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First data on the disease associated with vaping in Colombia

Jeadran Malagon-Rojas, Yesith Guillermo Toloza , Alvaro Javier Idrovo, Jürg Niederbacher-Velazquez

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Primeros datos de la enfermedad asociada al vapeo en Colombia

First data on the disease associated with vaping in Colombia

Primeiros dados sobre a doença associada à vaporização na Colômbia

Jeadran Malagón-Rojas https://orcid.org/0000-0001-5801-936X , [1] Yesith Toloza https://orcid.org/0000-0001-9514-7192 , [1] Alvaro J. Idrovo https://orcid.org/0000-0001-9579-1463 ,[2] Jürg Niederbacher-Velazquez https://orcid.org/0000-0002-5395-7717 [3]

[1] Grupo de Salud Ambiental y Laboral, Instituto Nacional de Salud, Bogotá DC, Colombia.

[2] Department of Public Health, School of Medicine, Universidad Industrial de Santander Bucaramanga, Colombia.

[3] Department of Paediatrics, School of Medicine, Universidad Industrial de Santander, Bucaramanga, Colombia.

Corresponding author

*Jeadran Malagón-Rojas; jmalagon@ins.gov.co; Avenida Calle 26 N° 51 – 20; 5712207700

Summary

Background

Electronic cigarettes are a mass consumption product with great market penetration, particularly among groups of young adults. Recently, attention has been drawn to the increasingly frequent reports of cases with vaping-related disease, leading to hospitalizations and death.

Methods

An ecological study was designed to characterize the use of these devices and the demand for vaping-related consultations in Colombia between 2020 and 2022. The National Health Service Registries and the 2019 National Survey of Psychoactive Consumption were used as data sources.

Results

Young adults and residents of Bogotá, Caldas, Antioquia, Valle del Cauca, and Boyacá had the highest consumption of e-cigarettes. Their consumption was associated with cigarette and marijuana use. The greatest reports of vaping-related disease occurred in adults over 45 years of age residing in the departments of Antioquia and Boyacá. 245 cases of vaping-related disease were reported. A total of 59 deaths were reported in the period evaluated.

The data suggest that in Colombia users are older than in other countries, which seems to relate to the costs associated with the devices. Preventive actions should begin at an early age, although adverse effects may not be observed until years later. In addition, there is a need to fill the knowledge gaps among health care professionals' and the clinical skills to identifying and reporting vaping-related disease. Decision makers can already have data that allow health policies that prevent use and decrease cases of vaping-related disease.

Funding

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Keywords

Vaping, electronic cigarette, vaping-related disease, Colombia

Introduction

Electronic nicotine delivery systems (ENDS) and similar systems without nicotine (SSSN), better known as electronic cigarettes (e-cigarettes), have been one of the most trending products in recent decades. Worldwide, their successful marketing is especially effective among the population under 30 years of age. According to the National Youth Tobacco Survey of the United States of America, the percentage of e-cigarette users in high school increased from 2.4% to 26.5% between 2019 and 2021 [1]. An alarming increase in the proportion of adolescents and young adults who have tried or used e-cigarettes has been reported by the health agencies of the European Union, Korea and Australia. [2–5] In Colombia, it is estimated that 5% of the population between 12 and 65 years of age have used some type of e-cigarettes at some point in their life, with 23 years being the average age of the start. [6]

Much is still unknown about how e-cigarettes can affect human health [7]. Although several authors have been outspoken against the potential risks associated with chemical products contained in ENDS or SSSN devices, some of

which are considered toxic and carcinogenic [8,9], it was not until 2020 that the code U07.0 of the International Classification of Diseases (ICD-10) was used to refer to the diseases associated with vaping. [10] E-cigarette or vaping use-associated lung injury (EVALI) is a disorder that occurs in occasional or regular users of ENDS or SSSN devices. [11]

EVALI is clinically manifested by the presence of cough, with or without expectoration, which may or may not be accompanied by respiratory distress. [12] In radiological images, lesions of the respiratory tract and lung parenchyma are described, which are evidenced in chest X-ray as ground-glass diffuse opacities. [13] In sputum analysis, the presence of macrophages with lipid infiltrates has been described. [13] Although parenchymal lung injury has been reported most frequently, cases of broncho-obstructive syndrome and pneumothorax attributed to vaping have been documented.[13] The majority of patients with EVALI have a good prognosis, although a large percentage (up to 25% of cases) require in-hospital management and ventilatory support. [14] Mortality ranges from 2% to 3% and is associated with multimorbidity, such as asthma and cardiovascular disease, in men older than 35 years. [15]

In Colombia, except some warnings issued by the Ministry of Health and Social Protection and the National Institute of Drug and Food Surveillance (INVIMA), there is no regulation regarding the commercialization and sale of ENDS and SSSN devices. The Superintendence of Industry and Commerce has stated that it does not have information about the brands, types, and organoleptic characteristics, percentage of nicotine or quantities of devices that are marketed in the country. In this context, the purpose of the present work was to perform the first characterization of vaping-related disease in the Colombian population using secondary data.

