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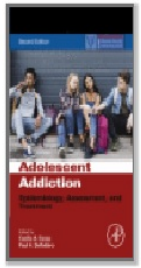

Chapter 5 - Nicotine and e-cigarettes addiction

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CHAPTER

5

Nicotine and e-cigarettes addiction

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5.1 Introduction and prevalence

Tobacco use continues to be the single most significant avoidable cause of death globally and claims more than 8 million lives annually. Smoking is now highly prevalent throughout the developing world, with most tobacco-related deaths occurring in low and middle-income countries, which are the targets of intensive tobacco industry interference and marketing (World Health Organization [WHO], 2019, Tobacco, para. 1). Smoking can be deadly for smokers as well as for nonsmokers. In addition to the direct effect of tobacco on users, second-hand tobacco smoke contributes to an additional 1.2 million deaths annually due to heart disease, cancer, and other diseases (WHO, 2019, Tobacco, para. 2). For most smokers, quitting smoking is the most important thing they can do to improve their health. Smoking cessation has been associated with significant health benefits, including reducing the risk of developing lung cancer, heart disease, and stroke. However, despite a high number of smokers wanting to quit, many find it challenging to do so. Few smokers are successful in quitting at their first attempt, and frequent relapses are common (Strong et al., 2011).

Not all smoking involves cigarettes. In the United States, an estimated 12.3 million people aged 12 or older have been estimated to be cigarette smokers, which translates to around 1 in 5 people aged 12 or older. An estimated 8.8 million people aged 12 or older are current smokeless tobacco users.

Concerning conventional cigarette smoking, these estimates suggested that 3.4% of adolescents aged 12–17 years of age are monthly smokers, while an estimated 1.4% of adolescents report having used smokeless tobacco in the past month (U.S. Department of Health and Human Services, 2017). Although cigarette smoking in the United States has declined in the past two decades, this decline does not appear to reflect increased smoking cessation, but instead appears to be related to a substitution effect with an increasing number of young people reporting using electronic vaporizing devices such as electronic cigarettes (e-cigarettes) (U.S. Department of Health and Human Services, 2017). Gentzke et al. (2019) found a considerable increase in the use of e-cigarettes during the year 2017–18, with an increase of 77.8% among high school students and 48.5% among middle school students. By contrast, in countries such as China, about 45% of middle school children had heard of e-cigarettes, but only 1.2% reported using e-cigarettes in the past month (Xiao, Parascandola, Wang, & Jiang, 2018).

Meanwhile, in Korea, dual users of both conventional cigarettes and e-cigarettes were higher than e-cigarettes only users. Among middle and high school students, 5.1% of males and 1.2% of females use both conventional cigarettes and e-cigarettes compared to 1.2% of males and 0.3% of females who use e-cigarettes on their own (Oh et al., 2019).

The research appears to show a lack of scientific evidence about the value of e-cigarettes as a smoking cessation tool. Instead, there is more evidence of its potential to attract tobacco-naïve youth on nicotine as well as acting as a bridge to combustible tobacco use (Kalkhoran & Glantz, 2016). Adkison et al. (2013) reported that although 85% of e-cigarette users claimed they were using the product to quit smoking at the initial wave, e-cigarette users were no more likely to have quit 1 year later than nonusers were. Another review found no significant effects on the efficacy and short term effects of e-cigarettes as a method for smoking cessation (Khoudigian et al., 2016) while e-cigarette use was significantly associated with a higher risk for subsequent cigarette smoking initiation and past 30-day cigarette smoking among 17,389 adolescents and young adults (Soneji et al., 2017).

5.2 Tobacco use disorder

According to the Diagnostic Statistical Manual Fifth Edition (DSM-5) of the American Psychiatric Association (2013), nicotine dependence is now referred to as tobacco use disorder. To be diagnosed with tobacco use disorder, a person must meet a minimum of 2 out of 11 criteria within 1 year. These include:

(1) higher intake of tobacco or use over an extended period of time than intended;
(2) persistent desire or unsuccessful attempts to cut down or control the use of tobacco;

(3) spending a lot of time to obtain or use tobacco;
(4) strong craving or desire or urge to use tobacco;
(5) recurrent use of tobacco resulting in failure in fulfilling responsibilities at work, school, or home;
(6) continued use of tobacco despite having persistent or recurrent social or interpersonal problems caused or exacerbated by the effects of tobacco (e.g., having conflicts with others about tobacco use);
(7) giving up or reducing important social, occupational, or recreational activities due to tobacco use;
(8) recurrent tobacco use in situations that are physically hazardous;
(9) continued tobacco use despite knowledge of having a persistent or recurrent physical or psychological problem that is likely to have been caused or exacerbated by tobacco;
(10) tolerance;
(11) withdrawal.

