavioral pathways and predictors of cigarette smoking, potential intervention considerations, and research challenges.

Keywords Young adult · Smoking progression · Prevention

Young adulthood is a distinct and important developmental period, typically spanning ages 18–29 (Arnett 2000, 2001), as young adults are different biologically and psychosocially from both adolescents and older adults (Bonnie et al. 2014).

These differences affect their decision making, health, and behavior. The young adult years are also a period of heightened vulnerability to escalation and persistence of substance use as well as psychological distress and associated changes in social and environmental factors involved in the transition from living at home and school attendance to living independently (Bonnie et al. 2014).

Young adult rates of cigarette use and trajectories show clear cohort and period/historical trends (Johnston et al. 2014), making it important to understand bio-behavioral and contextual influences on young adult cigarette use. Recent years have seen a more rapidly changing landscape and profile of young adults than have been seen previously (Bonnie et al. 2014). The gap in knowledge about the critical transition to young adulthood has been identified as a missing link between interventions focused on early primary prevention of smoking and later adult smoking cessation treatment (Rath et al. 2012). Thus, the young adult years are an important transitional period for protecting health, with downstream consequences for the remainder of the life course (Bonnie et al. 2014).

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This paper presents a new framework for conceptualizing, developing, and evaluating interventions that better fit the unique behavioral, psychosocial, and socio-environmental characteristics of the young adult years. We introduce the concept of “prevescalation” (pronounced “pri-ves-kuh-ley-shuhn”) to capture the need and opportunity to prevent the escalation of risk behaviors that typically occur during young adulthood, with a focus on the example of cigarette smoking. However, since risky behaviors often travel together because of shared vulnerability (Vanyukov et al. 2012), the core concept of prevescalation may apply to other risky behaviors that support one another and become entrenched and harder to change in later adulthood. We discuss the need to target this transitional phase, what we know about behavioral pathways and predictors of cigarette smoking, and potential intervention considerations and research challenges.

Young Adults and Tobacco Use

Young adults are a particularly vulnerable population for tobacco and nicotine use, as they are a prime target for marketing and advertising by tobacco companies. The young adult years are also the period of greatest escalation and entrenchment of smoking (Hammond 2005; Thompson et al. 2017), and significant initiation of cigarette and other combustible tobacco use still occur after age 18 (Foldes et al. 2010; Hammond 2005; Richardson et al. 2014; U.S. Department of Health and Human Services 2012).

Studies of smoking trajectories from adolescence into young adulthood show that smoking progression occurs from adolescence through young adulthood, with persistent smoking patterns being established around age 25 (Brook et al. 2008; Chassin et al. 2000; Costello et al. 2008). Age of smoking onset and rapidity of progression differ, however, by trajectory. In Chassin et al. (2000) study on the natural history of smoking conducted from 1980 to 1993, early progressors escalated their smoking behavior through early and middle adolescence, establishing a high level of smoking by age 18–19 and smoking at this level into their thirties. Late progressors in this model experimented with smoking in late adolescence, experience a jump to weekly smoking at age 18, and achieve their maximum, stable pattern of smoking at age 24. Individuals on these smoking trajectories comprised 28% of the sample (12% early, 16% late) compared to 60% who remained non-smokers over time, 6% who experimented with smoking in adolescence and reported no smoking after age 20, and 5% whose smoking progressed rapidly from middle to late adolescence, peaked around age 20–21, then declined to zero after age 25. Consistent with evidence on the increase in light or intermittent smoking among young adults (Pierce et al. 2009) and smoking initiation after age 18 (Foldes et al. 2010;

Thompson et al. 2017), stable, lower-level smoking was added as a distinct trajectory in two 2008 studies (Brook et al. 2008; Costello et al. 2008). In a study from 1975 to 2002 of participants aged 14–32 years, Brook et al. found that “occasional smokers” escalated their smoking between ages 16 and 22, maintaining a pattern of non-daily smoking through their thirties (approximately 10% of the sample). Costello et al. found a pattern of “stable light” smoking (7% of the sample) from age 13 through age 25 using a national, probability-based sample collected from 1994 through 2002.

