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E-cigarette Use and Regulation in South Africa: a Synthesis of Evidence in Response to Industry Efforts to Undermine Product Regulation

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Abstract

Purpose of Review This narrative review of the published scientific literature on e-cigarettes in South Africa examines and responds to reports commissioned by the e-cigarette industry about proposed regulations in South Africa.

Recent Findings The results of a nationally representative study suggest that the number of e-cigarette users is much larger than the number provided by the industry-commissioned reports. Contrary to industry claims, e-cigarettes are more expensive than regular cigarettes and the proposed regulation, the *Control of Tobacco Products and Electronic Delivery Systems Bill*, which aims to regulate e-cigarettes as tobacco products rather than as medicines would benefit public health. Furthermore, the government's proposed tax on e-cigarettes would generate much-needed revenue for the government and reduce e-cigarette uptake by youths.

Summary E-cigarettes were introduced to the South African markets about a decade ago. E-cigarette consumption has grown exponentially without a commensurate decrease in cigarette smoking. Yet, e-cigarettes are not yet regulated as tobacco products as the e-cigarette industry continues to aggressively lobby against the passing of a proposed legislation that would have achieved this. This legislation, the "Control of tobacco products and electronic delivery systems bill", is yet to be passed into law over 4 years after its inception. This narrative review was conducted on peer-reviewed South African literature on e-cigarettes up to December 2021, supplemented by a search of the grey literature, government publications, and industry-commissioned reports. We found that reports commissioned by the e-cigarette industry misrepresented the potential impact of restricting e-cigarette advertisements and promotions. Furthermore, by underestimating the prevalence of e-cigarette use in the population, these reports also attenuated the revenue-generating ability of potential e-cigarette excise taxes as proposed by the South African National Treasury Department. The regulation of e-cigarettes would benefit public health in South Africa.

Keywords E-cigarettes · South Africa · E-cigarette industry · E-cigarette regulation

Introduction

While the use of conventional cigarettes has decreased from 33% in 1993 to 20% in 2017, the use of electronic nicotine delivery systems (ENDS) in South Africa has been increasing, consistent with global trends [1••, 2–4]. ENDS commonly referred to as e-cigarettes and vaping products were first introduced to the South African market about 2008, but have grown exponentially more recently [1••]. E-cigarette marketing, like any other commercial product, is influenced by the mix of what is described in marketing parlance as the five Ps, namely, product, price, promotion, place, and people [5]. These are interdependent factors that influence product sales: what tobacco product to offer, what price to charge for it, how to promote it, where to place it for sale, and who to sell it to. The deployment of the factors under industry

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control (product, price, promotion, and place) may be driven by the free market, by government regulation, or by both. Many aspects of cigarette design, manufacture, and marketing are regulated in South Africa, for example, including the product appearance (product labelling and packaging requirements), price (excise taxes), promotions (bans on advertisements), places sold (restrictions on certain distribution outlets, such as youth-oriented channels and online sales), and people marketed to (minimum purchase age laws that prohibit the sale of tobacco products to those younger than 18 years) [6, 7].

In South Africa, e-cigarettes are currently regulated, but not as tobacco products. According to the South African Medicines and Related Substances Act 101 of 1965 as amended in 2008 [8, 9], nicotine when intended for human medicinal use as an aid to smoking cessation or as a substitute to tobacco products is a schedule 3 substance that can only be dispensed in pharmacies, except if it has been evaluated and approved as a substance that can be sold over the counter, or in general retail stores [8, 10]. In other words, in the absence of an evaluation of e-cigarettes by the appropriate health authorities for safety, quality, and efficacy, the default classification of nicotine-containing e-cigarettes should be as a schedule 3 substance. No such evaluation has occurred, and therefore, e-cigarettes are subject to medicine scheduling and by law can (or should) only be sold at pharmacies [8, 10, 11]. However, in reality, e-cigarettes are marketed as consumer products and sold at kiosks, malls, shops, and online instead of pharmacies [12, 13••].

Several factors have facilitated the emergence of e-cigarettes as a de facto consumer product rather than as a medical product in South Africa. First, there is no well-defined enforcement mechanism for the de jure classification of e-cigarettes as medicines, which has contributed to their ubiquity over a plethora of distribution channels outside those allowed under the current regulation. Second, nicotine-free e-cigarettes are technically not subject to regulation as the basis for medical regulation is nicotine, not the device itself. This creates a legal challenge in consistently and correctly applying the law to all indicated products, especially when the nicotine content is unknown, unclear, or indeterminate [8]. E-cigarette manufacturers have taken advantage of these loopholes and have even sought further gains through litigation. For example, in 2014, the then Medicines Control Council (MCC), Registrar of Medicines, and representatives of the South African Ministry of Health lost a court case against an e-cigarette company that imported "Playboy e-cigarettes" [14]. The e-cigarette company argued that the seizure of a large consignment of their product by regulatory authorities was both unfair because it was targeted at them only and no other similarly marketed e-cigarettes, as well as without merit as their e-cigarettes were not being marketed as smoking cessation aids and therefore could not be classified as medicines. The same legal strategy was used by another e-cigarette manufacturer, Twisp (now owned by British American Tobacco), who argued that since they were not making any health claims, and that e-cigarettes were only used for recreational purposes, the sale and use of their e-cigarettes and refills should not be regulated under the medical act [15].

To close these loopholes and protect public health, the South African government proposed a bill in May 2018 to regulate e-cigarettes as tobacco products rather than as medicines. This bill was called "*The Control of Tobacco Products and Electronic Delivery Systems (CTPENDS) Bill*" (henceforth, the Bill) [16]. Some of the key provisions in this bill concerning "tobacco products and electronic delivery systems" included the following aspects: regulation of their "sale and advertising" (promotion), "packaging and appearance and to make provisions for the standardization of their packaging" (product), regulation of their "manufacturing and export" (product and place), prohibition of "sales to and by persons under the age of 18 years" (people), prohibition of their "free distribution" (price), and prohibition of "sales by means of vending machines" (place). Separately, the South African National Treasury Department also recently published its intention to levy taxes on e-cigarettes [17]. These proposed legislation align with the World Health Organization's (WHO) regulatory framework for ENDS, which recommend provisions for restricting youth-oriented marketing, appealing flavours, attractive design elements, indoor use, and unproven health claims [18].