5.3 Screening and clinical assessment methods

Assessing the factors to help smokers quit may help clinicians to formulate an initial treatment plan. It informs clinicians on how to assess smokers' characteristics and how to use the assessment's results to inform treatment. Clinicians need to note that each smoker will have different concerns, motivation, and experience regarding quitting smoking, as well as different ability to sustain abstinence, which means that the same treatments will not work with every smoker. By using triage assessments, clinicians will be able to identify unique biopsychosocial, spiritual, and cultural factors that contribute toward the smoker's motivation, initial cessation, and relapse prevention, and use the knowledge of these individual differences to tailor a treatment that best meets the needs of the individual (Niaura & Shadel, 2003). Triage assessments are brief screening tools that allow for informed decisions about the best course of treatment for smokers. Five measures of clinical areas during smoker triage are motivation, nicotine dependence, past quit attempts and smoking history, substance abuse comorbidity, and psychiatric comorbidity.

5.3.1 Measuring motivation to quit

The Readiness to Quit Ladder has shown to be an excellent objective measure in measuring readiness to quit smoking and with actual quit attempts. It has 10 response options that assess motivation along the continuum, from not considering quitting smoking at all shortly to having already quit smoking. Another popular tool to measure

one's readiness to change is the University of Rhode Island Change Assessment (URICA) (McConnaughty, Prochaska, & Velicer, 1983). It has four scales, precontemplation, contemplation, action, and maintenance to change.

5.3.2 Measuring tobacco dependence

Two questions from the Heaviness of Smoking Index (HSI) are used as an assessment of smokers' current nicotine dependency level (Heatherton, Kozlowski, Frecker, Rickert, & Robinson, 1989). One item assesses time to the first-morning cigarette, and the other asks for the individual's daily smoking rate. Another widely used questionnaire to assess tobacco dependence level is the Fagerstrom Test for Nicotine Dependence (Heatherton, Kozlowski, Frecker, & Fagerstrom, 1991). This questionnaire has six items with a possible score range of 1–10.

5.3.3 Past quit attempts and smoking history

The length of the most extended past quit attempt, and the length of the most recent quit attempt are the strongest determinants of a smoker's success in quitting smoking. Four simple questions can be asked (Niaura & Shadel, 2003):

(a) How many times in the past have you made a serious attempt to quit smoking?
(b) What was the longest period of time that you were able to quit smoking?
(c) When was your most recent serious attempt to quit smoking?
(d) How long were you able to stay quit during your most recent quit attempt?

5.3.4 Other substance use and comorbid psychiatric disorder

Drug and alcohol use, misuse, and abuse have been associated with the difficulty of giving up smoking. It is thus essential to ask about past use and treatment, and present use of alcohol, overuse of prescription medications, and/or illegal drugs. Some studies have reported a significant relationship between depression and smoking. For example, in one study of adolescents in the United States aged 12–17 in 2016, 0.9% of those with a past year major depression episode were daily cigarette smokers in the past month compared with 0.4% of those without a past year major depression episode (U.S. Department of Health and Human Services, 2017). Accordingly, it has been suggested that treatment protocols should include a brief assessment for assessing mood disorder, which involves

asking about the current or past history of treatment for mood disorders and psychiatric treatment. Niaura and Shadel (2003) outlined an example of this type of measure and suggested the following simple questions with yes or no answer choices:

(a) Have you ever received treatment for a mental health problem?
(b) Has there been a time in your life when you were down or depressed most of the day, nearly every day for a period of 2 weeks?

