Components of e-cigarettes, health complications and regulatory process: Preliminary considerations

Elementos componentes dos cigarros eletrônicos, complicações relacionadas a saúde e processo de regulamentação: Considerações preliminares

Elementos componentes de los cigarrillos electrónicos, complicaciones relacionadas con la salud y proceso regulatorio: consideraciones preliminares

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According to the Pan American Health Organization (PAHO), the tobacco epidemic is one of the main causes of death, disease and impoverishment, and this health problem developed by tobacco products is one of the greatest threats to public health that the world has ever faced.[1,2,3,4,19] Also according to PAHO, this international public health issue is responsible for the death of more than eight (8) millions people per year, and more than seven (7) millions of these deaths are the result of the direct use of products that have tobacco in their composition, while more than 1.2 million deaths are the result of non-smokers exposed to passive smoke.[1,2,3,4,19]

In this complex context, almost 80% of the more than 1.1 billion smokers worldwide live in low- and middle-income nations, where the burden of tobacco-related diseases and death is much more severe.[1,2,3,4,19] Thus, users of tobacco, contained in various tobacco products, die prematurely, depriving their families of income, increasing the cost of health care and even impeding development and economic progress.[1,2,3,4,19]

One of the modalities of smoking widely used today is the consumption of electronic cigarettes (ECs), which has increased worldwide. [1,2,3,4,5,6] They also have the designations of "electronic cigarette", "electronic cigarettes", "e-cig", "e-cigarettes", "e-cigs", "e-cigarrettes", "electronic nicotine delivery system", "electronic nicotine delivery systems" (ENDS), "vape pens", "e-hookahs", "electronic shishas", "mechanical mods" and "Juul".[1,2,3,4,5,6]

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They are presented in the form of vapor and aerosol dispersion devices, with rechargeable batteries, aiming to generate heat and carry out the embolization process, which are present in a liquid with flavoring substances and nicotine (NNK), associating each model to its pharmacological and toxicological profiles.[1,2,3] In most of these smoking devices and, in their physical structure, the battery is usually connected to a sensor, which detects the suction moment, initiated by the user, stimulating the vaporization process, whose solution is heated to temperatures between 100ºC and 250ºC.[2,3,4]

This process tends to generate the aerosol, which is popularly known as a "vape" liquid, or even "e-liquids", at the same time that this sensor activates a small luminous mechanism, thus characterizing the sensations of pleasure.[2,3,4] Thus, specialized research and studies prove that the liquid used in ECs has in its composition, elements such as propylene glycol (C3H8O2), glycerol ($C_3H_8O_3$), additives and solvents.[5,6]

These substances, when heated and vaporized, generate toxic and carcinogenic compounds that, in addition to causing irritation in the body of the smoker, in the eyes, in the respiratory system and, in more advanced cases, in the nervous system (NS) and spleen.[5,6] In this context, and through clinical and epidemiological studies, smoking has been directly related to various types of cancers (AC), respiratory, cardiac, circulatory, neurological problems, and, by extension, to national and international public health problems, especially in the periods from 1990 to 2017.[4,5,6]

Thus, and through regulatory measures and policies, Brazil had a significant reduction in the prevalence of smoking in a global context, with a reduction in its consumption by almost 70% among young adults, belonging to the age group greater than or equal to 20 years.[1,4,5,6] In 2018, it was possible to verify that more than 3.6 million students in the United States of America (USA), already used ECs, with a significant increase recorded in 2019 and reaching approximately 5.2 million people.[7,8]

This phenomenon, according to some researchers and those interested in the subject, has caused a great alert in society, with regard to the health risks and its association with the habits of the direct users of these dangerous smoking devices.[7,8] In this context, Brazil was one of the first nations to decree a ban throughout its constituent territory, its use and the dissemination of advertising(s) of any electronic smoking device, whether or not it contains the presence of nicotine ($C_{10}H_{14}N_2$).[7,8,9]

In this way, and through the Collegiate Board Resolution (RDC) number 46/2009, of the National Health Surveillance Agency (ANVISA), it was "prohibited the commercialization, importation and advertising of any electronic smoking devices, known as ECs".[7,8,9] According to some researchers, the strategy used by the tobacco industries, aiming to obtain greater social adherence in the use and consumption of ECs, was the idea that they would promote and support the suspension and dependence of the use of the well-known conventional cigarettes, and also of their similar ones.[9,10]

In this context, ECs were introduced by several industries in the market, aiming that this new product would induce the social understanding that they were safer than the current tobacco products existing today, as well as in the sense of supposed aid in the treatment against tobacco dependence, in addition to its impulse for greater social acceptance.[8,9,10] According to the Ministry of Health (MS), smoking is defined as a disease characterized as chronic, whose dependence is caused by NNK, present in the composition of tobacco products.[8,9,10,11]

When compared to ECs, they present, in addition to NNK, polonium (Po), aromatic amines, aldehydes, heavy metals, polycyclic aromatic hydrocarbons (HCAP), and are potentially harmful to human health.[8,9,10,11] Regarding aromatic amines, they

are constituted as a group of amino amino that are linked to an aromatic ring, such as benzene (C6H6).[8,9,10,11]

In relation to the aldehyde e, based on chemistry, it constitutes an important organic function that is characterized by the presence next to a structure of the carbonyl group (C=O) at the end of the chain and is characterized by the presence of a -CHO group near the end of the organic compound, which is called, aldoxyl, Methanoyl.[8,9,10,11] In relation to heavy metals, some researchers define them as an important group of elements, which are located between copper (Cu) and lead (Pb), along the periodic table, having their respective atomic weights between "63.546" and "207.2", in addition to a density that is greater than 4.0 grams (g) per cubic centimeter (cm^3).[8,9,10,11]