In support of the regulations, the government raised the following concerns, with supporting evidence mostly drawn from the literature and WHO advisory documents, as only limited studies had been conducted in South Africa at the time [19]: (i) that ENDS//electronic non-nicotine delivery systems (ENNDS) use may act as a potential "gateway" for young people to initiate smoking and lead to regular smoking [20, 21]. (ii) Widespread internet advertising of ENDS/ENNDS could lead to the proliferation of online shops and sales, with a study showing that up to half of ENDS/ENNDS sales are made online [22]. The government acknowledged that regulating ENDS/ENNDS could reduce the market growth, of the e-cigarette industry. However, the government also noted that the e-cigarette market was dominated by one company (Twisp), and that the consequences would not necessarily be in "absolute terms, but relative to past trends and possibly expectations".

More than 4 years later, the Bill still has not been passed as law, despite more recent local studies supporting regulation of e-cigarettes [1••, 13••, 23–31]. E-cigarette manufacturers and retailers have lobbied against the passage of this bill and released at least two reports asserting the bill "is not based on credible evidence" [32–34, 35••]. The first report was published in 2018 and claimed that e-cigarettes

were much cheaper than cigarettes [33]. The second report commissioned by the Vapour Products Association of South Africa (VPASA)—an organisation representing the e-cigarette industry's interests, was published in September 2021 and made several broader economic claims [35••]. Besides direct claims about the extent to which the e-cigarette industry contributes to the economy, the new report made several sweeping claims, including that: (i) the number of e-cigarette users in South Africa is a mere 350,000 (perhaps implying that the size of the market is too trivial to be regulated); (ii) the introduction of the new Bill could see a reduction in sales of vapour products of more than 34% which will affect thousands of jobs in the industry's value chains; (iii) the ban on advertising will limit adult smokers' access to less harmful alternatives to tobacco cigarettes as smokers would be less informed about the benefits of e-cigarettes; (iv) the literature shows that some mediums of advertising such as television (TV), if well regulated, could assist in tobacco control (smoking cessation), suggesting government should not impose a blanket ban over all media; (v) the prohibition on advertising, promotion, and sponsorship of ENDS/ENNDS, as proposed in the Bill, could reduce e-cigarette sales by as much as 11.4% in South Africa, which would be detrimental to the economy; and (vi) if passed, the Bill would lead to an estimated decline in vapour product sales that could lead to a loss in terms of the industry's gross value-added contribution to the GDP.

In this narrative review, we examine the industry's claims through the lens of the published scientific literature on e-cigarettes within the South African context. This synthesis is important as it allows policymakers to evaluate the industry's arguments and to have a complete picture of the pattern of e-cigarette use and the potential impacts of regulation on individual and population harm. Furthermore, given that the current literature mainly covers studies from high-income countries, this review provides a perspective on e-cigarette use and regulation within the context of low- and middle-income countries and the e-cigarette industry's interference in the policy-making process.

Methods

A narrative review was conducted based on available literature up to December 2021. A search for peer-reviewed publications was conducted in PubMed, Embase, SCOPUS, and Web of Science databases, supplemented by a search of the grey literature and government reports. The main terms applied were e-cigarettes AND South Africa, Bill, regulations, marketing, advertising, manufacturers, taxation, cost, vape, smoking cessation, and youth. Literature was considered for inclusion if it was published in English, was conducted in or in relation to South Africa, and was related to e-cigarettes. These articles were reviewed using a targeted framework that sought to empirically evaluate the claims made by the e-cigarette industry in South Africa. In addition to grey literature, a total of 13 peer-reviewed e-cigarette-related studies conducted in South Africa were found, 11 were included [1••, 13••, 23–31], and two were excluded because their subject matter was not related to the discussion of this paper [36, 37]. Results are presented thematically using broad areas discussed in the industry reports based on available literature.

Results

Size of the E-cigarette Market and Number of E-cigarette Users in South Africa

The e-cigarette industry's claim that the number of e-cigarette users is only about 350,000 [35••] represents a gross underestimation of the number from population-level surveillance [1••, 13••, 26]. The most recently available data from a 2018 nationally representative household survey—South African Social Attitudes Survey (SASAS), showed that the number of persons aged 16 or older who used e-cigarettes every day or on some days was almost triple that amount. In 2018, it was estimated that 1.09 million (2.71%) South African adults were using e-cigarettes either every day or on some days [26]. Broken down by frequency of use, 295,081 (0.73%) reported using e-cigarettes every day, while 794,936 (1.98%) reported use on some days. Based on projected growth in e-cigarette consumption by 24.9% during 2018–2021 as forecasted by Euromonitor International [38], the number of e-cigarette users may well have reached 1.36 million by 2021, but this remains to be seen from population-level surveillance (which typically lags behind real time).

As projected by Euromonitor International, the South African e-cigarette market is only expected to grow [38]. The percentage of South Africans aged 16 + years who had ever used an e-cigarette increased four-fold in less than a decade, from 1.10% in 2010 to 4.08% in 2018 [1••]. Market research estimated that the South African e-cigarette market generated $20.7 million in revenue in 2018, and it is predicted to grow up to $62 million by 2024 [12]. This prediction of growth may be correct, as recent analyses of the latest Nielsen retail scanner sales data covering the period 2018–2021 showed an upward trend in e-cigarette volume sales [39]. Furthermore, the sales of e-liquid with higher nicotine content (between 18 and 24 mg/ml) increased from 57.4% in 2018 to 72.4% of total volume sales in 2021, while those with lower nicotine content (labelled content between 0.5 and 8 mg/ml nicotine) dropped from 38.7% in 2018 to 21.8% in 2021 [39]. With none of the e-cigarette companies

complying with the current regulation under the medical act requiring sales only within pharmacies, the increase in volume sales is likely driven by the increase in online marketing and the increasing number of e-cigarette vendors in South Africa [12]. This situation has indeed created an enabling environment for the proliferation of e-cigarette vape shops, promotions, and online marketing, including a large social media presence [12, 13••, 30].

