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E-Sigara Kullanımının Ergenler ve Yetişkinler Üzerindeki Etkisi: Riskleri ve Zorlukları Anlamak

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Anahtar Kelimeler

E-sigara,
Adölesan ve yetişkin,
Halk sağlığı

E-sigaralar elektromanyetizma prensibiyle çalışan elektronik cihazlardır ve tarihsel olarak 1960'ların başında ilk defa ABD Genel Cerrahları tarafından icat edilen bir sigara içme tekniğinden esinlenilerek Çinli eczacı Hon Lik tarafından mevcut haliyle icat edilmiştir. Elektronik sigaralar (e-sigaralar), genellikle propilen glikol veya gliserol (gliserin), nikotin ve tatlandırıcı maddelerden oluşan bir çözeltiyi ısıtarak kullanıcılara nikotin içeren bir aerosol (genellikle buhar olarak adlandırılır) veren ürünlerdir. E sigaralar, yoğun reklam kampanyaları ile pazarlanarak tütün içimine sağlıklı bir alternatif olarak gösterilmiş, sigarayı bırakmak ve sigara tüketimini azaltmak için tavsiye edilerek, kullanıcıların "her yerde sigara içebilmesini" sağlayan ve dumansız yasaları atlatmanın bir yolu olarak pazarlanmıştır. Buna karşılık bu ürünlerin özellikle gençler tarafından kolay ulaşılabilir olması, bireylerin toksik e-sigaranın toksik maddelerine maruz kalmaması, yoğun bireysel riskler taşıması kaynaklı ortaya çıkan sağlık sorunları hızla artmaktadır. Bu inceleme makalemizde E-Sigara Kullanımının ergenler ve yetişkinler üzerindeki etkisi ve riskler araştırılmaktadır.

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The Impact of E-Cigarette Use on Adolescents and Adults: Understanding the Risks and Challenges

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E-cigarettes are electronic devices that operate on the principle of electromagnetism and were historically invented in their current form by Chinese pharmacist Hon Lik, inspired by a smoking technique first invented by US Surgeons General in the early 1960s. Electronic cigarettes (e-cigarettes) are products that deliver a nicotine-containing aerosol (often called vapor) to users by heating a solution of nicotine and flavourings, usually propylene glycol or glycerol (glycerine).
E cigarettes have been marketed through intensive advertising campaigns, portrayed as a healthy alternative to tobacco smoking, and used to quit smoking and reduce cigarette consumption. It has been marketed to circumvent smoke-free laws, enabling users to "smoke anywhere". On the other hand, health problems arising from the fact that these products are easily accessible especially by young people, individuals are not exposed to

the toxic substances of toxic e-cigarettes, and carry intense individual risks are rapidly increasing. This review article explores the impact and risks of E-Cigarette Use on adolescents and adults.

1. Introduction

E-cigarettes are electronic devices that work on the principle of electromagnetism and are largely inspired by a smoking technique that was invented by the first U.S. Surgeon General in the early 1960s. That smoking technique was called a "safe" cigarette, which used a piezoelectric element to heat a vaporizer that would resemble a cigarette. Today, the replaceable liquid solutions or "juices" that are utilized in e-cigarettes vary greatly and can range from containing no nicotine to high concentrations of nicotine that are equivalent to two packs of cigarettes (Grana and Benowitz, 2014). In the few short years since e-cigarette retailers began emerging in places like New York City, the use of these devices has skyrocketed in popularity. Forecasts by the CDC estimate that e-cigarettes comprise 32% of the $56 billion global market for smoking alternatives, at approximately $18 billion worldwide, and are expected to surpass the sales of both traditional cigarettes and other nicotine replacement therapies (Felberbaum, 2013).

Today, e-cigarettes' rise in popularity and prevalence is notable. According to the National Institutes of Health, NIDA, the prevalence of e-cigarette use in the past month by 12-year-olds to 17-year-olds in the US has fluctuated around 8.1%, whereas the prevalence amongst young adults (18–25-year-olds) has stabilized between 22.5% and as high as 27.5%, whereas the prevalence amongst adults ages 26 years and older has similarly stabilized between 12.3% and 13.7% (Mcneill et all., 2020). As the variety of flavoured e-cigarettes continues to grow, a partial reason for increased prevalence among non-smokers is thought to be due to non-smokers' cognitive misinterpretation of e-cigarettes to be less hazardous than traditional tobacco-based cigarettes. Given the diverse assortment of nicotine-flavoured additives and risks, and the varying interpretations and representations of products, it is no surprise that consensus on short-term effects varies by study (Besaratina, 2021).