Materials and methods

Study design and data sources

An ecological study was conducted using microdata from the National Survey on Psychoactive Substance Consumption (ENCSP[6]) 2019 and the Health Information System (RIPS) cube of demand v3 for the year 2020. The data was obtained from the National Department of Statistics (DANE[6]) and the information was analyzed in order to understand the relationship between the use of vapers and mortality. The detailed information about the databases and variables used can be found in the supplementary material.

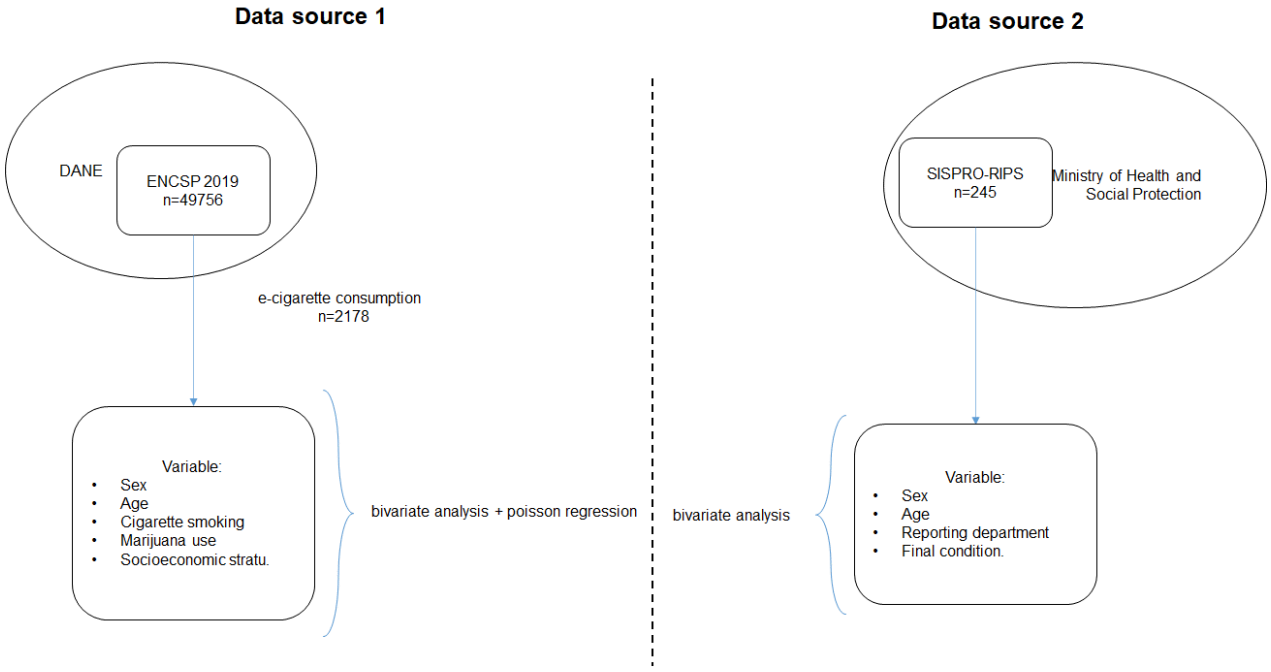

Figure 1. Flow diagram of data source and analysis.

The data used in this study was collected from two sources: the ENCSP 2019 and the RIPS. The unit of analysis for the ENCSP 2019 survey was the individual who participated in the survey. The ENCSP 2019 survey provides information on the use of e-cigarettes, tobacco, marijuana, as well as the sex, age, and department of

residence of the participants. The RIPS data, on the other hand, provides information on the distribution of U070.0 diagnoses from 2020 to 2022, as well as sex, age, place of occurrence of the event, and the final condition (alive or deceased). Mortality was determined based on the information reported in the "final condition" variable. This information was obtained from the Integrated Social Protection Information System (SISPRO) cube-RIPS demands V3 for the year 2020.

Statistical methods

To describe the participants, means and standard deviations were utilized for quantitative variables, and frequencies and percentages were determined for qualitative variables. A bivariate analysis was then performed to compare nominal or ordinal variables using Pearson's chi-square test with Yates' correction. Variables potentially associated with the use or non-use of vaping and mortality were explored using prevalence ratios (PRs) and their 95% confidence intervals (CIs), which were estimated using Poisson regressions. The variables to be included in the multivariate analysis were determined by considering the variables proposed in two systematic reviews of the literature [16,17]. Additionally, variables with a p-value less than 0.2 in the crude analysis were also included in the multiple regression analysis [18]. The data analysis was conducted using R version 4.2.1, which has a free license.