E-cigarette Advertising Ban and Potential Impact on E-cigarette Use

E-cigarette manufacturers have claimed that "the ban on advertising will limit adult smokers' access to less harmful alternatives to tobacco cigarettes as smokers would be less informed about the benefits of e-cigarettes" [35••]. This industry statement is misleading as it disingenuously posits that such advertising serves mainly to inform and educate, contrary to the reality that it stirs emotive pro-tobacco reactions—one of the concerns raised by the government in support of the proposed regulation. Indeed, 61.2% of South African adults surveyed in 2017 feared that e-cigarette advertisements could entice youth to use tobacco products [13••]. As demonstrated in studies among adolescents and youth in the USA, exposure to tobacco advertising was associated with increased appeal and experimenting with tobacco products, including e-cigarettes, while exposure to tobacco promotions was associated with current and ever smoking and vaping [40–42]. In South Africa, Muposhi and Dhurup [24] found a positive relationship between awareness of e-cigarettes and willingness to experiment with them among the youth surveyed. Therefore, the fears of youth being enticed by advertisements expressed by the South African public could be a result of the glamorous advertising and/or promotion of e-cigarettes in South Africa. In January 2018, South Africa's Advertising Standards Authority (ASA), an entity that previously governed and regulated advertising, ordered one of the then South Africa's largest e-cigarette manufacturers—Twisp, to remove an advertisement that was shown on pay-to-view channels, promoting e-cigarettes in a highly glamorous manner [43]. The advertisement in question showed people using e-cigarettes and blowing out colourful hot air balloons, butterflies, and colour swirls. E-cigarette advertising and promotion persists. E-cigarette vendors continue to use smoking cessation, cost-effectiveness, convenience, healthiness, environmental friendliness, hedonic value, and safety as their main selling propositions when marketing e-cigarettes [28]. An example of an advert is shown in Fig. 1. In 2017, one in five (20.1%) of South African adults reported being exposed to an e-cigarette advertisement [13••]. The main sources of exposure to e-cigarette advertisements among those who saw at least one form of

Fig. 1 Billboard advert of e-cigarette store promoting e-cigarette use. [13••] Source: [31].

advertisement were retail stores (40.7%), malls (30.9%), and television (TV) (32.5%).

E-cigarette advertisements have explicitly featured health claims that are misleading. For example, in April 2017, ASA ordered the e-cigarette company—Twisp, to withdraw an advert from South African radio, which stated "E-cigarettes are 95% less harmful than normal cigarettes" [44, 45]. In addition to the previously published scientific critique of the validity of this statement [46], this statement is misleading because it fails to consider the nuances of individual-level harm vs population-level harm. At the level of the individual, e-cigarettes may contain lower levels of harmful and potentially harmful emissions [47]; however, the net effect at the population level may be harmful if they cause never e-cigarette users to start using e-cigarettes, former smokers to relapse into using nicotine, or if they perpetuate nicotine use. Analysis of South African Social Attitudes Survey data showed that while the prevalence of current cigarette smoking did not differ significantly in 2011, 2017, and 2018 when compared to 2010 among those aged 16–34 years, for e-cigarettes, significant increases were seen in 2017 and 2018 when compared to 2010 among this same age group (Fig. 2). If e-cigarettes were associated with cigarette smoking cessation at population level, a decline in smoking prevalence should have been seen among this group. Rather than being associated with smoking cessation, findings from South African studies showed the opposite at an individual level, with one nationally representative study showing an association between e-cigarette use with higher rates of relapse [25], another study among e-cigarette users showed that e-cigarette use was not effective as a cessation aid as all users relapsed after "a few months of quitting" [29]. Two studies among learners from higher learning institutions in one of the provinces in South Africa showed that e-cigarette

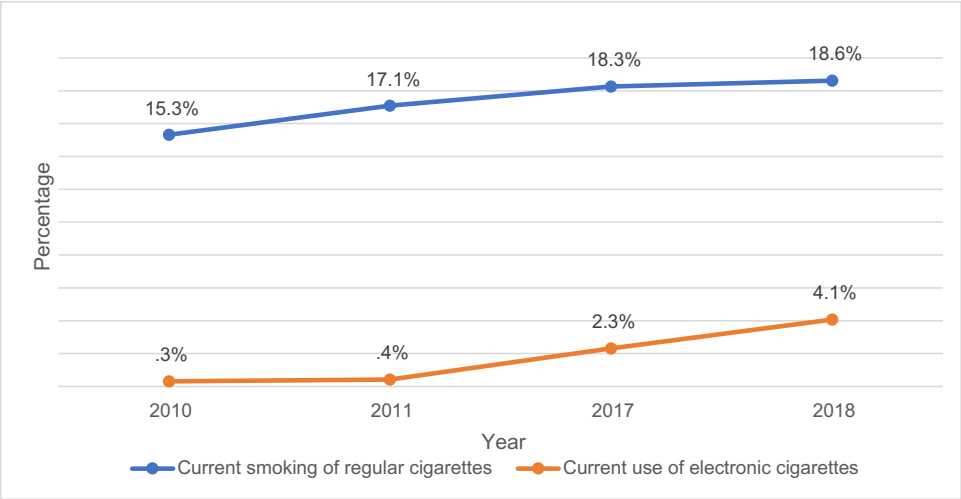

Fig. 2 Trends in current use of regular and electronic cigarettes among persons aged 16–35 years in South Africa during 2010–2018. Source: 2010–2018 South African Social Attitudes Survey

users did not perceive e-cigarettes as quitting aids [24, 48]. Furthermore, almost all current e-cigarette users (97.5%) in South Africa reported concurrent regular use of cigarettes in 2018, and among ever e-cigarette users, 43.5% were current combustible tobacco smokers [27]. Evidence also does not show that e-cigarette users in South Africa have significantly reduced average number of cigarettes consumed per day [1••]. Additionally, in the South African context, most ever e-cigarette users are older adolescents and young adults [1••, 29]. This raises concerns because nicotine exposure during adolescence can cause addiction and can harm brain development which continues well into the third decade of life [49].

