Electronic Nicotine Delivery Systems: Scientific Production in Brazil

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Dispositivos Eletrônicos para Fumar: Produção Científica no Brasil

Sistemas Electrónicos de Administración de Nicotina: Producción Científica en el Brasil

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ABSTRACT

Introduction: Electronic nicotine delivery systems (ENDS), known as e-cigarettes and vapes, have been banned in Brazil since 2009. Despite this, their consumption has increased, especially among young people. National researches are essential to support public control and prevention policies. **Objective:** To identify national scientific production on ENDS and identify areas that could be targeted for future studies. **Method:** Integrative literature review in the LILACS, SciELO, and PubMed databases, using the descriptors: Electronic Cigarette Vapor, Electronic Nicotine Delivery Systems, Vaping, Smoking Devices, Tobacco-Derived Product Registry, Marketing of Tobacco-Derived Products, Tobacco Products, and Control and Inspection of Tobacco-Derived Products. The terms "Electronic Cigarettes" and "Electronic Smoking Devices" were also searched in the titles and abstracts. The following filters were applied: full texts, Brazilian authors, and publication period from 2019 to March 2025. **Results:** Fifty-nine articles were selected. Of these, 33 (55.9%) addressed health risks, such as biochemical alterations and oral and respiratory damage. Another 20 (33.9%) presented epidemiological data, highlighting the increased use among adolescents, university students, and young adults. Six studies (10.2%) discussed public policies, indicating the need to strengthen regulatory measures. Quantitative approach and authorship of public academic institutions in the Southeast predominated. **Conclusion:** National scientific production on ENDS is relevant. New research should focus on regulatory strategies and prevention of initiation among young people, strengthening actions that limit access to and consumption of these products in the country.

Key words: E-Cigarette Vapor; Electronic Nicotine Delivery Systems; Smoking Devices; Tobacco Products; Control and Sanitary Supervision of Tobacco-Derived Products.

RESUMO

Introdução: Os dispositivos eletrônicos para fumar (DEF), conhecidos como cigarros eletrônicos e vapes, são proibidos no Brasil desde 2009. Apesar disso, seu consumo tem aumentado, especialmente entre os jovens. Pesquisas nacionais são essenciais para subsidiar políticas públicas de controle e prevenção. **Objetivo:** Identificar a produção científica nacional sobre DEF e apontar áreas que poderiam ser alvo de estudos futuros. **Método:** Revisão integrativa da literatura nas bases LILACS, SciELO e PubMed, com os descritores: Vapor do Cigarro Eletrônico; Sistemas Eletrônicos de Liberação de Nicotina; *Vaping*; Dispositivos para Fumar; Cadastro de Produtos Derivados do Tabaco; Comercialização de Produtos Derivados do Tabaco; Produtos do Tabaco; e Controle e Fiscalização de Produtos Derivados do Tabaco. Também foram pesquisados os termos "Cigarros Eletrônicos" e "Dispositivos Eletrônicos para Fumar" nos títulos e resumos. Foram aplicados os seguintes filtros: textos completos; autores brasileiros; e período de publicação: de 2019 a março a 2025. **Resultados:** Foram selecionados 59 artigos. Destes, 33 (55,9%) abordaram danos à saúde, como alterações bioquímicas e prejuízos bucais e respiratórios. Outros 20 (33,9%) apresentaram dados epidemiológicos, destacando o aumento do uso entre adolescentes, universitários e adultos jovens. Seis estudos (10,2%) discutiram políticas públicas, indicando a necessidade em fortalecer medidas regulatórias. Predominaram a abordagem quantitativa e a autoria de instituições acadêmicas públicas do Sudeste. **Conclusão:** A produção científica nacional sobre DEF é relevante. Novas pesquisas devem focar em estratégias regulatórias e de prevenção da iniciação entre jovens, fortalecendo ações que limitem o acesso e o consumo desses produtos no país.