The Brief Screener for Tobacco, Alcohol, and Other Drugs (BSTAD), developed by the National Institute on Alcohol Abuse and Alcoholism, is a brief screening test to triage pediatric patients rapidly. It is a valid, reliable, and promising screening tool for identifying problematic tobacco, alcohol, and marijuana use in pediatric settings in the past year. Designed for use with 12–14-year-old adolescents, this tool starts by asking questions about friends' use, followed by personal use questions. The order is reversed for adolescents ages 15–17 (and 14-year olds who were in high school). Participants who answer yes to personal use in any domain (tobacco, alcohol, and drugs) are asked additional questions to gauge the frequency of use during the past 30, 90, and 365 days. The BSTAD could be administered via interviewer-administration or self-administration using an iPad, the latter of which was well received by participants. The BSTAD serves as a quick and straightforward method to triage patients into low-risk and high-risk groups. Additionally, it is very efficient to be used in a busy clinic and yields more accurate and reliable responses from adolescents compared with administration by an interviewer for sensitive issues (Kelly et al., 2014).

5.4 Epidemiology

The National Youth Tobacco Survey in the United States documents a rapid increase in the use of e-cigarettes in young people—3.8 million in 2018, which constituted an increase of 1.5 million compared to 2017. Several factors are identified to explain why these new activities are popular or adopted (Tsai et al., 2018). These include the presence of a family member who is an e-cigarette user, the availability of multiple flavors, which increased the attraction for its use, or the belief that e-cigarettes are harmless. Another factor is technical innovation. For example, the invention of a new e-cigarette device called JUUL with nicotine content as high as a pack of 20 cigarettes has raised concerns. In a short time, it has become the most popular device in the e-cigarette market, and this has been driven by the small, USB-shape appearance that makes it unidentifiable and easy for young people to use discreetly. According to Willett et al. (2019), 25% of 1012 respondents in an online

survey of 15–24-year olds identified photos of the JUUL device that contained a nicotine compound.

Tobacco use appears to peak in early and middle adolescence among middle and high school students (Marshall et al., 2006; Villanti, Boulay, & Juon, 2011). Such elevated rates of tobacco (nicotine) use in adolescence have long-lasting consequences and can affect young people's health and well-being as well as their longer-term functioning as adults (Ryzin, Fosco, & Dishion, 2012). Tobacco (nicotine) use during adolescence (i.e., under 17 years) is a strong predictor of future dependence and addiction (Brook, Brook, Zhang, Cohen, & Whiteman, 2002).

According to the World Health Organization (2013), within the South-East Asian region, the prevalence of current smoking in young male adolescents (13–15-year olds) was higher in Malaysia (35%) and Indonesia (41%) than that of the neighboring countries (i.e., Philippines 28%, Thailand 24%, and Myanmar 23%). In Malaysia, 5 million adolescents below 18 years are estimated to smoke tobacco (nicotine). In 2015, research indicated that 1 in 10 adolescents in Malaysia were at risk of becoming smokers, while 33.2% of schoolboys were current smokers (Hum, Hsien, & Nantha, 2016). Dahlui et al. (2015) further stated that smoking is common among men, but the prevalence is increasing, especially among young women; 4% of the girls smoked; compared to 13% of boys and almost a third of current smokers were girls. However, the result might be due to underreporting of smoking among girls.

Further exploration based on qualitative approaches showed that the perspective on the effectiveness and safety of vaping among vapers showed, at least anecdotally, that vaping was used to assist in quitting smoking (Rahman, Nik Mohamed, & Jamshed, 2015). The findings showed that vaping was used as a quit smoking aid, which reduced tobacco consumption as a cheaper and healthier alternative device to nicotine to manage withdrawal symptoms (Nik Mohamed, 2015). However, further study is needed to determine the effects, as many vapers, especially adolescents, develop dual smoking behavior as a consequence of vaping.

5.5 Comorbidity

Tobacco use and dependence are comorbid frequently with other substance use disorders (SUD) as well as with emotional and behavioral problems. For example, nicotine dependence has been reported to cooccur in the use of transdermal nicotine patches. In a study by Lewinsohn, Rohde, and Brown (1999), daily smoking in adolescence could increase the likelihood of future cannabis, hard drug, and

multiple drug use disorders. In total, 27% of the adolescents who smoked daily developed cannabis use disorders compared to 8% of those who had never smoked by adolescence. Quitting smoking did not reduce the risk of future SUD. These findings highlight the substantial degree of comorbidity across various types of substance abuse and dependence.