The e-cigarette industry's claim that "the literature shows that some mediums of advertising, if well regulated, could assist in tobacco control (smoking cessation)" is also inconsistent with data from South Africa [27]. A South African study demonstrated that advertising exposure, irrespective of the medium, was associated with positive norms/beliefs about e-cigarettes [13••]. Furthermore, the WHO Framework Convention for Tobacco Control (WHO FCTC) requires parties to ban "ALL" forms of advertisements, promotions, and sponsorship, a recommendation at odds with the industry's preferred scope of policy implementation. In addition, e-cigarette shops with colourful, sleek branding are proliferating in the public space in South Africa [30, 50]. In March 2021, following the launch of the e-cigarette brand—Vuse, the British American Tobacco (BAT) announced plans to open 67 "Vuse inspiration" stores throughout South Africa [50]. This would increase the number of e-cigarette shops by more than 25% when compared to previously reported 240 vape shops [30]. Although these Vuse inspiration stores indicate that the product is not to be sold to persons under the age of 18 [51], but this may not necessarily prevent underage access given that a previous adolescent study in South Africa has shown that about 70% of 13–15 year-olds were not refused the sale of cigarettes because of age [52]; the basis for concern about such proliferation of e-cigarette shops is therefore related to the potential to increase both access to, and appeal of e-cigarettes to youth [30]. For example, these planned Vuse inspiration stores are to be equipped with "flavour bars", offering attractive flavours to entice customers, particularly youth (Fig. 3) [53]. To promote their Vuse brand—a nicotine salt e-cigarette, BAT also launched a "festival of inspiration" featuring top artists and celebrities in the month of June 2021 (commonly referred to as youth month in South Africa) [53]. The festival was streamed through a four-part series with discounts and prizes up for grabs.

Furthermore, a study [31] found that almost half (49.6%) of the 240 e-cigarette vape shops identified between 2016 and 2018 in SA were within a 5-km radius to higher education institutions. This exposes youth and young adults to point-of-sale e-cigarette advertisements and it increases their susceptibility to e-cigarette use [30, 54]. Most of the new Vuse shops are strategically located at high-end shopping

Fig. 3 "Vuse inspiration" concept store. Source: Bizcommunity.com

malls, targeting working adults, youth, and affluent groups that often visit these malls.

Given the observations that the increase in young adults' e-cigarette use was not associated with a corresponding decrease in cigarette smoking [1••], that e-cigarettes used were associated with increased relapse rates among adult smokers, and that youth aged 16–19 years reported the highest prevalence of e-cigarette advertisement exposure (24.6%) [13••, 25], the e-cigarette industry's conclusion that banning e-cigarette advertisements would "reduce e-cigarette sales by as much as 11.4% in South Africa" is welcomed news if the projections are accurate, rather than the public health disaster the industry makes it to be.

Potential Impacts of E-cigarette Regulation on Government Revenue Generation

Copying the tactics from their cigarette-manufacturing counterparts of exaggerating the potential economic impacts of tobacco control regulation [55], e-cigarette manufacturers in South Africa claimed that if the Bill is passed as law, the ensuing decline in vapour product sales could diminish their industry's gross value-added contribution to the GDP. It is pertinent to note that the user estimates, procurement, tax, human resources, and financial data used as input data for estimation of the economic impact of the proposed bill in the industry's own commissioned report were from the e-cigarette industry itself, some as reported a year before the report [56••]. As mentioned earlier, the government acknowledged that the proposed bill would negatively affect the growth of the e-cigarette industry, but argues that the public health benefit of the proposed bill outweighs any negative impact on the growth of the e-cigarette industry [19]. Since their introduction to the South African market, e-cigarettes have not been taxed, but the National Treasury recently proposed to introduce an e-cigarette tax with effect from January 2023 [17]. In 2018, it was estimated that the South African government lost up to R2.20 billion ($143 million) (95% CI: 0.96–3.44) of potential revenue from e-cigarette excise tax if it were taxed at 75% of the cigarette tax rate as then proposed for heated tobacco products [26]. If taxed at 37.5% of the cigarette tax rate—half of the proposed rate, the projected revenue was up to R1.10 billion ($71.5 million) (95% CI: 0.48–1.72) [26]. Therefore, even with the implementation of the bill and the projected revenue comes at the lower end, implementing excise taxes on e-cigarettes may generate significant revenue for public good in general, including for comprehensive tobacco control/prevention efforts.

Furthermore, it is estimated that the average South African daily e-cigarette user spends between R8575 ($560) to 19,781 ($1292) on e-cigarettes per year (vs mean daily cigarette smoking cost of R6693 ($437) annually) [26]. This finding is at odds with the conclusion of the 2018 industry report [33], which claimed that e-cigarette use is far cheaper than cigarette smoking. The findings suggest that e-cigarettes may be relatively more expensive than cigarettes in South Africa; by contrast, in some high-income countries, e-cigarettes are cheaper than cigarettes, which is not surprising given high cigarette prices [57]. In the USA, for example, the federal excise tax increased from 24 cents per cigarette pack in 1995 to $1.01 per pack in 2009 (321% increase), and the average state excise tax increased from 32.7 cents per pack to $1.20 per pack during the same period (267% increase) [57]. The 52% tax incidence on cigarettes targeted by the South African Treasury Department since 2006 (which includes both value-added tax then at 14% and excise tax burden, at approximately 40%) [58] is much smaller compared to many high-income countries [59]. For example, this tax share is smaller than that of the European Union/European Economic Area member states with the least cigarette tax share [60]. This underscores the need to increase the tax incidence on cigarettes to meet the recommended minimum 75% tax share.