Palavras-chave: Vapor do Cigarro Eletrônico; Sistemas Eletrônicos de Liberação de Nicotina; Dispositivos para Fumar; Produtos do Tabaco;

RESUMEN

Introducción: Los sistemas electrónicos de administración de nicotina (SEAN), conocidos como cigarrillos electrónicos y vapeadores, están prohibidos en el Brasil desde 2009. A pesar de ello, su consumo ha aumentado, especialmente entre los jóvenes. Investigaciones nacionales son esenciales para fundamentar las políticas públicas de control y prevención. **Objetivo:** Identificar la producción científica nacional sobre SEAN e identificar las áreas que podrían ser objeto de estudios futuros. **Método:** Revisión bibliográfica integradora en las bases de datos LILACS, SciELO y PubMed, utilizando los descriptores: Vapor de Cigarrillo Electrónico; Sistemas Electrónicos de Suministro de Nicotina; Vapeo; Dispositivos para Fumar; Registro de Productos Derivados del Tabaco; Comercialización de Productos Derivados del Tabaco; Productos de Tabaco; y Control e Inspección de Productos Derivados del Tabaco. También se buscaron los términos "Cigarrillos Electrónicos" y "Dispositivos Electrónicos para Fumar" en los títulos y resúmenes. Se aplicaron los siguientes filtros: textos completos; autores brasileños; y período de publicación: de 2019 a marzo de 2025. **Resultados:** Se seleccionaron 59 artículos. De estos, 33 (55,9%) abordaron perjuicios a la salud, como alteraciones bioquímicas y daños orales y respiratorios. Otros 20 (33,9%) presentaron datos epidemiológicos, destacando el aumento del consumo entre adolescentes, estudiantes universitarios y adultos jóvenes. Seis estudios (10,2%) abordaron políticas públicas, indicando la necesidad de fortalecer las medidas regulatorias. Predominó el enfoque cuantitativo y la autoría de instituciones académicas públicas del Sudeste. **Conclusión:** La producción científica nacional sobre SEAN es relevante. Las nuevas investigaciones deben centrarse en estrategias regulatorias y la prevención del inicio en jóvenes, fortaleciendo las acciones que limitan el acceso y el consumo de estos productos en el país.

Palabras clave: Cigarrillo Electrónico a Vapor; Sistemas Electrónicos de Liberación de Nicotina; Dispositivos para Fumar; Productos de Tabaco; Control y Fiscalización de Productos Derivados del Tabaco.

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INTRODUCTION

Electronic nicotine delivery systems (ENDS), also known as e-cigarettes or vapes have been gaining popularity worldwide and also in Brazil. These devices deliver an aerosol by vaporizing contents from cartridges or liquids containing nicotine, flavorings and other substances, also known as e-cigarettes, heated tobacco products and hybrid products[1].

Countering the expansion of these devices has become an additional challenge the National Tobacco Policy has to deal with. The full implementation of the Collegiate Board Directive (RDC) number 14 of 2012 that banned the sale of tobacco products with additives is but one of the examples. Another critical point is the expansion of the sales ban, a key measure to restrict minors' access to these products[3].

The Brazilian Health Regulatory Agency (Anvisa) bans the trade, importation and advertising of ENDS since 2009[4]. In 2022, Anvisa's Collegiate Board unanimously approved the final report of the regulatory impact analysis (AIR)[5], a technical document recommending the continued banning of ENDS in Brazil. Upon a thorough analysis of the scientific literature, inputs from health entities and the experience of other countries, Anvisa corroborated in 2024 the banning of these devices through Directive RDC number 855[6].

Given this scenario, recent international literature reviews investigated health damages, beliefs, knowledge and opinions about ENDS as well as regulatory challenges and strategies to control sales[7-9]. In that line, investigations on these products to support effective public policies which already mirror straightforwardly its effects on the population and protect them against consumption associated risks are essential. The objective of this study is to identify and map the national scientific production and suggest target-areas for future studies.

METHOD

Comprehensive integrative literature review following the stages suggested by Souza et al.[10]: elaboration of the research question, literature search, data collection, critical analysis of the studies included, discussion of the results and presentation of the integrative review.

Initially, the research question was defined: which Brazilian studies address ENDS? It was attempted to present the state-of-art of the Brazilian scientific literature on ENDS to find evidences and identify knowledge thematic gaps.

The source of the data was identified in the second stage and the inclusion and exclusion criteria have then be determined. Studies conducted by Brazilian investigators were searched at the databases LILACS, SciELO and PubMed utilizing the following health descriptors: electronic nicotine delivery systems, vaping, smoking devices, e-cigarette vapes, registries of tobacco products, sale of tobacco products, tobacco products and control and inspection of tobacco products, in addition to e-cigarettes and electronic smoking devices. The descriptors and terms were combined with Boolean operator "OR" in the fields title and abstract. Filters of availability were applied: full texts, filiation: Brazil; period of publication: from 2019 through March 2025.