Tobacco (nicotine) use is associated with a variety of maladaptive consequences and elevated mental health problems (Liao, Huang, Huh, Pentz, & Chou, 2013; Swahn et al., 2012). These include a likelihood of depression and anxiety (Fluharty, Taylor, Grabski, & Munafò, 2017; Johnston, Bachman, & Schulenberg, 2012; Liao et al., 2013) and other at-risk problem behaviors such as violent crime (Brook et al., 2002; Lennings, Copeland, & Howard, 2003), early teenage sexual activity, academic failure, and antisocial or delinquent activity (Dishion & Patterson, 2006; Ryzin et al., 2012). Other issues that relate to nicotine addiction are the abuse of or dependence on other substances, such as alcohol and marijuana use, especially in young adulthood (Liao et al., 2013; Palmer et al., 2009) if an experimentation with tobacco use starts much earlier in adolescence (Johnston et al., 2012). Further, nicotine dependence also predicts later respiratory problems and may serve as an independent lifetime risk factor for lung cancer (Liao et al., 2013).

5.6 Course and outcome

Trajectories of the use of tobacco (nicotine) in adolescence do not occur in a vacuum. However, they are necessarily related to the significant developmental transitions that may influence the onset of tobacco (nicotine) use, such as pubertal timing, school transitions, and other significant life events. It is also noticeable that patterns of substance use like tobacco (nicotine) change rapidly during early adolescence and late adolescence, with e-cigarette use the most current trend among adolescents. Early experimentation with substance use often begins during the early years of adolescence, typically in the context of negative peer influence, with readily available substances such as cigarettes (including e-cigarette), alcohol, and inhalants (Griffin, 2010). The prevalence of tobacco (nicotine) use often intensifies throughout adolescence. Some adolescents will have already started their experimentation with new substances such as marijuana, hallucinogens, cocaine, and the nonmedical use of prescription drugs. Tobacco (nicotine) use usually reaches its peak during late adolescence and early adulthood, and for most young people, it begins to decline in the mid to late 20s, with a more rapid decline occurring in adulthood (Griffin, 2010).

5.7 Risk and protective factors

There are various theories that have been used to explain the risk and protective factors of tobacco use among adolescents. Social influence models appear to be useful and encourage systems thinking that involves the consideration of social influence theories, including Bandura's Social Learning Theory (Clayton, Leukfeld, Donohew, Bardo, & Harrington, 1995; Corrigan, Loneck, Videka, & Brown, 2007). For instance, studies by Duncan, Duncan, Biglan, and Ary (1998) were based on Patterson's Social Context Model; Atkinson, Richard, and Carlson (2001) tested Oetting's Primary Socialization Theory; and Kelder and Perry (1993) utilized Perry and Jessor's Social Influence Model. Other researchers prefer to use a biopsychosocial framework to describe adolescent's thinking, with an emphasis on systems thinking, as well as an individual's interaction with their family, peers, and community (Corrigan et al., 2007). Another approach, termed social development theory, uses a developmental perspective, a systems approach, and social influence theories to elucidate a framework of risk and protective factors. According to this theory, different social influences have varying importance at different points in a child's life. As children progress through stages, subsequent success is predicated on their past success. When the children's socialization experience is consistent and stable, there is a greater likelihood of bonding with adults, which leads to attachment, commitment, and investment in the beliefs and values of the children (Hawkins, 1996).

For decades, researchers have recognized that many possible causal factors contribute to tobacco (nicotine) abuse among adolescents. These variables are known as risk factors. Coie et al. (1993, p. 1013) defined risk factors as "variables associated with a high probability of onset, greater severity, and longer duration of major mental health problems." However, Corrigan et al. (2007) stressed that not all adolescents who are exposed to risk factors develop tobacco (nicotine) problems and dependency, but there seem to be other variables that keep adolescents from experimenting with tobacco (nicotine) use and misuse. These variables are known as protective factors and are defined by Coie et al. (1993, p. 1013) as "conditions that improve people's resistance to risk factors and disorder."