1.1. Definition and Types of E-cigarettes

Electronic cigarettes (e-cigarettes) are a diverse group of battery-driven devices that can deliver nicotine and other inhaled aerosolized constituents to the lungs of the user. These devices have evolved over time, with new generations of products differing substantially from early iterations (McCue, 2022). Early models were designed to mimic the appearance and physiological effects of tobacco cigarettes. These models were referred to as "cigalikes" and functioned by drawing fluid from a medium that contains highly concentrated nicotine (usually propylene glycol), which is attached to a small internal reservoir, using energy stored in the device's battery, which was used to activate a heating element and convert nicotine fluid to inhaled vapor (Eaton et all., 2018; Eden, 2023). Succeeding generations of e-cigarettes were larger and more complex and could be refilled with different concentrations of liquid nicotine, allowing thousands of commercially produced flavours to be added to the device's internal solution. Today, the landscape of e-cigarettes is broad and variable, featuring disposable e-cigarettes, and is more recently including highly modified e-vaporization systems that allow for customized evaporation rates and more efficient nicotine delivery (Yagi et all., 2023).

Although e-cigarettes have evolved in design, they all share several key components in common, an operational model different from that of traditional tobacco cigarettes, included a tobacco substitute, a cylindrical battery, and an electronics mechanism that heats a metal coil within a chamber that is filled with the main ingredient (a tobacco substitute, usually referred to as e-liquid) to generate an aerosol that is inhaled. Traditional cigarettes increase toxicity in users by burning and vaporizing tobacco to create an aerosol that contains over 50 known carcinogens. It spreads these harmful

contaminants through combustion products not only in the lung of the user but also in the air as side-stream smoke. Although e-cigarettes generate broadly the same function as a cigarette, they have a key distinction from other nicotine delivery systems: the use of heat does not burn technology (Cao et all., 2021; Tegin et all., 2018).

2. Prevalence of E-Cigarette Use

E-cigarettes are battery-operated devices that heat a liquid solution called an e-liquid to create an aerosol, which is then inhaled, or "vaped," into the lungs. Evidence shows that e-cigarette use is a burgeoning and increasingly widespread public health concern. According to data from the National Health Interview Survey, time, place, and manner restrictions, as well as making accommodations to decrease harms from e-cigarette use, may be better use than more restrictive laws (Baldasari, 2020; Hagen, 2023).

It is understandable why laws have sought to reduce e-cigarette use. E-cigarettes have become more prevalent, particularly among the young. Overall, while only a subset of the U.S. population uses e-cigarettes, their use is becoming more prevalent. The prevalence of e-cigarette uses among adults increased from 4.5% in 2013 to 13.6% in 2019. The greatest increase was among adults aged 18 to 24 years, with a small increase between 2013 and 2014 (7.6% to 10%) and larger increases between 2014 and 2015 (10% to 14.3%) and 2017 and 2019 (14.2% to 20.8%). The other category with large increases was adults 25 to 44, who increased between 2013 and 2015 from 5% to 11%. After 2015, the percentage of adults in this age range who vaped remained steadier, with that group increasing to 14.1% in 2019. Among adults 45 and older, the prevalence of e-cigarette use ranged from 3.3% in 2017 to 4.7% in 2014. Some estimates have proposed that over 3.6 million Florida adults use e-cigarettes (Laestadius et. all., 2023; Kim et all., 2021; Boakye et all., 2022).

2.1. Trends in Adolescents and Adults

Adolescent and young adult use of electronic nicotine delivery systems, especially e-cigarettes, skyrocketed in the US and around the world beginning in 2011-2012. The 2020 Monitoring the Future survey revealed that approximately 17-18% of 12th and 10th graders had vaped nicotine during the past thirty days. E-cigarettes are now the most used tobacco product among youth. Adult use of e-cigarettes has also significantly increased, largely motivated by trying to quit combustible cigarettes. The National Health Interview Survey (2018 NHIS) found that about 3.2% of US adults used e-cigarettes daily or some days. Use was highest among adults under fifty-five years of age, males, LGBTQ adults, those with any other tobacco product use, and with comorbid conditions (i.e., asthma, cancer, chronic obstructive pulmonary disease, cardiovascular disease, overweight) (Miech et all., 2021).