Only original articles and literature reviews addressing ENDS as main theme have been considered further to articles whose authors or co-authors included at least one Brazilian investigator affiliated to academic, governmental or non-governmental institutions located in Brazil or abroad.

As the study goal is to map the scientific production mainly by Brazilian investigators and within a national context approach, literature reviews which analyzed international articles were deemed relevant, most of all addressing ENDS-related health damages.

The subsequent stages were performed concurrently and systematized by the investigators supported by Microsoft Office Excel. The PRISMA[11] model was applied to present the sample on the databases and ensure the representativeness of the articles, search and synthesis. The following data have been extracted from the articles: title, objective, results and conclusions. The fourth stage consisted in the analysis of the data when the investigators read the articles thoroughly to identify the main themes related to the research question. Based on the data collected, the articles were organized in three thematic categories of analysis of common characteristics to the scope: health damages, epidemiological data and public policies. The category "health damages" encompassed articles that described ENDS-related compromised physical, mental or social well-being of the individual. The category "epidemiological data" considered studies whose goal was to investigate the occurrence, distribution and determinants of the events of interest of the populations. At last, the category "public policies" included studies discussing aspects that support the actions and decisions taken by the State to ensure the rights, meeting the society needs and promotion of the collective well-being and social equity.

The discussion of the results comprehended the contextualization of the data after the analysis, connected to other scientifically relevant references to highlight critical topics and detect possible knowledge gaps. The

presentation of the review was based on a clear and structured text through detailed information about the respective procedures and textual systematization with charts, tables and figures that portray important findings of the study.

RESULTS

59 scientific articles were selected at the three databases surveyed for analysis.

Figure 1 depicts the process of selection of the articles in each database.

Chart 1[12-70] presents the 59 scientific articles selected, organized by thematic categories of analysis and respective subdivisions. 33 are related to health damages, 20, epidemiological data and six highlighted aspects of ENDS-related public policies.

Table 1 presents the articles pursuant to thematic category, method and type of the institution associated with the authors.

Given the origin of the authors according to Brazil's regions, 34 (58.62%) are from the Southeast, 12 (20.69%) from the South, 8 (13.79%) from the Northeast, and 4 (6.90%) from the Midwest. The States of São Paulo and Rio de Janeiro concentrate the majority of the publications. Figure 2 portrays the distribution of the articles per State and Table 2, the articles according to the category and Brazilian States.

HEALTH DAMAGES

ENDS-associated health damages have been widely investigated revealing various adverse effects. The use of e-cigarettes can damage the buccal mucosa[12,14], potentially leading to cancer[13]. Metabolic alterations of the saliva and cellular damages to the buccal mucosa have also been identified[12,14], suggesting that the prolonged use can be associated with increased risk of oral diseases as caries and inflammations[16,20]. In addition, the aerosol emitted by these devices can change the color of the dental enamel and compromise the oral health of regular users[13].

E-cigarettes can promote biochemical alterations, including carcinogensis[23]. Toxic and inflammatory components associated with the use of these products can increase the risks of developing chronic diseases[24,25,27].

Batista, Coelho, Tanni and Godoy[31] observed that the exposure to the primary and environmental aerosol is associated with higher concentrations of metals in biological samples in smokers than in non-smokers, also detected in second-hand smokers exposed to aerosol.

National studies showed that the exposure to ENDS' aerosol can cause the development of pulmonary emphysema and other respiratory complications[33]. In addition, the continued use can lead to pulmonary injury associated with the use of e-cigarette or vaper (Electronic or Vaping Acute Lung Injury – EVALI)[34], reinforcing the concern with the inhalation of these substances.