Protective factors are those that facilitate healthy development (Corrigan et al., 2007; Glantz & Pickens, 1992; Jessor, 2014). By contrast, risk factors are conceptualized as those factors that inhibit an adolescent's natural development. For instance, Tarter and Vanyukov (1997) argue that substance abuse arises from suboptimal age-appropriate cognitive, emotional, and behavioral skills. As a result, substance use such as tobacco (nicotine) results from more distressful development progress among adolescents caused by specific risk factors. However, further research to determine the salient risk and protective factors in different developmental stages and times in adolescence are much needed (Corrigan et al., 2007).

Arthur, Hawkins, Pollard, Catalano, and Baglioni (2002) have further explained a framework of risk and protective factors of adolescents with substance abuse that can be used as guidelines for tobacco (nicotine) and e-cigarette use, with cautions that not all risk and protective factors are present for tobacco (nicotine) abuse in adolescence. Both risk and protective factors explicated by Arthur et al. (2002) can be described in four different categories: individual/peer, family, school, and community. Individual/peer risk factors include rebelliousness, attitudes favorable to drug use, peer drug use, peer rewards for antisocial behavior, impulsiveness, early initiation of antisocial behavior, attitudes favorable to antisocial behavior, peer antisocial behavior, sensation seeking, and peer rejection. Family risk factors include poor family management, family history of antisocial behavior, parental attitudes favorable to antisocial behavior, high family conflict, and parental attitudes favorable drug use. School risk factors include academic failure and low commitment to the school, while community risk factors include low neighborhood attachment, high transition and mobility, perceived availability of drugs, community disorganization, laws and norms favorable to drug use, and extreme economic deprivation.

Furthermore, Arthur et al. (2002) explained four different categories of influences that act as protective factors in adolescents' substance abuse behavior such as, firstly, individual/peer protective factors. The individual/peer protective factors include belief in the moral order, prosocial peer attachment, social skills, resilient temperament, and sociability. The second category is family protective factors. The family protective factor includes opportunities for prosocial family involvement, rewards for prosocial family involvement, and family attachment. Thirdly, there is the school protective factor. The school protective factor includes opportunities for prosocial school involvement and rewards for prosocial school involvement. The fourth category is community protective factors. The community protective factor includes opportunities for prosocial community involvement and rewards for prosocial community involvement.

According to the Search Institute (2019), family factors (e.g., parental nonsmoking, family monitoring, and family bond) are usually associated with a lower risk of daily tobacco (nicotine) use among urban adolescents. By contrast, low school connectedness, academic difficulties, and undesirable neighborhood environment factors would increase the likelihood of smoking among diverse groups of adolescents. However, the roles of community factors, religiosity, and spirituality in tobacco use remain less known.

During middle adolescence, young people spend less time with parents, so that their level of involvement with the family decreases along with the frequency and quality of adolescent-parent communication (Hill, Graham,

Caulfield, Ross, & Shelton, 2007; Loeber et al., 2000). Consequentially, early adolescents are particularly vulnerable to negative peer influence related to substance use, including tobacco (nicotine) use (Kelly et al., 2014; Ryzin et al., 2012). However, the influence of negative peer influence on adolescents' tobacco (nicotine) use has produced inconsistent findings across different racial/ethnic groups. Continuous exposure and susceptibility to tobacco advertising can also affect smoking initiation among adolescents (Hanewinkel, Isensee, Sargent, & Morgenstern, 2011; Liao et al., 2013).

Tobacco (nicotine) use often starts among a small percentage of adolescents during their early adolescence. The percentage increases as they hit puberty and throughout adolescence (Ryzin et al., 2012). Age also seems to be an essential factor related to tobacco (nicotine) use, in that older than younger adolescents smoke (Malcon, Menezes, & Chatkin, 2003; Teodoro, Cerqueira-Santos, Araujo de Morais, & Koller, 2007). Furthermore, smoking in late adolescence can be a powerful predictor of smoking in adulthood (Fagan, Brook, Rubenstone, & Zhang, 2005). It is essential to point out that younger adolescents who engage in early tobacco experimentation may befriend peer groups whose members are smokers, and this increases their chances of becoming a future smoker.

The fundamental assumption is that adolescent behaviors result from individual attributes, including biological and genetic factors, within the individual's primary social contexts, ranging from the proximal contexts of family and peers, school, community, and the larger society. However, much of what is known regarding the risk and protective factors of adolescent tobacco (nicotine) use comes from studies of predominately white adolescents. Thus, it is unclear whether the findings can be generalized to other populations around the world.