Following the 1998 Master Settlement Agreement which placed greater restrictions on marketing tobacco products to youth, young adults became a focus of industry marketing efforts (Biener and Albers 2004). Recent tobacco company marketing efforts signal that young adults remain a key target audience for their products (Mickle and Valentino-DeVries 2016). National data highlight significant reductions in cigarette smoking among adolescents (Warner 2015) and show that from 2006 to 2013, the onset of smoking is now greater among young adults than adolescents (Thompson et al. 2017). Our studies in a cohort of young adults, conducted following the 1998 Master Settlement Agreement and the 2009 Family Smoking Prevention and Tobacco Control Act which granted FDA regulatory authority over tobacco products, provide new insights into smoking behavior in today’s young people. These studies report rapid escalation of smoking behavior in a subset of youth after age 18, the presence of multiple lower-level smoking trajectories, and the lack of a “quitter” group in emerging adults (Hair et al. 2017; Johnson et al. 2018). Cross-sectional studies also highlight that exclusive cigarette use is no longer the typical pattern of tobacco and nicotine use in young people given the high prevalence of multiple tobacco and nicotine product use (i.e., poly-product use) in contemporary adolescents and young adults (Collins et al. 2017; Fix et al. 2014; Rath et al. 2012; Richardson et al. 2014; Villanti et al. 2016).

Prevescalation as a Research Gap and an Intervention Opportunity

Understanding and preventing or reversing the escalation and entrenchment of cigarette smoking in the young adult years is critically important to reducing smoking’s long-term health toll (Doll et al. 2004, 2005; Jha et al. 2013; Pirie et al. 2013; U.S. Department of Health and Human Services 2014). However, current tobacco control efforts may be missing the mark when one considers the complexity of patterns of young adult tobacco use, including the phenomenon of initiation starting after age 18. As Rath et al. (2012) have noted, young adults are the “missing link” between youth prevention and adult cessation. Traditionally, interventions for youth have focused on preventing smoking initiation, and interventions

for adults have focused on smoking cessation. In addition, young adults frequently do not self-identify as “smokers,” and thus may not tune-in to cessation messages or believe that evidence-based cessation programs fit them (Y. Choi et al. 2011; Guillory et al. 2016; Staten and Ridner 2007). As a result, young adults have not been the target of prevention, and there have been limited efforts targeting them for cessation. Finally, tobacco control efforts to date have focused almost exclusively on cigarettes, failing to consider the complexities of use of alternative nicotine or multiple tobacco products with different harm profiles (e.g., combusted products—hookah, little cigars/cigarillos, and non-combusted smokeless tobacco products and e-cigarettes that may or may not contain nicotine), the differences in context and motives for use, and transitions between tobacco and nicotine products—all of which are likely to affect probabilities of escalation or discontinuation (Cobb et al. 2015; Collins et al. 2017; Kozlowski and Warner 2017; Villanti et al. 2016).

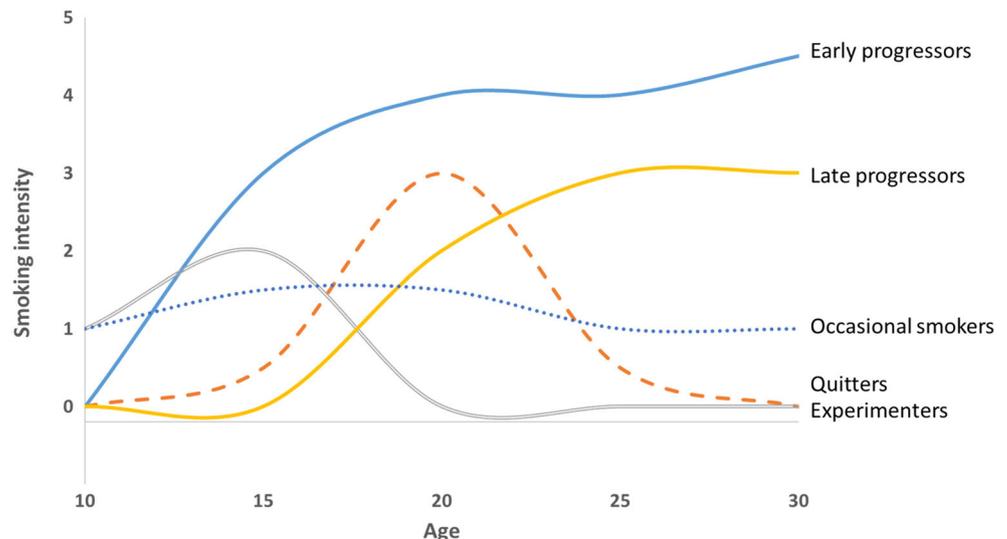
Young adulthood is a developmental period that is likely to present discontinuities or turning points in personal trajectories including the trajectory of smoking and other nicotine or tobacco product use (see Fig. 1). We propose the concept of prevescalation (preventing escalation) as the missing link between youth prevention and adult cessation, a key developmental period in which interventions can target turning points in the personal trajectories that lead to entrenched smoking behavior (Niaura 2018). Prevescalation negates the notion that prevention has failed if tobacco or nicotine experimentation occurs during adolescence and focuses instead on understanding and interrupting transitions between experimentation with tobacco products and established cigarette smoking that largely occur during young adulthood. Prevescalation proposes that we think differently about this unique developmental period and devise more precise research questions and also new evidence-based interventions that may gain traction in