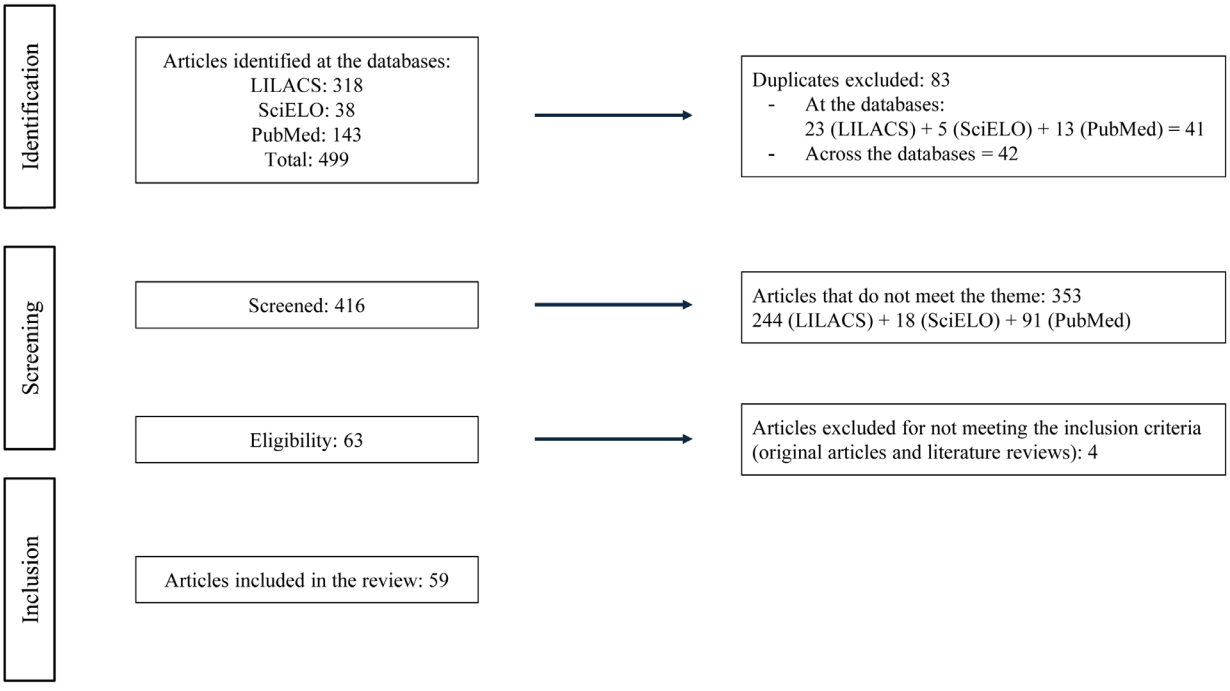

Figure 1. Flowchart – Selection of the articles – PRISMA
Source: Adapted from Page et al.[11].

Chart 1. Number of articles per theme

Health damages			
Theme	**Number**	**Authors**	**Year**
Buccal health	11	Schwarzmeier LAT et al.[12]	2021
		Pintado-Palomino K et al.[13]	2019
		Carvalho BF do C et al.[14]	2024
		Lima JM de et al.[15]	2023
		Souza-Gabriel AE et al.[16]	2025
		Marçal T de O, Alves FR.[17]	2024
		Silva LA et al.[18]	2024
		Cral WG, Michels M.[19]	2022
		Amaral AL et al.[20]	2023
		Amaral AL, et al.[21]	2023
		Ferrazzo KL et al.[22]	2024
Biochemical alterations	10	Pilati SFM, Pilati PVF.[23]	2023
		Carvalho BF do C et al.[24]	2024
		Faria GM et al.[25]	2023
		Silva PF et al.[26]	2022
		Scharf P et al.[27]	2022
		Heluany CS et al.[28]	2022
		Otenaike TA et al.[29]	2024
		Neto AG dos S et al.[30]	2025
		Batista DR et al.[31]	2024
		Ruszkiewicz JA et al.[32]	2020
Respiratory diseases	5	Rodriguez-Herrera AJ et al.[33]	2023
		Lucas LGDCS et al.[34]	2023
		Matos MJR de et al.[35]	2021
		Araújo AC de et al.[36]	2022
		Rocha AKC da et al.[37]	2023
Other diseases	4	Oliveira NG de et al.[38]	2023
		Lima Menezes I et al.[39]	2021
		Benito R da C et al.[40]	2024
		Giongo MJD da S et al.[41]	2023
Cardiovascular diseases	1	Carll AP et al.[42]	2022
Cancer	1	Medeiros KS et al.[43]	2023
Pediatric diseases	1	Chong-Silva DC et al.[44]	2025