Ethics statement

The study was based on secondary sources which were anonymized by Ministry of Health. Data from RIPS and ENCSP 2019 survey is available in Ministry of Health and DANE website. According to the ethics committee of the National Institute of Health (Instituto Nacional de Salud) this kind of research do not requires an approval act.

Results

Vaping device use

According to the data of the ENCSP 2019, Bogotá, Caldas, Antioquia, Valle del Cauca, and Boyacá accounted for 60.1% (n=1311) of the regular consumers of e-cigarettes in the country. When stratifying marijuana use with smoking tobacco, it was found that 26.4% (n=2635/9954) of cigarette smokers younger than or equal to 45 years of age regularly consumed marijuana. In the group over 45 years of age, the proportion of cigarette and marijuana smokers was 10% (n=680/6603). In the relationship between the use of vaping and cigarette analysis, it was found that in the group younger than or equal to 45 years of age, 76.83% (n=1535/1998) of vapers were also cigarette smokers. In turn, it was found that 95% (n=171/180) of people over 45 years of age were vapers and cigarette smokers. A total of 42.2% (n=845/1998) of vapers younger than or equal to 45 years of age regularly consumed marijuana. This proportion dropped to 27.33% (n=49/180) in the group over 45 years of age.

In the multiple analysis, it was found that age (PR: 0.932, 95% CI: 0.928-0.936; $p < 0.001$), male sex (PR: 1.27, 95% CI: 1.16-1.39; $p < 0.001$), cigarette smoking (PR: 6.42, 95% CI: 5.73-7.20; $p < 0.001$), and marijuana use (PR: 2.36, 95% CI: 2.15-2.59; $p < 0.001$) were independent variables associated with the risk of vaping (Table 1). A linear relationship was found between the socioeconomic status and the risk of vaping ($X^2 = 385.102$, p-trend < 0.01).

Morbidity and mortality associated with vaping

In the RIPS between January 2020 and July 2022, 245 cases of vaping-related disease were reported. Most of the reported cases occurred in men older than 45 years (82.8%) who resided in the departments of Antioquia (63%) and

Boyacá (29%). The reports of a case in a child under 5 years of age in the department of Tolima and in young adults (3.7%) were noteworthy. A total of fifty-nine deaths were reported in the period evaluated. Again, mortality mostly occurred among men ($p < 0.05$) older than 60 years. The departments reporting deaths due to vaping-related disease were Antioquia (69%) and Boyacá (27%), followed by Sucre (1.69%) and Tolima (1.69%) (Table 2). The severity rate was 24.38% (95% CI: 19.4-30.16). We found no association between the independent variables sex, age and health insurance and mortality ($p > 0.05$).

Discussion

Lung injury associated with the use of e-cigarettes or vaping is a reality that represents a health risk in the country. It was found that the departments with the highest consumption, such as Antioquia and Boyacá, coincided with those with the highest case rates of vaping-related disease. Furthermore, it was possible to determine a greater risk of e-cigarette consumption in men under 45 years of age, who also regularly consumed cigarettes or marijuana. This finding is consistent with those reported in the literature, which documented higher consumption in the young adult population. Worldwide, the main groups of consumers are adolescents and young adults [19]. However, the concomitant consumption of marijuana and e-cigarettes reported in the 2019 ENCSP data is striking. In an outbreak of lung disease associated with the use of e-cigarettes or vaping that occurred in 2019 in the United States of America, it was determined that the involvement of the lung parenchyma largely occurred because of the exposure to vitamin E acetate, which is used in vaping preparations containing marijuana derivatives [17].

Our results are consistent with the reports in the literature that describes the demographic profile of those who have died from vaping-associated illnesses are predominantly young, male, and from lower socioeconomic backgrounds [20]. The median age of those who have died from vaping-related illnesses is around 35 years old, and two-thirds of the cases reported are male [21]. The use of vaping products is also more common among individuals with lower income levels[21]. Additionally, some studies suggest that individuals from minority racial and ethnic groups are disproportionately affected by vaping-related illnesses and deaths [22].

While our study did not assess the presence of comorbidities in individuals who died from vaping-associated illness, reports from various regions indicate that these individuals frequently had underlying conditions, such as cardiovascular disease, lung disease, and diabetes [23]. The use of vaping products may have exacerbated these pre-existing conditions, resulting in severe and potentially fatal outcomes. In addition to exacerbating pre-existing conditions, the use of vaping products has also been associated with various health risks, including respiratory and cardiovascular symptoms, as well as the development of nicotine addiction.