subpopulations who are on a pathway of escalating their smoking. This concept focuses on understanding and interrupting transitions between experimentation with tobacco products and established smoking behavior that largely occur during young adulthood. On the one hand, as shown in Fig. 2, prevention efforts typically target a single time point to prevent any use or any experimentation, whereas cessation treatments target adults who have maintained daily cigarette smoking for many years and have great difficulty quitting. Prevescalation efforts, on the other hand, offer a novel way to think about interventions across the wide range of patterns of use during experimentation and during the many variations of progression along the pathway to a possible lifetime of cigarette smoking that will prematurely kill about one in every two smokers that fails to stop (U.S. Department of Health and Human Services 2014).

Principles for Prevescalation Interventions

Designing prevescalation interventions requires a clear understanding of the target population; an understanding of the environmental, biological, psychosocial, and behavioral pathways leading to escalation; an identification of potential leverage points or factors on which to intervene; strategies for delivering and scaling an intervention to broad population bases; and a plan for evaluation that captures changes in a longitudinal, unfolding behavioral pattern. Prevescalation interventions may contain elements of both prevention interventions, in which universal population-based approaches are used (that is, interventions that target all youth in schools or mass media approaches), as well as more targeted strategies from cessation interventions, such as those that help smokers address some of the benefits of nicotine (e.g., mood management). For

Fig. 1 Smoking trajectories from adolescence through adulthood. Adapted from Chassin et al. (2000), Brook et al. (2008), and Costello et al. (2008)



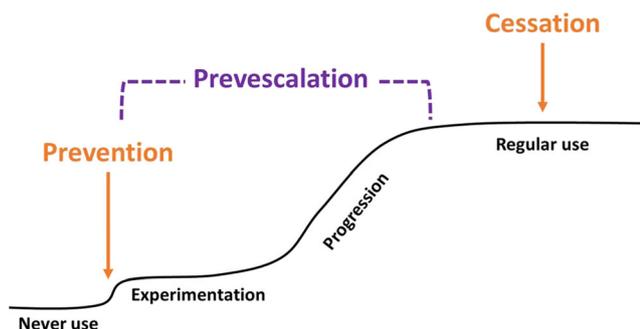


Fig. 2 Targets for intervention across the trajectory of tobacco use

example, traditional tobacco prevention interventions have focused on limiting youth access to tobacco products and exposure to marketing, increasing the price of tobacco products, and denormalizing smoking via environmental restrictions and interventions related to parents and peers (U.S. Department of Health and Human Services 2014). Prevescalation interventions may also leverage these successful strategies for young adults. More recent strategies have focused on young adults, attempting to raise the minimum age of tobacco sales to 21 (Kwan et al. 2015). A tobacco prevescalation intervention may be iterative or adaptive to meet changing social influences on tobacco use from adolescence through young adulthood. It may approach multiple problem behaviors (e.g., diet, alcohol use) to reduce tobacco use, as has been successful in young adult smoking cessation interventions (An et al. 2013). One of the more defining features of prevescalation interventions, though, is the need to develop approaches that have durable effects, given that the period of risk for escalation extends over several years.

Target Population

Prevescalation interventions target a broad range of individuals, including those who may be considered “susceptible” to cigarette use, those who have tried or “experimented,” and those who have moved beyond initial trials, but smoke infrequently or at very low levels. Approximately 35% of the total young adult population may fall into this range when one considers the full range of tobacco and nicotine products (Kasza et al. 2017; Richardson et al. 2014). The FDA’s *The Real Cost* campaign, a national media campaign trying to persuade youth to reassess the costs of tobacco use, similarly targets both susceptible never users and experimenters (Duke et al. 2015). However, *The Real Cost* campaign is geared towards adolescents aged 12–17 in the USA, and not to young adults. Thus, although some of its concepts and strategies could likely translate into messages for young adults, the execution, channels, and alternative messages may need to be better tailored to young adults.