Epidemiological data			
Theme	**Number**	**Authors**	**Year**
Prevalence	5	Bertoni N et al.[45]	2021
		Bertoni N, Szklo AS.[46]	2021
		Menezes AMB et al.[47]	2023
		Martins BNFL et al.[48]	2022
		Degani-Costa LH et al.[49]	2023
Prevalence – youngsters	5	Santos Maximino G et al.[50]	2023
		Godói AT et al.[51]	2024
		Malta DC et al.[52]	2022
		Malta DC et al.[53]	2024
		Santos IS et al.[54]	2025
Knowledge	5	Bruno FP et al.[55]	2024
		Carneiro HML[56]	2023
		Guckert EC et al.[57]	2021
		Oliveira WJC de et al.[58]	2018
		Santos EP dos et al.[59]	2024
Smoking initiation	2	Barufaldi LA et al.[60]	2021
		Piras SS et al.[61]	2020
Prevalence – specific groups	2	Fontanari AMV et al.[62]	2021
		Martins SR et al.[63]	2023
Sale	1	Szklo AS[64]	2023
Public Policies			
Analysis of the conjuncture	4	Nunes-Rubinstein M, Leão T.[65]	2023
		Ling PM et al.[66]	2022
		Silva ALO da, Moreira JC.[67]	2019
		Sóñora G et al.[68]	2022
Advertising and sale	1	Viegas JRR[69]	2022
User's perspective	1	Perez C de A et al.[70]	2025

Table 1. Synthesis of the articles selected according to category, method and institution

		Number of articles	Percent (%)
Thematic Category	Health damages	33	55.93%
	Epidemiological data	20	33.90%
	Public policies	6	10.17%
	Total	**59**	**100.00%**
Method	Quantitative	35	59.32%
	Review	18	30.51%
	Qualitative	6	10.17%
	Total	**59**	**100.00%**
Institution	Academic	49	83.05%
	Governmental	9	15.25%
	Non-governmental	1	1.69%
	Total	**59**	**100.00%**

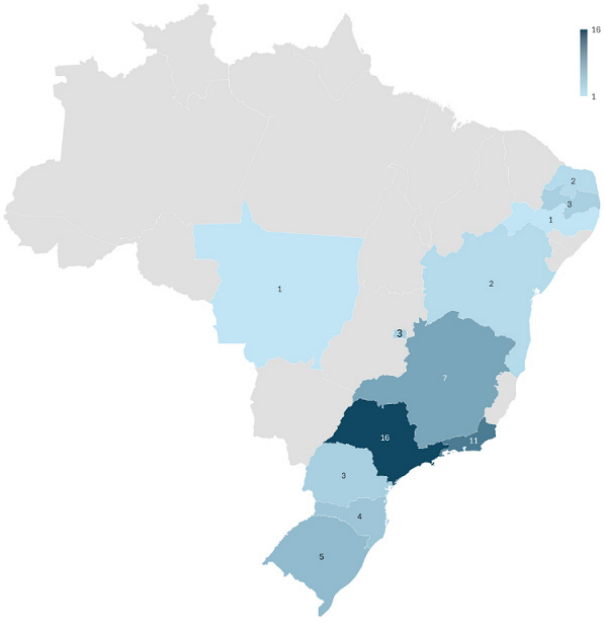

Figure 2. Synthesis of the articles selected according to the authors' origin States
Note: One article was not included in this figure because the origin institution of the first author is located abroad[65].

Cardiorespiratory effects are also concerning as some studies with humans and experiments *in vitro* and *in vivo* in mice have observed. Asthma, pneumonia, lung cancer and infectious diseases can be caused or exacerbated by e-cigarettes[36]. Based on a meta-analysis, Rocha et al.[37] concluded there is a significant association among asthma exacerbation and e-cigarettes in adolescents. Studies indicate that the use can induce cardiac arrhythmia and increased risk of cardiovascular diseases[38,42].

Table 2. Articles selected according to the category and States

States	Epidemiological data	Health damages	Public policies	Total
Bahia	1	1	0	2
Distrito Federal	0	2	1	3
Mato Grosso	1	0	0	1
Minas Gerais	3	4	0	7
Paraíba	1	2	0	3
Paraná	0	3	0	3
Pernambuco	0	1	0	1
Rio de Janeiro	5	2	4	11
Rio Grande do Norte	0	2	0	2
Rio Grande do Sul	3	2	0	5
Santa Catarina	1	3	0	4
São Paulo	5	11	0	16
Total	**20**	**33**	**5**	**58**

Note: One article was not included in this table because the author's affiliated institution was located abroad[65].

Further to health damages in adults, scientific evidences show that ENDS are a risk to physical and mental health of children and adolescents[44] and can expose individuals to toxic substances emitted in closed environments. Several of these pollutants acknowledgedly cause many diseases[41].

EPIDEMIOLOGICAL DATA

Epidemiologic studies present data on prevalence, knowledge, smoking initiation and sale of ENDS-related products and shed light on prevalence of consumption, a clear public health concern.