It is nothing new that smoking continues to be a significant risk factor for a considerable number of negative health outcomes. However, smoking is becoming less common and that users are migrating to ENDS or SSSN products. In this sense, it is imperative that Colombia develops a regulatory core that allows the characterization of the supply of products that exist on the market to determine the contents of chemical substances (including compounds such as tetrahydrocannabinol, heavy metals, and formaldehyde, among others) that could have a negative effect on human health. In addition, urgent regulation is required against the commercialization of these products that would include prevention messages on the labels, the prohibition of flavours and odours that can encourage the use in underage populations, and the dissemination of information among health

professionals about the clinical presentation of vaping-related diseases and how to report them.

It is also necessary to collaborate preventively with parent associations, educational institutions and government agencies that generate prevention messages to discourage the use of these products among the younger population. On the other hand, it is recommended that the entities regulating imports and trade advance a registry that would allow accounting for the types of products that are sold, in addition to promoting a regulatory framework like the one that exists for dispensing wholesale and retail tobacco [24].

An adequate interpretation of the findings should consider that the data analysed from the health service delivery records may have limitations. First, there are aspects related to the quality of the data; the lack of dissemination of information about the clinical presentation of vaping-related disease reduces the possibility of its identification. On the other hand, the ICD-10 code U07.0 that is reported in the RIPS could have biases and even be used incorrectly. Additionally, it is noteworthy that when consulting the vital statistics registry, there were no deaths associated with the code in question. It was also impossible to determine the multimorbidity in the individuals reported as deceased or whether there was simultaneous use of tobacco products. Additionally, due to the nature of the study, it was not possible to include information about the type of vapers, nicotine concentrations, the amount of doses each e-cigarette has, the puffs administered by users, variables that could enrich the analysis. In the same sense, other analysis alternatives, such as structured equations, were not considered due to the limitation of available information. Nonetheless, the proposed multivariate model is sufficient for a first exploration and the data it presents is consistent with what has been published in the literature. Finally, the ENCSP 2019 does not have complete information on the department of residence; therefore, when using this record, the data entries ranged from 49,450 to 21,160, which could introduce an error in the analyses. Additionally, due to the nature of the study, it was not possible to include information about the type of

vapers, nicotine concentrations, the amount of doses each e-cigarette has, the puffs administered by users, variables that could enrich the analysis. In the same sense, other analysis alternatives, such as structured equations, were not considered due to the limitation of available information. Nonetheless, the proposed multivariate model is sufficient for a first exploration and the data it presents is consistent with what has been published in the literature.

In conclusion, the data presented herein are a first approximation of the health problems associated with vaping in Colombia. Despite e-cigarettes being a new product on the market, their adverse health effects are already evident and correspond to those described in other countries that have experienced this problem for a longer time. Preventive actions should begin at an early age, although adverse effects may not be observed until years later. There is a need for health professionals to stay up to date in detecting vapers and diagnosing associated injuries. It is highly likely that in the future, there will be a noticeable increase in cases if immediate actions are not taken to reduce the use of e-cigarettes.

Contributors

JMR designed the original study. JMR conceived the study idea and design. YT conducted all analyses. AJI and JN authored the first draft of the manuscript. All authors contributed to editing and approval of the final version of the manuscript.

Data sharing statement

Requests for the data can be sent to the corresponding author. The data are available to the public with no special access privileges.

Declaration of interests

The authors declare no conflict of interest.

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Table 1. Factors associated with the use of e-cigarettes or vaping (ENCSP 2019).

		Crude association		Multiple association	
	Variable	**PR**	**95% CI**	**PR**	**95% CI**
Sex	Male	2.304	2.113-2.514	1.278	1.169-1.397
	Female	1		1	
Age (years)		0.946	0.943-0.950	0.932	0.928-0.936
Cigarette smoking	Yes	7.247	6.551-8.033	6.423	5.737-7.201
	No	1		1	
Marijuana use	Yes	8.003	7.347-8.715	2.364	2.150-2.599
	No	1		1	
Socioeconomic stratum	Stratum 1	1		1	
	Stratum 2	2.020	1.769-2.313	1.950	1.707-2.232
	Stratum 3	2.766	2.423-3.166	2.650	2.320-3.035
	Stratum 4	3.738	3.152-4.428	3.473	2.925-4.119
	Stratum 5	3.892	3.066-4.892	3.756	2.955-4.728
	Stratum 6	4.255	3.168-5.609	4.063	3.020-5.365

Table 2. Distribution of cases of lung injury deaths associated with the use of e-cigarettes or vaping according to the department of residence, as reported in the RIPS, 2020-2022.

Department	**Women**	**Men**
Antioquia	30.5% (n=18)	39.0% (n=23)
Boyacá	6.8% (n=4)	20.3% (n=12)
Sucre	1.7% (n=1)	0.0% (n=0)
Tolima	1.7% (n=1)	0.0% (n=0)
Grand total	40.7% (n=24)	59.3% (n=35)

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