It is pertinent to also note that the estimated price elasticities of demand for e-cigarettes are between −0.53 and −0.60 [61]. These numbers indicate that for a 10% increase in price, the demand for e-cigarette will only drop by between 5.3 and 6%. Indeed, several non-price factors have influence on tobacco use behaviour, including product appeal, chemosensory characteristics, perceived health benefits, access, and perceived social norms [62]. In the USA, for example, chewing tobacco carries a much lower tax and overall price than cigarettes; yet uptake of smokeless tobacco remains relatively low even though it equally remains a viable alternative to access nicotine [63]. Similarly, the fact that smokeless tobacco products are not taxed in South Africa has not led to significant number of smokers' interest in shifting to this product [64]. However, as e-cigarette product innovation is ongoing, regular market surveillance would be needed to determine any possible change in behaviour as a result of whatever excise tax structure is finally imposed on e-cigarettes in South Africa. In particular, further research would be needed on how the proposed excise tax would influence youth access to the increasing availability of relatively less expensive disposable e-cigarettes.

Discussion

From a regulatory point of view, the review of e-cigarette literature in South Africa indicates that context matters. The regulation of e-cigarettes in South Africa can inform policy globally, with emphasis on the importance of context-specific regulation. For example, the context of the e-cigarettes in South Africa differs from that of the UK, where e-cigarettes are reportedly not considered a gateway

for cigarette use among the youths and used as smoking cessation aids [65], whereas in South Africa e-cigarettes are not effective long-term cessation aids [25]. Hence, the need to ensure the policy process clearly articulates the context for which policy or regulatory action is being sought. For example, a recent global tobacco epidemic report suggests that many African countries with smoking prevalence less than 10% would need to double up the implementation of the well-tested WHO FCTC supply and demand measures [66] and not the harm reduction approach. A harm reduction approach, such as promoting "less harmful" nicotine products, including e-cigarettes may distract African countries from the evidence-based WHO FCTC provisions, such as raising tobacco taxes, using pictorial/graphic warnings on plain standard packages, and promoting evidence-based smoking cessation therapy, which have not been well implemented in many of the African countries [67]. The poor implementation of WHO FCTC for cigarette regulation should not be used as an excuse not to introduce e-cigarettes regulation in markets at an early stage of the tobacco epidemic, which is characterised by relatively low tobacco-related mortality among men and low prevalence of use among women, as currently observed in many countries in Africa [66, 68]. Finally, complex regulatory approaches in jurisdictions with limited enforcement capacity may not be effective as the case in South Africa with regulating nicotine-containing e-cigarettes as medicines. With most countries having established a tobacco control infrastructure, it would be advisable to regulate e-cigarettes as tobacco products as done in the USA under the US Food and Drug Administration.

Rapid passage of the tobacco control bill can benefit public health. Four reasons warrant the urgent regulation of e-cigarettes in South Africa, namely; (i) e-cigarettes use is rapidly increasing in South Africa [1••]; (ii) older adolescents and young adults aged 34 years or younger make up most of the current e-cigarette users in South Africa, most of whom concurrently smoke cigarettes [1••]; (iii) there is currently no scientific evidence that e-cigarettes use is associated with long-term smoking cessation among South African smokers, but evidence suggests that e-cigarette use may increase the odds of relapse [25]; (iv) there is aggressive marketing or promotion of e-cigarettes even on media that are prohibited for tobacco products, including TV and billboards [31]. The increase in the use, marketing, and sales of e-cigarettes can be attributed to the lack of regulation of ENDS/ENNDS in South Africa.

This study has some limitations. First, this was a narrative review and as such there was no formal quality appraisal of the literature used. Also, the search and therefore the number of issues addressed in the industry's report was constrained by the number of published literature within South Africa which was relatively limited. Nonetheless, this represents the first and the most comprehensive review of the situation of e-cigarette use and regulation in the World Health Organization Africa region and an evidence-based argument for regulating e-cigarettes in South Africa.

Conclusion

South Africans, especially older adolescents and young adults, have experienced an exponential growth in e-cigarette use, with no commensurate decrease in regular cigarette smoking over the same 10-year period. The consideration for regulation of e-cigarettes should go beyond potential reduction of individual harm or potential generation of revenue for the government, but also a consideration of potential population harm. Findings from this review suggest that the regulation of e-cigarettes as currently proposed by the South African government will benefit public health.

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Declarations

Conflict of Interest The authors declare no competing interests.

References

Papers of particular interest, published recently, have been highlighted as:
•• Of major importance

1.•• Ayo-Yusuf OA, Omole OB. Smoking cessation advice and quit attempts in South Africa between 2007 and 2017: a cross-sectional study. TobInduc Dis. 2021;19:11. **The purpose of this study was to assess trends in quitting advice received from healthcare professionals among current smokers in South Africa, both before and after the WHO FCTC adopted the Article 14 guidelines, and it explored the relationship between quit advice, e-cigarette use, and quit attempts. While the prevalence of e-cigarette use was not the main aim of the study, this was the first and only study in South Africa that showed the trend of e-cigarette use between 2010 and 2017. And despite the increase in the uptake of e-cigarettes during that period, the study found no significant change in smoking or quitting behaviour, even though the e-cigarette industry argues that e-cigarettes are an effective tool for smoking cessation. The authors are experts in the field of tobacco control.**

2. Kalideen S. A hefty tobacco tax increase will raise revenue and improve health. Daily Maverick. 2019. Available at https://www.dailymaverick.co.za/article/2019-10-29-a-hefty-tobacco-tax-increase-will-raise-revenue-and-improve-health/. Accessed 29 Nov 2021.