This section describes the prevalence of e-cigarette use, flavour and product preference, and dual use or poly substance use with e-cigarettes amongst adolescents. It is described before turning our attention to adult use. In the context of adolescents, data comes from multiple studies from the US, primarily from the Monitoring the Future study and Pathways study, which are large, well-designed and nationally representative. Among adults, a broad review on the many small, grassroots studies carried out since 2015 is necessary. Using epidemiologic data is challenging due to the relatively low overall prevalence of e-cigarette use. To date, NHIS reports, and a few dozen small-scale studies have garnered the bulk of the data (Hampsher et all., 2024).

3. Health Effects of E-Cigarette Use

The use of e-cigarettes has been heavily marketed to adolescents and has quickly gained popularity, particularly among younger age groups. The movement toward using this form of smoking symbolizes what some people call "vaping culture." Several studies have shown e-cigarettes to have negative health effects, with chronic use potentially leading to respiratory and cardiovascular diseases. The devices and e-liquids produced are not regulated, which results in little oversight for what chemicals are put into the e-liquid. Knowing the fact of how many youths may pick up the habit from

being around it and from being targeted for using the product, it is important that more research is conducted on whether it is harmful to them. Although e-cigarettes are marketed as a safer alternative, it is important to consider these potential effects from a public health perspective (Seiler-Ramadas et all., 2021).

Using e-cigarettes or vaping has been linked to several different diseases or conditions that are related to the respiratory and cardiovascular system. Many advertisements say that e-cigarettes are a healthy alternative to smoking. Although those chemicals are the only ones found in e-liquids, the vapor produced and then inhaled contains many other harmful chemicals and particles. Many of the chemicals found in e-liquids and those produced in the vapor are well-known contributors to respiratory and cardiovascular disease, cancer, and other potentially fatal diseases. Many physicians are seeing cases of life-threatening illnesses stem from using e-cigarettes. The larger health impacts, both negative and positive of using e-cigarettes are unknown. More and more people are advocating for more research to be done on the impacts that using e-cigarettes is having and could have on future generations (Livingston et all, 2022).

3.1. Respiratory and Cardiovascular Effects

The effects of e-cigarettes on cardiovascular and respiratory systems are widely studied. The use of e-cigarettes can alter lung functional structures, weaken lung physiological functions, lower resistance to lung infection and development of diseases, increase airway resistance, and are positively linked to the emergence of chronic cough and other respiratory symptoms. At a cellular level, vaping can induce persistent lung injury and inflammation in the parenchyma (Brożek et all., 2019). A decrease in immune cell viability and suppressed immune response have been linked to lung injury after e-cigarette use.

Epidemiological and biochemical studies have shown a negative correlation between vaping and heart health, indicating an increased risk of heart disease with the exposure of e-cigarette aerosol. E-cigarette users demonstrated changes in heart rate, endothelial function, increased oxidative stress, direct injury to heart muscle cells, and vascular reactivity and endothelial-dependent vasodilatation (Seiler-Ramadas et all., 2021). There also appears to be a significant risk due to the association between the use of e-cigarettes and the incidence of a variety of heart diseases. Vaping products have carcinogenic particle additives, heavy metals and formaldehyde and other harmful compounds, even in the absence of nicotine and tar in "nicotine-free" e-cigarettes. There is currently no research on the assessment of the dangers of "nicotine-free" smoke produced by secondary decomposition of flavour residues on alveolar surface or residual harmful chemicals that can cause cardiovascular and cerebrovascular diseases. Moreover, it is known that 70% of the aerosol containing carcinogenic substances of e-cigarettes produced less than the intensity of the lower nicotine emission (Neuberger, 2021).

4. Psychological and Behavioural Impacts

Psychological and behavioural impacts. The rapid rise in e-cigarette use among these groups suggests the need for a better understanding of longer-term risks as well as the challenges to prevention. For instance, preliminary studies indicate that some features associated with youth e-cigarette use, namely use of nicotine-containing e-cigarettes and more frequent use, are associated with increased risk of subsequent cigarette initiation. Additionally, little is known about the potential for some adverse impacts to be reversed with sustained complete abstinence from e-cigarettes. For these reasons, we review known or likely psychological and behavioural impacts of e-cigarette use. Such harms could be rapidly alleviated if proper regulatory actions and public health interventions were implemented. A better understanding of the full psychological and behavioural toll of e-cigarettes is essential for a full assessment of public health impact (Smith et all., 2021).