In summary, the risk and protective factors can be classified into four different categories: individual/peer, family, school, and community. All four factors must be assessed when determining which risk and protective factors are affecting a child's life before deciding upon a specific intervention program. It is also insufficient merely to identify child risk behaviors because every practitioner, researcher, and policymaker must identify and determine the specific threats that a child encounters, or the specific lack in their protection. Thus, identifying the risk and protective factors is the beginning of intervention that could take place at individual/peer, family, school, and/or community contexts.

5.8 Evidenced-based clinical strategies for prevention and treatment of nicotine addiction and e-cigarettes use

Tobacco smoking in adolescents is a problem that should be prevented at primary, secondary, and tertiary levels and treated due to its negative

consequences. The chronicity of tobacco smoking imposes a toll on a person's overall health. Available data showed that 90% of the people who die due to smoke-related health conditions have a long history of using tobacco since their adolescent years (CDC, 2015). Smoking also increases the risk for subsequent drug use in later life (Levine et al., 2011; McQuown, Belluzzi, & Leslie, 2007) and has an impact on adolescents' memory, attention, and learning (Office of the Surgeon General, 2014).

The addictive potential of nicotine is dependent on its fast activation in the bloodstream. Research has shown a varying rate of nicotine delivery across e-cigarette variants. Those who are classified as experienced users showed a more significant increase in blood nicotine as compared to nonexperienced users (Farsalinose et al., 2015; Hajek et al., 2014). The peak nicotine level of experienced users was observed within just 2–5 minutes, which is indicative of the e-cigarettes' addictive potential (St. Helen, Havel, Dempsey, Jacob III, & Benowitz, 2016). The process of becoming addicted to tobacco or e-cigarette use involves several stages. The US Department of Health and Human Services (1994) highlighted five stages: (a) the preparatory stage (when the knowledge and expectations about tobacco smoking are formed); (b) the trying stage (when the cigarettes are first tried); (c) the experimentation stage (characterized by irregular use of substance occurring in specific situations); (d) regular use (when smoking becomes regular with a specific pattern, for example, smoking after each meal); and finally (e) the addiction phase. In short, the process of addiction does not occur within a short time frame but instead develops over time.

5.8.1 Smoking policy in children and adolescents

US Department of Health and Human Services, Centers for Disease Control and Prevention (2012) emphasized the importance of having government legislation place to assist in the prevention of tobacco smoking in adolescents. Some relevant legislation or guidelines include: the CDC Best Practices for Comprehensive Tobacco Control Programs 2014 (outlines programs for implementing interventions); the World Health Organization (WHO) Framework Convention on Tobacco Control (worked on trade liberalization, foreign investment, and trading of tobacco products); the World Health Organization MPOWER (reduce tobacco demand at country level by implementing components such as monitoring of tobacco use and offering help to those who wants to quit); the Truth Initiative (study and provide public about the impact of tobacco use); and the Campaign for Tobacco-Free Kids (advocating public policies in the prevention of smoking in children). Other bodies that also play important roles are the American Lung Association and the American Academy of Pediatrics (AAP).

5.8.2 Effective tobacco prevention strategies for adolescents

Smoking prevention measures for adolescents can be undertaken in the primary care setting, family-based, school-based, and community-based, and in the form of government legislation and initiatives. In the primary care setting, education and counseling are one of the most essential and universal interventions being practiced by healthcare providers. Counseling can be provided individually or in groups, and can be undertaken on the phone. The effectiveness of this type of intervention has been confirmed in several research studies (Moyer, 2013; Patnode et al., 2013). Familial smoking behavior or the acceptance of smoking in a family is also a risk factor for the initiation of smoking in adolescents. It is, therefore, necessary for the focus of intervention also to be targeted toward family members. Thomas, Baker, Thomas, and Lorenzetti (2015) revealed that family-based interventions for smoking prevention could deter children and adolescents from starting to smoke, and promote nonsmoking behavior in young people. Furthermore, adding the family-based component to a school intervention may also increase its effectiveness.