3. Van Walbeek C. The economics of tobacco control in South Africa [Internet]. University of Cape Town; 2005. Available from: http://www.reep.uct.ac.za/sites/default/files/image_tool/

images/405/People/Staff_research/Corne/van-walbeekcp-the-economics-of-tobacco-control-in-south-africa1%20%281%29.pdf. Accessed 21 Nov 2021.
4. Southern Africa Labour and Development Research Unit. National Income Dynamics Study 2017, wave 5 dataset. [Internet]. 2018. Available from: http://www.nids.uct.ac.za/images/documents/201901-NIDS-W5Overview-V1.0.pdf. Accessed 21 Nov 2021.
5. Ennew C. The marketing blueprint [Internet]. 1st ed. Oxford: Blackwell Business; 1993. pp. 238–41. Available from: https://openlibrary.org/books/OL1728208M/The_marketing_blueprint. Accessed 21 Nov 2021.
6. South African Government. Tobacco Products Control Act 83 of 1993 [Internet]. Cape Town; 2022. Available from: https://www.gov.za/sites/default/files/gcis_document/201409/act83of1993.pdf
7. World Health Organization. WHO framework convention on tobacco control [Internet]. 2003. Available from: https://fctc.who.int/publications/i/item/9241591013. Accessed 21 Nov 2021.
8. Government Gazettes. Medicines and Related Substances Act No. 101 of 1965 [Internet]. 2017. Available from: https://www.sahpra.org.za/wp-content/uploads/2020/02/Government_Gazette_Medicines_and_Devices_Act_Jun_2017-1.pdf. Accessed 24 Jan 2022.
9. Government Gazette. Medicines and Related Substances Act [Internet]. 2020. Available from: https://www.sahpra.org.za/wp-content/uploads/2020/02/Government_Gazette_Medicines_and_Devices_Act_Jun_2017-1.pdf. Accessed 24 Jan 2022.
10. Motala I, Judin M. Legal status of e-cigarettes in South Africa [Internet]. 2014. Available from: https://cansa.org.za/files/2014/06/Legal-Status-of-e-Cigarettes-in-South-Africa.pdf. Accessed 12 Dec 2021.
11. Bateman C. Smoke, fire and mirrors: the e-cigarette debate. Vol. 103, South African medical journal = Suid-Afrikaanse tydskrif vir geneeskunde. South Africa; 2013;818–9.
12. Research and Markets. South Africa e-cigarette market [Internet]. 2020. Available from: https://www.researchandmarkets.com/reports/4844626/south-africa-e-cigarette-market-research-repor. Accessed 17 Dec 2021.
13.•• Agaku I, Egbe C, Ayo-Yusuf O. E-cigarette advertising exposure among South African adults in 2017: findings from a nationally representative cross-sectional survey. BMJ Open [Internet]. 2021;11(8):e048462. Available from: http://bmjopen.bmj.com/content/11/8/e048462.abstract. **According to the World Health Organization (WHO) MPOWER framework, parties to the WHO FCTC should enforce bans on tobacco advertising, promotion, and sponsorship. South Africa has proposed a new tobacco control bill, the Control of Tobacco and Electronic Delivery Systems Bill, which seeks to regulate e-cigarettes, including their advertising, promotion, and sponsorship. It was important to assess the extent of e-cigarette marketing in South Africa and examine whether certain subgroups were being targeted (i.e., youth). The study found that exposure to e-cigarettes was higher (24.6%) among South African youths aged 16–19 years compared to older age groups. The results of the study further indicated that youths among this age group were least likely to support the banning of e-cigarette use in public areas, nor did they support the restriction of e-cigarette advertisements. This suggested that they were more receptive to e-cigarette advertisement and e-cigarette use among them was acceptable, and thus highlighted the need to regulate the advertising, marketing, and sponsorship of e-cigarettes in South Africa in order to prevent and reduce uptake of e-cigarettes, particularly among youths.**
14. South African Legal Information Institute. Quick Drink Co (Pty) Ltd and Another v Medicines Control Council and Others (64056/2014) [2014] ZAGPPHC 904; 2015 (5) SA 358 (GP) (11 November 2014) [Internet]. 2014. Available from: http://www.saflii.org/za/cases/ZAGPPHC/2014/904.html. Accessed 22 Dec 2021.
15. Child K. Retailers of e-cigarettes "breaking law." Times Live [Internet]. 2014. Available from: https://www.timeslive.co.za/news/south-africa/2014-06-23-retailers-of-e-cigarettes-breaking-law/. Accessed 16 Jul 2022.
16. Government Gazette. Control of tobacco products and electronic delivery systems bill: draft [Internet]. 2018. Available from: https://www.gov.za/sites/default/files/gcis_document/201805/41617gon475re.pdf. Accessed 24 Jan 2022.
17. National Treasury. Taxation of electronic nicotine and non-nicotine delivery systems [Internet]. 2021. Available from: http://www.treasury.gov.za/comm_media/press/2021/TaxPolicyDiscussion/20211121501%20Discussion%20Paper%20-%20Taxation%20of%20Electronic%20Nicotine%20Non-Nicotine%20Delivery%20Systems%20(Vaping).pdf. Accessed 24 Jan 2022.
18. World Health Organization. Tobacco: e-cigarettes [Internet]. 2022. Available from: https://www.who.int/news-room/questions-and-answers/item/tobacco-e-cigarettes. Accessed 14 Jul 2022.
19. The National Department of Health. Socio-economic impact assessment system (SEIAS) on the control of tobacco products and electronic delivery systems bill [Internet]. 2018. Available from: https://static.pmg.org.za/180322seias_-_ndoh_tpc_bill.pdf.
20. King AC, Smith LJ, McNamara PJ, Matthews AK, Fridberg DJ. Passive exposure to electronic cigarette (e-cigarette) use increases desire for combustible and e-cigarettes in young adult smokers. Tob Control. 2015;24(5):501–4.
21. King BA, Patel R, Nguyen KH, Dube SR. Trends in awareness and use of electronic cigarettes among US adults, 2010–2013. Nicotine Tob Res Off J Soc Res Nicotine Tob. 2015;17(2):219–27.
22. Zhu S-H, Sun JY, Bonnevie E, Cummins SE, Gamst A, Yin L, et al. Four hundred and sixty brands of e-cigarettes and counting: implications for product regulation. Tob Control. 2014;23 Suppl 3(Suppl 3):iii3-9.
23. Egbe CO, London L, Kalideen S, Delobelle P, Datay I. The need to regulate electronic cigarettes amidst health concerns: let's follow the evidence. South African Med J [Internet]. 2020;110(3):178. Available from: http://www.samj.org.za/index.php/samj/article/view/12866. Accessed 17 Aug 2021.
24. Muposhi A, Dhurup M. Is vaping a panacea or peril? Consumers' attitudes towards electronic cigarettes and relationship with quitting intention. African J Phys Act Heal Sci [Internet]. 2016;22(31):655–66. Available from: https://hdl.handle.net/10520/EJC195995.
25. Agaku I, Egbe CO, Ayo-Yusuf O. Associations between electronic cigarette use and quitting behaviours among South African adult smokers. Tob Control. 2021.
26. Agaku IT, Egbe CO, Ayo-Yusuf OA. Potential revenue from taxing e-cigarettes and comparison of annual costs of daily e-cigarette use versus daily cigarette smoking among South African adults. Tob Induc Dis. 2021;19:7.
27. Agaku I, Egbe C, Ayo-Yusuf O. Utilisation of smoking cessation aids among South African adult smokers: findings from a national survey of 18 208 South African adults. Fam Med community Heal. 2021;9(1).
28. Dhurup M, Muposhi A. A content analysis of e-cigarettes selling propositions on South African retail websites. J Transdiscipl Res South Africa [Internet]. 2018;14(1). Available from: https://doi.org/10.4102/td.v14i1.552.