Based on the National Health Survey (PNS), the prevalence of ENDS use in 2019 was estimated in 0.64% of which 70% in the age range of 15-24 years. Nearly 90% were non-smokers of conventional cigarettes, the majority used water pipes and abused alcohol[45].

Data from the national telephone investigation of surveillance of risk factors and protection of chronic diseases (Vigitel) of 2019 with individuals older than 18 years or more living in the 26 Brazilian capitals estimated the current use of ENDS in 2.32%. More than half of the users had never smoked conventional cigarettes in their lifetime. The prevalence of daily use and dual use is ten-fold higher in until 24 years old adults[46].

Investigations conducted in universities revealed that many students try and use regularly these devices with prevalence ranging between 12.2% and 21.8%. The

abusive use of alcohol, other tobacco products and illicit drugs can increase the likelihood of use of e-cigarettes[50,51].

The National School Health Survey (PeNSE) 2019 presented data on trying e-cigarettes and last 30-day use in 13-17 years students and revealed that the experimentation was estimated between 16.8% and 18.1%, higher among 16-17 years old males[52,54]. The prevalence in the same period ranged between 2.8% and 3.4%[53,54].

Malta et al.[53] compared PeNSE's 2015 with 2019 and noticed that the cigarette use kept stable between 2015 (6.6%) and 2019 (6.8%), but the use of any tobacco product has risen from 10.6% in 2015 to 14.8% in 2019, standing out the prevalence of water pipe (7.8%) and e-cigarette (2.8%) in 2019.

In addition, there is a knowledge gap about the risks associated with the use of e-cigarettes among health students, which can compromise their ability to correctly address the patients. Bruno et al.[55] noticed that 27.4% of resident-doctors believed that the use of e-cigarettes was less damaging than tobacco use and 32.4% recommended the use of e-cigarettes for conventional cigarettes-cessation. Guckert et al.[57] identified that only 40% of odontology students had satisfactory knowledge after responding to a questionnaire about experimentation, approach to the theme in the academic curricula and self-perception to guide the patients.

Another concerning aspect is the overall unawareness of the impacts of e-cigarettes on oral and respiratory health. Researches indicated that not only odontology students, but young adults in general have but limited information about the damages these devices can cause, reinforcing the necessity of more education and preventive campaigns[56,59].

The use of e-cigarettes is also associated with conventional smoking initiation, particularly among adolescents and young adults. Evidences suggest that these devices increase the risk of nicotine-dependence and can potentially become a gateway to smoking conventional cigarettes[61].

PUBLIC POLICIES

Whereas the Latin America scenario, it is necessary to adopt a WHO Framework Convention on Tobacco Control-based robust regulatory framework to strengthen the ruling of flavored tobacco, e-cigarettes and heated tobacco products. The progress achieved in tobacco prevention and control can be threatened if these initiatives are not implemented[68]. There is a strong polarization in the regulatory debate pro and against these devices involving tobacco industry interests and public health concerns. Public health technicians and academics are able to muster scientific evidences to effectively respond to arguments upholding the lifting of the banning of these products, most of all of moral and economic nature[9].

According to Silva and Moreira[71], the banning of e-cigarettes in Brazil was aimed to impede the experimentation by youngsters and adolescents and consumption of a yet unsubstantiated product to treat smoking with potential significant toxicity. The outcome of the ban was better than the alleged benefits of approving these products, a strong argument to strengthen the acknowledged success of tobacco control policies in Brazil. However, the policies often lag behind the evolution of the industry which may continue to sell these products for years while regulations are established, refined or enforced. Policies that anticipate commercial tobacco, nicotine and related products and marketing changes and that are broad enough to cover these products are needed[66].

Other studies demonstrated that the influence of advertising and easy-access through digital platforms contribute to the expansion of the illicit market of tobacco products requiring the refinement of the actions of inspection bodies to control the sale[69]. This scenario negatively impacts the perceptions about ENDS because they appear to be socially acceptable or even formally approved. Many users see these devices as a safe alternative to conventional cigarettes, most of all because its use is not easily measured (daily frequency and doses of nicotine intake) and the attempt by part of the users to place ENDS in the same category of conventional cigarettes in the last decades when it was fashionable and glamourized[70].

DISCUSSION

The review of the national literature identified mostly ENDS articles addressing health damages, of quantitative approach, from academic institutions in the Southeast region. The search for more knowledge about ENDS-generated health damages and the magnitude of the consumption has been the object of several studies mainly by public universities due to the relevance of these institutions as creators of knowledge in important public health themes.