Predictors of Escalation and Potential Leverage Points

Various predictors of smoking progression provide an opportunity to innovate and rethink interventions for young adults and how these predictors may provide intervention targets. A number of studies have examined individual psychosocial factors associated with smoking progression, or escalation. These studies identify key predictors of smoking progression in young adulthood: (a) early experience of symptoms of dependence, even at the very lowest levels of smoking (e.g., less than 25 lifetime cigarettes) (Dierker and Mermelstein 2010); (b) concurrent use of other substances, notably marijuana; (c) smoking identity (Hertel and Mermelstein 2012); (d) mood responses to smoking in-the-moment (Hedeker et al. 2009; Weinstein et al. 2008; Weinstein and Mermelstein 2013a, b); (e) expectancies about mood benefits of smoking (Colvin and Mermelstein 2010; Heinz et al. 2010; Wahl et al. 2005); and (f) social influences (Choi et al. 2003, 1997). Studies suggest that young adults use smoking to relieve anhedonia (i.e., diminished pleasure), stress, and boredom (Colvin and Mermelstein 2010; Heinz et al. 2010; Wahl et al. 2005). Smoking immediately increases positive affect and improves negative mood (Hedeker et al. 2009) and adolescents who regulate mood by smoking experience rapid increases in smoking behavior (Weinstein and Mermelstein 2013a, b). The product itself may also influence smoking progression. Studies documenting the differential impact of menthol cigarettes (vs. non-menthol cigarettes) on subsequent smoking outcomes among youth and young adults highlight the role of menthol cigarettes in facilitating increased smoking and progression to regular smoking in youth and young adults (Delnevo et al. 2016; Nonnemaker et al. 2013).

Strategies for Delivering and Scaling an Intervention

These predictors provide ample targets for intervention. Some key strategies for prevescalation interventions may include decreasing psychological triggers to smoking and escalation (e.g., reducing negative moods, including boredom and anhedonia); changing self-perceptions or reinforcing self-perceptions that are incompatible with smoking; facilitating decisional, self-control in the moment; and changing social feedback and norms to discourage all forms of tobacco or nicotine product use. Under-explored, but potentially useful strategies are self-affirmation interventions. Self-affirmation interventions encourage individuals to reflect on values that are personally relevant to them, and reaffirm core values that will help to buffer individuals from stressors that might lead to unhealthy behaviors (Cohen and Sherman 2014). Self-affirmation interventions may also have surprisingly long-lag effects (Miller et al. 2017).

Most individuals and young adults do not plan or want to be a “smoker” or “tobacco user,” yet a sizable proportion end

up trying and using tobacco or nicotine products to varying degrees. Experimenters or intermittent, low-level users often do not consider themselves to be cigarette smokers, and certainly do not envision sustained use. With prevescalation interventions, the goal is to interrupt or to stop or reverse the chain of events that unfold over time to lead someone up the path to persistent use. Developing interventions that help reduce inattention to potentially problematic behavior or that help to heighten self-monitoring or social monitoring of tobacco use behaviors may further help to disrupt escalating trajectories. Prevescalation interventions can help to remind individuals of an aspect of their identity that is consistent with their aspirational self-image (e.g., healthy, appearance conscious, ambitious). External reinforcers, either through frequent, personalized messages (e.g., text messaging, social media messages) or through social feedback cycles, can be employed to remind people of their own goals and values, and facilitate self-control. Commitment devices, which include formal or self-imposed penalties or rewards to achieve one's goals (Bryan et al. 2010), can further help propel intentions to resist tobacco use into more controlled behavior. Commitment devices can include brief self-affirmation interventions which provide individuals with the opportunity to think about values that are personally relevant to them, with the notion that this reflective process will buffer them from stress that might lead to unhealthy behaviors (Cohen and Sherman 2014). Other potential strategies include exploring micro-incentives, which could take a variety of forms (e.g., social, personal rewards, small tokens, or “credits”), for not using tobacco or for not engaging in associated problem behaviors. Micro-incentives could be delivered through social media platforms, texting, or phone apps, all of which are commonly used among young adults.