29. Naidoo M, Mbonane TP, Mathee A. Risk factors and perceptions of e-cigarette use among selected users in Johannesburg. South Africa J Community Health. 2021;46(2):405–12.
30. Agaku IT, Egbe CO, Ayo-Yusuf OA. Geospatial spread of e-cigarette vape shops in South Africa and the relationship with tobacco product use among adults. Health Place. 2021;68:102507.
31. Agaku IT, Egbe CO, Ayo-Yusuf OA. Circumvention of COVID-19-related restrictions on tobacco sales by the e-cigarette industry in South Africa and comparative analyses of heated tobacco product vs combustible cigarette volume sales during 2018–2020. Prev Med (Baltim). 2021;148:106526.
32. Daily Maverick. The cigarette industry is being disingenuous in its efforts to oppose draft tobacco control laws. 2018. Available from: https://www.dailymaverick.co.za/article/2018-09-06-the-cigarette-industry-is-being-disingenuous-in-its-efforts-to-oppose-draft-tobacco-control-laws/. Accessed 14 July 2022.
33. Canback. Analysing the market of vaping and its economic impact in South Africa [Internet]. 2018. Available from: https://drive.google.com/file/d/0B3bdiKtnkgmjT3lYWjFUdDBOTm9oakQ3NmQwSW4yU05FMTN3/view?resourcekey=0-bSwXXCSUnWN-GtFWPf8bKA. Accessed 13 Dec 2021.
34. Ivo Vegter. Tobacco Bill unjustified by government's own impact assessment. Daily Maverick [Internet]. 2018; Available from: https://www.dailymaverick.co.za/opinionista/2018-07-31-tobacco-bill-unjustified-by-governments-own-impact-assessment/. Accessed 14 July 2022.
35.•• NKC African Economics. The economic impact of the vaping industry in South Africa [Internet]. 2021. Available from: https://drive.google.com/drive/folders/117QLwokQar3U9EyVamQsj2Pr5m6TE1ue. **Exaggerating the economic importance of the industry is one of the main forms of tobacco industry interference. This report shows findings from a study commissioned by the Vapour Products Association of South Africa (VPASA); they demonstrate the supposed substantial contribution of vapes, e-cigarettes, and heat-not-burn products to the South African economy. The report was published in September 2021, a critical period for tobacco control in South Africa, as the country anticipated the passing of new tobacco control bill. To date (at the time of writing this review), the bill has not been passed.**
36. Johnson N, Venter M. Factors affecting consumer resistance to innovation diffusion of e-cigarettes. J Econ Behav Stud [Internet]. 2016;8(5(J)):108–19. Available from: https://ojs.amhinternational.com/index.php/jebs/article/view/1436. Accessed 21 Jul 2022.
37. Van Staden SR., Groenewald M, Engelbrecht R, Becker PJ, Hazelhurst LT. Carboxyhaemoglobin levels, health and lifestyle perceptions in smokers converting from tobacco cigarettes to electronic cigarettes. South African Med J [Internet]. 2013;103(11):865–8. Available from: http://www.scielo.org.za/pdf/samj/v103n11/26.pdf.
38. Euromonitor International. Cigarettes in South Africa [Internet]. 2020. Available from: https://www.euromonitor.com/cigarettes-in-south-africa/report. Accessed 17 Dec 2021.
39. Ayo-Yusuf OA, Jakavula JL, Nkosi LG, Kali KS AI. [Abstract] E-cigarettes sales trends and market share from South African sales scanner data. Society for Research on Nicotine and Tobacco 2022 annual meeting; 2021.
40. Moran MB, Heley K, Czaplicki L, Weiger C, Strong D, Pierce J. Tobacco advertising features that may contribute to product appeal among US adolescents and young adults. Nicotine Tob Res Off J Soc Res Nicotine Tob. 2021;23(8):1373–81.
41. Agaku IT, Ayo-Yusuf OA. The effect of exposure to pro-tobacco advertising on experimentation with emerging tobacco products among U.S. adolescents. Heal Educ Behav Off Publ Soc Public Heal Educ. 2014;41(3):275–80.
42. Fielding-Singh P, Epperson AE, Prochaska JJ. Tobacco product promotions remain ubiquitous and are associated with use and susceptibility to use among adolescents. Nicotine Tob Res Off J Soc Res Nicotine Tob. 2021;23(2):397–401.
43. Africa Center for Tobacco Industry Monitoring and Policy Research. E-cigarette advert to be pulled off air [Internet]. 2018. Available from: https://www.atim.co.za/2018/03/e-cigarette-advert-to-be-pulled-off-air/. Accessed 13 Dec 2021.
44. Mosupi A. ASA blows smokes on Twisp vaping claim. Sowetan Live [Internet]. 2017. Available from: https://www.sowetanlive.co.za/business/2017-05-06-asa-blows-smokes-on-twisp-vaping-claim/.
45. Africa Check. No scientific credibility to claim that vaping is 95% safer than cigarettes [internet]. 2017. Available from https://www.wits.ac.za/news/latest-news/research-news/2017/2017-07/no-scientific-credibility-to-claim-that-vaping-is-95-safer-than-cigarettes.html. Accessed 3 Nov 2022.
46. E-cigarettes: Public Health England's evidence-based confusion. [Internet]. Vol. 386, Lancet (London, England). England; 2015. p. 829. Available from: https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(15)00042-2/fulltext.
47. Centers for Disease Control and Prevention (CDC). About electronic cigarettes (e-cigarettes) [Internet]. 2021. Available from: https://www.cdc.gov/tobacco/basic_information/e-cigarettes/about-e-cigarettes.html. Accessed 27 Nov 2021.
48. Muposhi A, DM. Diffusion of electronic cigarettes as a smoking cessation aid among young consumers. Int J Bus Manag Stud [Internet]. 2016;8(1). Available from: https://dergipark.org.tr/tr/download/article-file/255723.
49. Kolb B, Gibb R. Brain plasticity and behaviour in the developing brain. J Can Acad Child Adolesc Psychiatry = J l'Academie Can Psychiatr l'enfant l'adolescent. 2011;20(4):265–76.
50. Bizcommunity. Batsa begins rollout of Vuse inspiration stores in SA. 202. Available from: https://www.bizcommunity.com/Article/196/182/214351.html. Accessed 25 Nov 2021.
51. Vuse. Legal vaping age [Internet]. 2022. Available from: https://www.vuse.com/za/en/know-your-vape/legal-vaping-age. Accessed 29 Sep 2022.
52. Chandora R, Song Y, Chaussard M, Palipudi KM, Lee KA, Ramanandraibe N, et al. Youth access to cigarettes in six sub-Saharan African countries. Prev Med (Baltim). 2016;91S:S23–7.
53. Vuse. Vuse inspired live: a festival of inspiration [Internet]. 2021. Available from: https://www.vuse.com/za/en/blog/post/inspired-live-2021. Accessed 13 Dec 2021.
54. Giovenco DP, Casseus M, Duncan DT, Coups EJ, Lewis MJ, Delnevo CD. Association between electronic cigarette marketing near schools and e-cigarette use among youth. J Adolesc Heal Off Publ Soc Adolesc Med. 2016;59(6):627–34.
55. Warner KE. The economics of tobacco: myths and realities. Tob Control. 2000;9(1):78–89.
56.•• Stoddard E. Interview: SA's vaping industry is going up in smoke. Daily Maverick [Internet]. 2020. Available from: https://www.dailymaverick.co.za/article/2020-07-22-interview-sas-vaping-industry-is-going-up-in-smoke/. Accessed 12 Oct 2022. **It is particularly strange that the reference estimates of number of users and economic contribution stated in the 2021 report were similar to that offered in a published newspaper article exactly a year earlier and referenced in the report (Stoddard, E. 2020. Interview: SA's vaping industry is going up in smoke. Business Maverick.**
57. Centers for Disease Control and Prevention (CDC). Federal and state cigarette excise taxes — United States, 1995–2009. MMWR [Internet]. 2009;58(19):524–7. Available from: http://medbox.iiab.me/modules/en-cdc/www.cdc.gov/tobacco/data_statistics/mmwrs/byyear/2009/mm5819a2/highlights.htm. Accessed 17 Dec 2021.