The uneven production of researches across the country's regions stands out. The State of São Paulo is the leader with 16 articles published followed by the South (12), Northeast (8) and Midwest (4).Through the border of that region with Paraguay, cigarettes and ENDS are brought into the country illegally, however, the scientific production is scarce, exposing the necessity of stimulating researches on ENDS that take into consideration local specificities across the national territory since smoking reinforces regional and socioeconomic disparities[72].

More than half of the studies addresses ENDS-related health damages, mainly biochemical changes and damages to the buccal and respiratory health. The findings are aligned with the international literature that indicates that their use is not safe and the long term effects are still undetermined with potentially similar risks of conventional cigarette[73,74]. Glantz, Nguyen and Silva[75] are concerned with the hypothesis that e-cigarettes are a substantially less damaging alternative than conventional cigarettes. In addition to e-cigarettes not being associated with the increase of tobacco cessation, they are associated with high likelihood of the smoker becoming a dual user.

However, there are scarce qualitative studies analyzing players and processes involving the contextualization of ENDS in Brazil. In that sense, it is important to stimulate analysis of the challenges the National Tobacco Control policy has to face in relation to the expansion of ENDS. It appears to be paramount to put in place a tax reform that selectively addresses tobacco products and connection with resources of the National Health System (SUS), law enforcement actions against ENDS illegal trade, full implementation of the protocol to erase the illicit trade of tobacco products, protection of public policies against interference of the tobacco industry and regular corroboration of the national commission to implement the Framework Convention on Tobacco Control and its protocols (Coniq) as intersectoral management instance of tobacco control policies under the purview of the Federal Government[76]. The implementation of tobacco additives banning[2] and the expansion of tobacco products banning[3] are equally relevant. Qualitative studies targeted to political regulatory and economic approach on tobacco control can aggregate knowledge and contribute to decision-making to contain ENDS by the many players involved.

The last years have witnessed an increase of related publications due to ENDS notoriety in the media, and the health authorities concerns with a potential consumption boost[46,69]. Though successful, the 2009 banning in Brazil is yet insufficient to contain its use mainly in youngsters[46] because of the advance of the illicit sale at stores and online. The illicit online trade of these products can increase the number of young smokers and warns about the potential undermining of tobacco control policies in the short term in case restrictive regulatory and inspection measures are not enforced[71].

The vulnerability of youngsters is a major concern, they are more susceptible and influenceable in that phase of life by friends and relatives. The belief these products are less damaging than conventional cigarettes and other health related behaviors as substance use impact this population[77]. Flavor, pleasure and relief stress are strong motivators to use e-cigarettes as well[78]. ENDS "social acceptance" is a major concern as a potential overhaul of tobacco use requiring informative campaigns about the damages these products cause in addition to more effective inspection measures[79].

ENDS are an additional threat to tobacco control policies because further to the technological and esthetics appeal, they are offered in different models with addition of nutrients and vitamins allegedly beneficial to health[80]. In view of the misleading perception that ENDS are less damaging than conventional cigarettes[81], the perspective of harms reduction needs to be continuously demystified in face of increased number of users. Borges[82] highlights how serious this proposal advocated by the tobacco industry is, similarly to the past attempts with filter cigarettes as, like ENDS, would be less health damaging to ensure sales of a yet unproven safe product whose risk of early death and sickening is a reality.

The prevalence of use of ENDS among adults is lower than general tobacco products according to PNS 2019[83] and Vigitel 2023[84]. According to PNS, the prevalence of adult smokers of any tobacco product corresponded to 12.8% while the current use of ENDS was 0.64% among adults. These data corresponded to 9.3% and 2.1% respectively, says Vigitel. The prevalence of e-cigarette (daily or casual) did not vary significantly between 2019 (2.3%) and 2023 (2.1%), was kept stable across every age-range and education level and increased significantly only among 45-54 years adults, ranging from 0.4% in 2029 to 0.7% in 2023. Overall, the use of e-cigarettes was higher in 18-24 years male adults with 12 years or more of education[84].

The 2023 national survey of alcohol and drugs (Lenad) estimated that 15.5% of individuals older than 14 years were current smokers. The proportion of use of ENDS in the last year corresponded to 5.6% and the exclusive use, 3.7%. Among the general population, men were highly prevalent (7.3% males – 4.1% females) and among adults (7.3% males – 3.7% females). However, for adolescents, the prevalence was higher in females (9.8% females – 7.7% males). The study emphasizes that early initiation and access to ENDS are determinants for the epidemics in this population group and that the high perception of risk does not translate into effective protection while the access to these products is still unrestricted[72].