Prevescalation interventions also need to be delivered through channels that have broad reach. They need to be responsive to contextual influences on tobacco use, including social triggers and mood. Technological advances that allow for in-the-moment interventions triggered by location or mood monitoring may be of use in averting tobacco use episodes and reinforcing positive behavior. Easily scalable mobile health and social media technologies may be particularly well suited for the delivery of prevescalation interventions for young adults. As outlined in the Capability-Opportunity-Motivation-Behavior (COM-B) model (Michie et al. 2011), there are reciprocal influencing processes that drive behavior change: Education, Persuasion, Incentivization, Coercion, Training, Restriction, Environmental restructuring, Modeling, and Enablement. This model suggests matching change components (i.e., persuasion and modeling) to the contexts in which they can be delivered (e.g., social media platforms). The COM-B model is compatible with recent software design models that emphasize social influence processes (Fogg 2009), and behavior change support systems (BCSS)

(Oinas-Kukkonen and Harjumaa 2009). A prevescalation intervention that acknowledges strong social influences on tobacco use, therefore, may be delivered via social media and incorporate the following design principles: (1) social learning and facilitation, (2) competition (self-regulation via comparison of their performance with peers and behavioral adjustment), (3) cooperation (motivation to adopt a target behavior by leveraging the desire to be like their peers), and (4) recognition (motivation to change behavior in order to receive personal and public recognition for their efforts and accomplishments) (Oduor et al. 2014).

Evaluating Prevescalation Interventions

A key point for evaluation is the need to go beyond point-prevalence measures and to consider longer behavioral chains or trajectories. Evaluation of prevescalation efforts requires more detailed assessment of any tobacco or nicotine product use and smoking progression, and cannot rely solely on the dichotomous outcomes (yes, no) typically used to examine the impact of prevention and cessation efforts. Progression may be defined, for example, by changes in use patterns (i.e., frequency and amount used, variability in use) assessed at multiple time points. It may also be characterized by changes in use states (e.g., never use, ever use, current use, former use) as measured via the Lifetime Inventory of Smoking Trajectories tool (Colby et al. 2012) or via frequency and quantity of various types of products used (e.g., combustible products, non-combustible products, multiple products, nicotine-containing products). These measures may require assessment of complex poly-use patterns, multiple tobacco/nicotine use states with variation in sojourn times, and how to understand transitions in product use that stabilize after a few years (Cobb et al. 2015). Since the concept of prevescalation explicitly identifies changing an individual's smoking pattern as its target, the key outcome of a prevescalation intervention is within-subject change. This framework fits with contemporary use patterns in young adults which range from daily, heavy use to non-daily, light use. It also allows prevescalation efforts to engage a broader range of young users—not just never users or any past 30-day users, or more established most days, every day, or more than daily users—in interventions (Kozlowski and Giovino 2014; Saddleson et al. 2016; Villanti et al. 2016; Warner 2015). An important assessment challenge is the need to rely on self-reports, given that there are no objective measures that can capture the patterning of use of multiple tobacco- and nicotine-containing products that is often sporadic and highly variable. Having sensitive and reliable approaches that encourage accurate self-reporting about tobacco use is critical to appropriately evaluating interventions. Ecological Momentary Assessment devices can be programmed to more precisely and efficiently capture poly-product use patterns in

near real time as well as simultaneously evaluate the social and contextual factors driving use (Kirchner et al. 2013; Setodji et al. 2013; Thrul et al. 2014).

Researchers may also need to consider broader approaches to a traditional randomized controlled trial design, and may want to consider alternative approaches such as factorial experiments to better screen and identify promising treatment components (e.g., multiphase optimization strategy (MOST)), as well as designs that incorporate more individualized sequential multiple assignment randomized trial (SMART) designs (Collins et al. 2007, 2009). A MOST-based treatment development strategy, in which a set of theoretically or empirically supported intervention components are first screened, within a factorial design, is an especially efficient approach for identifying specific intervention components that are effective in preventing escalation. This approach also allows for tests of main and interactive effects among multiple intervention components, which is likely to lead to a more principled and effective multi-component, integrated intervention for prevescalation.

Conclusion

As adolescents cross the threshold to young adulthood, they encounter more opportunities to engage in or accelerate previously discouraged or prohibited behaviors. Young adults, therefore, are more apt to initiate cigarette smoking and, more importantly, to accelerate their use if they tried and experimented as an adolescent. This period of transition has been surprisingly neglected as an opportunity to prevent the progression of smoking and possibly other risky behaviors. Prevescalation provides a novel conceptual and practical focus for research and a target for intervention in young adults with the promise of a huge payoff averting the deleterious health effects caused by overwhelmingly by cigarette smoking (U.S. Department of Health and Human Services 2014).

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Compliance with Ethical Standards

Conflicts of Interest The authors declare that they have no conflict of interest.

Ethical Approval For this type of study, formal consent is not required.

Informed Consent For this type of study, formal consent is not required.

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