58. Linegar DJ, van Walbeek C. The effect of excise tax increases on cigarette prices in South Africa. Tob Control. 2018;27(1):65–71.
59. World Health Organization. WHO report on the global tobacco epidemic, 2017. Technical note III. Tobacco taxes in WHO member states. [Internet]. 2017. Available from: https://untobaccocontrol.org/impldb/wp-content/uploads/mozambique_2018_annex-1_WHO_report_on_the_global_tobacco_epidemic_2017.pdf. Accessed 17 Dec 2021.
60. Chaloupka F, Drope J, Siu E, Vulovic V, Mirza M, Rodriguez-Iglesias G, et al. Tobacconomics cigarette tax scorecard 2nd edition [Internet]. Chicago. 2021. Available from: https://tobacconomics.org/files/research/738/tobacco-scorecard-report-2nd-ed-eng-v5.0-final-1.pdf. Accessed 31 Jan 2022.
61. Corrigan JR, O'Connor RJ, Rousu MC. Which smokers adopt e-cigarettes and at what price? An experimental estimation of price elasticity of demand and factors correlated with e-cigarette adoption. Addict Behav. 2020;105:106324.
62. National Center for Chronic Disease Prevention and Health Promotion (US) Office on Smoking and Health. The health consequences of smoking—50 years of progress: a report of the surgeon general. Atlanta (GA): Centers for Disease Control and Prevention (US) [Internet]. 2014. Available from: https://www.ncbi.nlm.nih.gov/books/NBK179276/. Accessed 19 Sep 2021.
63. Centers for Disease Control and Prevention (CDC). Smokeless tobacco product use in the United States [Internet]. 2021. Available from: https://www.cdc.gov/tobacco/data_statistics/fact_sheets/smokeless/use_us/index.htm. Accessed 3 Feb 2022.
64. Ayo-Yusuf OA, Agaku IT. Intention to switch to smokeless tobacco use among South African smokers: results from the 2007 South African Social Attitudes Survey. PLoS One. 2014;9(4):e95553.
65. Rough E. The regulation of e-cigarettes [Internet]. 2022. Available from: https://commonslibrary.parliament.uk/research-briefings/cbp-8114/. Accessed 13 Jul 2022.
66. World Health Organization. WHO report on the global tobacco epidemic, 2021. Addressing new and emerging products [Internet]. 2021. Available from: https://apps.who.int/iris/bitstream/handle/10665/343287/9789240032095-eng.pdf. Accessed 25 Jul 2022.
67. Egbe CO, Magati P, Wanyonyi E, Sessou L, Owusu-Dabo E, Ayo-Yusuf OA. Landscape of tobacco control in sub-Saharan Africa. Tob Control. 2022;31(2):153–9.
68. Blecher E, Ross H. Tobacco control in Africa: tobacco control through prevention [Internet]. 2013. Available from: https://www.iccp-portal.org/system/files/resources/acspc-041294.pdf. Accessed 30 Sept 2022.