One key area of concern is the potential for addiction. Youth who start e-cigarettes are more likely to move on to traditional cigarettes, a pattern that has raised substantial attention. Given that e-cigarettes typically contain nicotine, it is conceivable that many of the key factors responsible for

addiction to conventional cigarettes, such as rapid delivery of a potent form of a highly addictive drug, would be replicated. Indeed, there is mounting evidence that e-cigarettes can deliver nicotine in a form capable of producing abuse liability. For adults, qualitative evidence indicates that some adults believe that e-cigarettes helped them reduce or quit cigarette use, although quantitative studies are less supportive of the notion that most adults use e-cigarettes to quit smoking (Cummins et all., 2014).

4.1. Addiction and Withdrawal Symptoms

Adolescents and adults use e-cigarettes because the nicotine that emerges from the aerosol produces pleasurable effects that consumers find rewarding. Nicotine is an addictive substance that triggers brain pathways that control emotions, movement, and sensation. Its effects are felt almost immediately. People who use nicotine can become addicted to it, and adolescents who have signs of addiction are more likely than nonsmoking youth to become adult cigarette smokers. Research on addiction harm is therefore relevant to understanding e-cigarettes and why people use these products. Although e-cigarette aerosol usually contains nicotine, addiction from use of other harmful substances such as polyvalent cations also occur (Towriss, 2024).

Long-term and continued use of e-cigarettes can lead to addiction, though not all those who use e-cigarettes become addicted. Research suggests that e-cigarette users become conditioned to use their device during specific events, when they experience certain feelings, or engage activities that increase the urge to vape. These can be considered behavioural dependencies that enhance the enjoyable effects of vaping. The development of addiction to e-cigarettes is accompanied by brain changes comparable to those seen in people with addiction to other substances such as cocaine. Physical dependence also occurs. Indeed, people who have only used e-cigarettes for a short period often find it challenging to quit. It can be as hard to quit vaping as it is to quit smoking (Hughes et all., 2020; Knight-West and Bullen, 2016).

Furthermore, the risks that people develop in withdrawing from e-cigarettes can reduce their chances of successfully quitting them. A survey of over 8,000 U.S. adults found that 80% of vapers who also currently smoke cigarettes want to quit vaping, yet only 38% had successfully quit for over one week during their most recent attempt. A leading reason that participants relapsed was the urge to use e-cigarettes. This behaviour remained even among participants who used FDA-approved smoking treatments. These findings suggest that e-cigarette addiction presents significant challenges for adults who wish to quit. In conclusion, addiction can cause consumers to continue using e-cigarettes after they have decided to quit, increasing their consumer welfare harm (Leavens et all., 2022).

5. Regulatory Policies and Public Health Interventions

Policies and strategies have been implemented to try and mitigate the risks and challenges associated with e-cigarettes from several federal and state entities. This section will summarize how e-cigarettes are regulated, who regulates them, and when and where they can be used. We will also discuss a variety of public health interventions intended to understand the risks, manage the use of e-cigarettes, prevent the initiation of e-cigarettes, and mitigate the negative effect of e-cigarettes on never users as summarized.

Who regulates e-cigarettes? The FDA Centre for Tobacco Products (CTP) and the Federal Trade Commission (FTC) are responsible for regulating e-cigarettes in the United States. The FDA CTP was given three areas to regulate that includes (1) e-cigarettes, (2) all other tobacco products and accessories, and (3) all advertising and marketing of e-cigarettes. The regulation that CTP applies is "appropriate for the protection of the public health," a phrase that is not defined and was part of the February 2007 agreement. There are several areas where the FDA can regulate e-cigarettes that includes regulating as drug/device (stop smoking aid), health warning labels, modified risk claim, enforcing age restrictions, and quality control such as examining N-Nitrosonornicotine (NNN). Regulatory regime has shown to effectively and safely regulate that behaviour such as speed limits reduce the risk of injury or death, minimum drinking age laws reduced drinking levels and alcohol-related crashes among young people, etc. Public health is defined as "public health interventions are

designed to target those behaviours that affect the greatest number of individuals. Public health interventions are not designed or intended to benefit only the individual who is the target of the intervention. They are designed to benefit the population as a whole" (Bhalerao et all., 2019 Levy et all., 2017; Bustamente et all., 2018).

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