In addition, Carson et al. (2011) stated that community-based intervention could also be effective in curbing smoking behavior among adolescents. However, further study should be carried out intensively as the findings were inconsistent, with some methodological flaws. On the contrary, a school-based smoking prevention program has several advantages. First, it can be provided to all children attending the school, so that no one misses out on the program. Second, school-based interventions do not entail the same costs as specialized counseling centers. In line with this view, the Centers for Disease Control and Prevention (1994) has outlined several guidelines and recommendations on an effective school-based tobacco prevention programs. The guidelines include the following:

1. Development and enforcement of tobacco use policy in schools.
2. Education on negative consequences of tobacco use, social influence, the role of peers, and skills for refusal.
3. Education on tobacco use prevention from kindergarten through 12th grade.
4. Training for teachers.
5. Parental and family involvement in supporting the prevention programs.
6. Supporting students and school staff in tobacco cessation.
7. Assessment of the prevention program regularly.

The findings underlined the importance of having intervention programs that are specifically tailored to the appropriate developmental

stages, for instance, enhancing personal competencies in elementary school students and social norms in early adolescents.

5.8.3 Nonpharmacological interventions for nicotine addiction in adolescents

Nonpharmacological management has been widely used in the prevention and intervention of smoking cessation in adolescents. Among the most widely used interventions are cognitive behavior therapy (CBT), contingency management (CM), and motivational enhancement therapy (MET), which was based on the motivational interviewing (MI) approach and practices.

5.8.3.1 Cognitive behavior therapy

CBT is a structured therapeutic approach that is effective for adolescents' smoking cessation. The aim of CBT in smoking cessation is to identify and change the cognitive processes that maintain tobacco use, followed by teaching the necessary skills or strategies to stop smoking and maintain the cessation of abstinence. CBT uses the ABC Model, which refers to how the (A) antecedents (external events) cause the formation of (B) belief (irrational beliefs), which produces (C) consequences (emotions and behaviors) in a person. In short, a person's emotions and behaviors are not directly linked to a specific life event, but more to how the events are evaluated and processed cognitively (Beck, 2011; Oltean, Hyland, Vallières, & David, 2017; Sarracino et al., 2017). The CBT model looks at substance use as a coping strategy, with the presence of specific triggers activating a person's core belief, which leads to individual unhealthy responses (e.g., using substances). Milton et al. (2004) described some essential elements in CBT targeting smoking cessation as follows: (a) establish one's self-awareness regarding tobacco use, (b) increase motivation to quit, (c) preparation for quitting, (d) providing strategies to maintain abstinence.

5.8.3.2 Contingency management

Contingency management is a form of behavioral therapy where positive behavioral changes are rewarded to reinforce the behavior. In the context of substance used treatment, the positive change can be negative urine drug results. The reward can be monetary-based or in the form of vouchers that can be exchanged for goods. Contingency management is not explicitly limited to managing substance use, but is used also in the context of other psychiatric treatments (Petry, 2011), for example, it can involve promoting regular follow-ups in treatment settings or increasing adherence to medications. For contingency management to be effective, there is a need to increase the reenrolments (e.g., an increase in voucher amounts) with sustained positive behavior (Petry et al., 2005).

5.8.3.3 Motivational-based interventions

Motivational-based interventions often use the transtheoretical model (TTM) of change, which was developed and introduced by Prochaska and DiClemente (1983). The TTM model uses the stages of change model that consists of five stages: precontemplation, contemplation, preparation, action, and maintenance. Interview techniques in MI cover four main features, namely, open-ended questions, affirmations, reflective listening, and summarizing. The practice of MI should be based on five general principles: (a) express empathy through reflective listening, (b) identify a discrepancy between the client's goals or values and their current behavior, (c) avoid argument or confrontation, (d) adjust to client resistance rather than opposing, and (e) support self-efficacy and optimism. Moreover, motivational enhancement therapy (MET) is a form of counseling approach based on MI principles that are designed to produce internally motivated change (NIDA, 2018).

5.8.4 Other forms of intervention

5.8.4.1 Web-based smoking cessation intervention

The Internet has become the most crucial tool of communication in today's world and is particularly relevant for adolescent interventions. However, results show that the effectiveness of using web-based interventions for smoking cessation in college students and adolescents is unconvincing (Hutton et al., 2011). Interactive and tailored internet-based interventions, with or without additional behavioral support, were found to be moderately more effective than nonactive controls at 6 months or more, but with no evidence of superiority against other interventions (Taylor et al., 2017).