Nevertheless, the weakening of the policy of prices and taxation over tobacco products since 2016 and the strong presence of illicit-origin, cheap cigarettes in the Brazilian market[85], potentially encouraging youngsters to smoking initiation of conventional cigarettes, is an additional concern. In this context, it is relevant to quantify the impact of tobacco products sale by the industry over the

direct and indirect costs imposed to the society to hold them accountable and pursue financial compensation[86].

The studies that shed light on tobacco control public policies, in general, emphasize the necessity of strengthening the surveillance of the current ruling, especially because of the increasing popularity of these devices among young adults. The successful ENDS banning continues to be discussed and the regulatory challenges and expanded surveillance are unanimously acknowledged[69].

Anvisa's regulatory model where social participation is a key feature makes their appraisal processes even more complex most of all in unsteady health, political and organizational contexts[87]. The Anvisa's corroboration of ENDS banning in Brazil in 2024 is a critical landmark for the Brazilian State, making the country a strong leader among Party-States of the FCTC. The risk of regulatory flexibilization is an actual threat in view of the great mobilization of the civil society. The opinion of non-governmental organizations as *ACT Promoção da Saúde*[88] and medical entities as the "*Sociedade Brasileira de Pneumologia e Tisiologia*[89], the "*Sociedade Brasileira de Cardiologia*[90] and the "*Sociedade Brasileira de Pediatria*"[91] that uphold the ENDS banning and the expansion of more effective regulatory measures stands out.

CONCLUSION

It has been found an important national scientific production on ENDS, most of all with quantitative studies that attempted to determine the relation with health damages and present epidemiological data. Studies analyzing ENDS-related biochemical alterations and buccal and respiratory health damages, in addition to studies about the prevalence of the use of these devices among youngsters and adults and the current knowledge about these products stand out. However, the paucity of studies with extended follow-up for thorough investigation of the many health outcomes that can be ENDS-related is clear. Also, there are scarce studies addressing the proportion of experimentation or current use of ENDS along the time, that are critical to counter the misleading information published in the media by the tobacco industry.

Likewise, there is paucity of qualitative studies analyzing aspects of public policies targeted to ENDS. It is important to have more tobacco control related studies with public policies, regulatory and economic approaches that contribute to the advancement of countering the initiation of these devices by youngsters and adolescents.

Taking into account the hegemony of academic productions in the Southeast region, mostly in São Paulo and Rio de Janeiro, it is essential to encourage regional researches targeted to local specificities and the necessity of involving the scientific community in face of the great threat to public health. It is emphasized the critical role of governmental initiatives to produce studies on ENDS as the call for proposals focused to the Brazilian population health, particularly non-communicable diseases in 2024 funded by the science and technology department of "*Secretaria de Ciência, Tecnologia e Inovação e do Complexo Econômico-Industrial da Saúde* of the Ministry of Health(Decit/Sectics/MS) and of the National Council of Scientific and Technological Development (CNPq).

It is essential that the production of researches holds relation with the current scenario and challenges as the monitoring of ENDS use among adolescents, college students and young adults in Brazil and also with poor knowledge health students have of health risks. Evidences corroborating the fight against illicit market, mostly digital and the encouragement of more effective ruling policies and awareness of ENDS risks are necessary to counter the increase of prevalence and expansion of the social rejection of these products mainly in youngsters.

To stimulate studies conducted across the country is critical to create robust evidences on ENDS to provide support to decision-makers to prioritize guidelines closely associated with collective health. Identify investigators that already address the theme or that potentially are able to conduct related studies is a key-strategy to push forward the national scientific involvement on ENDS. Strengthen the regulation, promote health literacy and create strategies that reduce the access and consumption of these products appears to be protective measures specially for young adults.

CONTRIBUTIONS

All the authors contributed substantially to the conception and design of the study, acquisition, analysis and interpretation of the data, writing and critical review. They approved the final version for publication.

DECLARATION OF USE OF ARTIFICIAL INTELLIGENCE

The authors utilized generative AI (artificial intelligence) in this article as a support for writing only. They were fully responsible for the analysis, interpretation or synthesis of the results.

DECLARATION OF CONFLICT OF INTERESTS

There is no conflict of interests to declare.

DATA AVAILABILITY SYSTEM

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