In this analytical context, arsenic (As), cadmium (Cd), copper (Cu), tin (Sn), antimony (Sb), lead (Pb), bismuth (Bi), silver (Ag), mercury (Hg), molybdenum (Mo), indium (In), osmium (Os), palladium (Pd), rhodium (Rh), ruthenium (Ru), chromium (Cr), nickel (Ni) and vanadium (V), are constituted as the chemical elements, which are normally included in the group of metals that are considered heavy.[8,9,10,11,12] In this context, several researchers have pointed out the risks caused by the use of ECs, with their aromatic essences, which tend to cause the sensation among young people of a false impression that ECs, are less toxic than traditional fume products.[8,9,10,11,12]

In this way, when its components are heated, the liquid produced can decompose into highly toxic substances, such as propylene glycon (C3H8O2), NNK and other psychoactive drugs, facilitating the development of cardiovascular diseases, acute respiratory diseases, lung injuries, pneumonia, diffuse alveolar hemorrhage, gastrointestinal problems, and even systemic problems.[10,11,12,13] Considering also that the use of ECs, in addition to being related to various oral pathologies, numerous studies bring evidence regarding alterations of the oral mucosa, of which it is possible to identify the black hairy tongue, identified due to alcohol abuse, reduced or absence of oral hygiene, especially among immunosuppressed patients, smokers and chronic smokers, which may be directly related, to users who consume ECs.[10,11,12,13]

In addition to the presence of allergic dermatitis, caused by the components found, when inhaled, they tend to cause the appearance of facial edema(s), as a result of chronic use, carelessness in handling or also manufacturing defects of ECs.[11,12,13,14,15] When it comes to complications caused by the use of ECs, it has been identified that, when smoke is inhaled, Initially for at least five (5) minutes, airway flow resistance may occur.[14,15,16]

This phenomenon can be altered when associated with the time of use, even for a short period, for example, in a week, since it is possible to verify early signs, for example, of discomfort, cough, chills, loss of body weight, and even chest pain.[10,12,14,15,16,17] Knowing that ECs are commercially considered illegal products and, despite the prohibition of commercialization by the competent agencies, research indicates that the tobacco consuming population is migrating from traditional cigarettes and other tobacco products to ECs.[10,12,15,17,18]

In this sense, the World Health Organization (WHO) and PAHO recommend that international governments implement rules prohibiting the commercialization of these devices, and currently, in nations belonging to the American continent, such as Argentina, Brazil, Mexico, Nicaragua, Paraná, Suriname, Uruguay, Venezuela, they already have in their territories, the total prohibition of these devices.[17,18] Historically, the first CE was developed and patented in 1963 by Herbert A. Gilbert, in Beaver Falls, Pennsylvania, USA, and was known as "smokelesss non-tabacco cigarette", which was not commercialized due to its reduced technology at the time.[18,20]

In 2012, the U.S. led the acquisition of ECs, totaling a value of approximately US$ 135 million, through the company, as defended by experts on the subject.[20, 21] In 2013, the patent for the ECs was purchased for around 75 million euros (EUR) and, since then, there has been an exponential expansion of this market, due to the distribution chains of their respective companies around the world.[20,21]

Although commercialization, importation and advertising are prohibited in the Brazilian territory, the tobacco industries are already organized in the production of what is known as the fourth (4th) generation of ECs, commonly known as "pods", which are rechargeable or disposable, and have a variation in values for acquisition between approximately R$ 60.00 to R$ 680.00.[20,21] Aware of the Brazilian national legislative issue, it was possible to identify the existence of Bill (PL) number 2158/2024, currently in progress in the Chamber of Deputies (CD), which addresses the criminalization, manufacture and importation of ECs.[22]

In this important bill, it is proposed to amend the Brazilian Penal Code (CPB), with regard to the punishment of one (1) to three (3) years of detention and a fine, for their commercialization, in addition to the use of CEs in collective and/or partially open environments.[22] On the other hand, in this same political-social scenario, there are movements developed, aiming at the legalization of ECs, proposed in November 2023 by Senator Soraya Thronicke (PODEMOS – MS), defending the release and security at the time of purchase, as well as the guarantee of these products, to be taxed.[22]

In view of this scenario and according to the aforementioned Bill, the existence of illegal practices is verified, which involve the purchase and sale of these goods, without the payment of the due taxes, which can favor the generation and fortification of informal and precarious work, thus contributing to the potentiation of the condition of illegal sales and the absence of labor rights, thus affecting the significant fiscal gains for the country.[22,23] Thus, in this political, economic and social context, it is essential to analyze the acceptability and growing consumption of these devices among young people and adults, configuring an alert about their reduced knowledge related to identified health problems that are potentially harmful to health.[20,21,22,23,24]

A disease related to its consumption is the "Lung Injury Associated with the Use of Electronic Products or Vaping" (EVALI), which is a respiratory disease, considered new and which, in addition to causing serious damage to lung health, can be related to gastrointestinal symptoms such as abdominal pain, nausea, vomiting, and also diarrhea.[21,22,23,24,25] However, even configuring the prohibition of ECs throughout the national territory, it is necessary to evaluate the knowledge of its users, regarding their harm caused, in addition to their behavioral counseling.[21,22,24,24,25,26]

It is also necessary to develop guidelines and implementation, through health education, health communication, health promotion and disease prevention, in order to address smoking cessation, in order to provide a better and more enlightened awareness of the whole society, in the face of the numerous complications generated by the use of ECs.[21,22,24,24,25,26]

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