5.8.4.2 Text messaging

Interventions using mobile phones had several advantages, including the low cost of implementation and the lack of need to come to treatment centers, which resolved the issue of stigma. Furthermore, mobile phone and text messaging have proven to be the preferred way to communicate with adolescents. A study by Scott-Sheldon et al. (2016) has explored the effectiveness of text messaging in smoking cessation. Findings showed that smokers who received a text-messaging intervention were more likely to abstain from smoking (continuous abstinence) and able to reduce their cigarette consumption.

A further study by Haug, Schaub, Venzin, Meyer, and John (2013) also supported the previous study that text-messaging intervention of smoking cessation showed a higher decrease in cigarette consumption among adolescents.

5.8.4.3 Pharmacological interventions for nicotine addiction in adolescents

Currently, there is no FDA approved medication to assist smoking cessation in children or adolescents. Various sets of guidelines address smoking issues in adolescents with recommendations regarding smoking management, such as the American Cancer Society, American Academy of Pediatrics (AAP) Committee on Substance Abuse, the United States Department of Health and Human Services (DHHS), the Department of Veterans Affairs (VA)/Department of Defense (DoD), the National Institute for Health and Clinical Excellence (NICE), and the Institute for Clinical Systems Improvement (ICSI). All the guidelines mentioned above give emphasis and recommendations on providing education, preventive measures, screening, and behavioral interventions among adolescents. However, their recommendations toward the use of medications differ. AAP, VA/DOD, and ICSI do consider the possibility of using medications. As for the NICE guidelines, their recommendation for medication is limited to the use of nicotine replacement therapy (NRT), but not Bupropion or Varenicline for adolescents less than 18 years old. The 2008 DHHS also does not recommend the use of medications in adolescents less than 18 years old.

5.8.4.4 Nicotine replacement therapy

NRTs aim to replace the nicotine obtained from cigarettes to enable one to reduce and subsequently stop smoking. NRT, which can be found in the form of lozenges, gums, spray, inhaler, patches, or sublingual tablets, is well accepted, has been well researched indicating its effectiveness for the treatment of nicotine dependence in adults (Theng, Wahab, Wahab, Sidi, & Das, 2019), and is often used with other behavioral interventions in the management of smoking cessation. The current availability of various forms of NRT also enables the patient to tailor the therapy based on their previous daily nicotine use. However, to date, only a handful of studies have examined the effectiveness of NRTs in adolescents.

5.9 Concise summary of key clinical points

The negative consequences of cigarette use have long been discussed. Smoking initiation during adolescence increases the likelihood of not only being tobacco-dependent but also developing a dependence on other substances in adulthood. The immaturity of the brain allows nicotine to disrupt brain function to a greater extent than in adults. Several factors have been identified as increasing the risk of adolescents to be nicotine dependent. These factors include starting to smoke at an early age, parental smoking behavior, negative peer pressure, a lack of knowledge regarding

smoking, and a negative school environment. However, factors such as high self-control and regulation, presence of parental role modeling of positive behavior, positive parent-child communication, high school commitment, and community engagement can act as protective factors and reduce the risk of becoming addicted to or dependent on nicotine.

Approaches to treatment should involve a comprehensive assessment to assist in the formulation of the personal treatment plan by taking into consideration the biopsychosocial-spiritual-cultural factors that may contribute toward the person's tobacco cessation and relapse prevention. Assessment should take note of past quit attempts, substance use comorbidity, and psychiatric comorbidity, which may also determine a person's chance of achieving recovery from nicotine addiction.

In general, the treatment of nicotine addiction in adolescents is similar to the methods used with adults. However, the use of pharmacological treatment in adolescents is still controversial. To date, there is no FDA approved medication to assist smoking cessation in children or adolescents. Further research is needed to evaluate the use of these medications in the young population to see the risks and benefits. In terms of nonpharmacological treatment, behavioral interventions have been widely studied. Among the highly recommended behavioral interventions are cognitive behavioral strategies, motivational strategies, and social influence strategies.

As the effectiveness of treatment is still generally debatable, a more careful approach should be targeted to prevent the first use of cigarettes in adolescents. Smoking prevention measures for adolescents can be initiated in the primary care setting, within the family, in school, in the community, and by the government.

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