

Taxation options for nicotine and tobacco products in Switzerland – a review of tax policies

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Summary

Alternative nicotine products such as electronic nicotine delivery systems (ENDS) and tobacco heating systems have gained worldwide popularity. Findings suggest ENDS to be probably less harmful than combustible cigarettes, but evidence on long-term health effects is still lacking. The potential risk reduction by using tobacco heating systems instead of combustible cigarettes has largely been studied by tobacco industry-sponsored research. Evidence on the extent of risk reduction is key for risk-adapted taxation policies, which will be discussed soon in the Swiss parliament. Evidence on the effects of tax policies in the USA shows that the level of taxation of ENDS, tobacco heating systems and combustible cigarettes has an effect on switches between these products. Therefore, excise taxes influencing one another need to be considered. In Switzerland, tobacco heating systems are currently taxed at a level of 12%, whereas ENDS are not subject to tobacco excise taxation as yet, because they do not meet the legal definition of a tobacco product. This article analyses approaches for imposing taxes on tobacco and nicotine products and possible outcomes, depending on the intended public health goals.

At least three tax models can be considered. Tax model A would apply a very small tax on ENDS and a higher tax for tobacco products, which could increase incentives for smokers to switch to vaping but comes with risks of increased vaping initiation among the youth and subsequent switch to or dual use of tobacco products. In contrast, model B would levy a moderate tax on ENDS and an increased tax on tobacco products, which could limit initiation among youth, incentivise to switch from smoking to vaping and discourage dual use. In model C, a comparable tax level for ENDS, tobacco heating systems and combustible cigarettes is levied. This could have overall positive effects in reducing tobacco- and nicotine-associated burden of disease by discouraging initiation in youth, overall consumption and dual use, but could discourage switching to less harmful products. When applying these tax models to current sales prices of these products we found that no public health goal, such as protecting youth and reducing tobacco-associated morbidity and mortality can be achieved. The price of tobacco products is too low

to achieve any price differentiation that reflects the different risks associated with ENDS and tobacco products. In order to achieve any public health goal with one of these tax models, prices for tobacco products need to be increased substantially.

Introduction

Tobacco products: combustible cigarettes and tobacco heating systems

In Switzerland, 9500 people die every year as a result of smoking-related noncommunicable diseases, which makes tobacco consumption the most common cause of preventable deaths [1]. According to the Federal Office of Public Health (FOPH), 27% of the Swiss population aged older than 15 years regularly smoked in 2017. In young adults aged 15 to 24 years as much as 32% indicated that they were smokers [2]. In a recent report, a private research institute estimated that addiction caused economic costs of almost CHF 12 billion, with tobacco consumption being responsible for half of the costs, followed by alcohol and illicit drugs [3].

There are a number of alternative tobacco products, which are consumed in ways different from conventional smoking [1]. Tobacco heating systems have been available in Switzerland since 2015, and consist of a charger, a holder, disposable tobacco sticks and plugs or capsules [4]. In 2016, 2% of the population older than 15 years indicated they had used tobacco heating systems at least once and 8% of smokers indicated they had tried them. Furthermore, 0.3% of the people were using a tobacco heating system at least once a week and 0.2% were using them on a daily basis. [5]

In tobacco heating systems, tobacco is not combusted but heated up to around 330°C (depending on the product brand) as compared with around 800°C for combustible cigarettes [6, 7]. In Switzerland, tobacco heating systems are legally defined as “other tobacco products” and are subject to tobacco excise taxation at an ad valorem rate of 12%, which is much less than the tax level of 53% of the price per pack of combustible cigarettes [8]. In the US, tobacco heating systems and also snus, which are a tobacco product for oral use, have been categorised as “modified risk tobacco product” by the US Food and Drug

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Administration (FDA), which enables the manufacturer to sell them with a product-specific, 5-years limited, modified risk claim in order to market these products as less harmful compared with smoking [9–11]. Nevertheless, this does not mean these products are safe. Most studies regarding the safety of tobacco heating systems are tobacco industry-sponsored [4]. An independent study from Auer et al. [7], however, indicated that harmful constituents contained in conventional tobacco smoke are also found in the smoke released by tobacco heating systems.

Electronic nicotine delivery systems (ENDS)

In contrast to the taxation of combustible cigarettes and tobacco heating systems, ENDS are currently not regulated under tobacco legislation and therefore not subject to tobacco excise taxation. The reason is that ENDS do not meet the legal definition of a tobacco product since they do not contain regular tobacco and do not have a combustion process, meaning that they are not being “smoked” but “vaped” [12]. However, they still contain nicotine and other toxic substances such as formaldehyde [13]. Even though ENDS vary widely in their appearance and can be refillable and disposable devices, they generally consist of a battery, a heating coil, a mouth piece and a cartridge containing liquid or a pod containing nicotine salts [14].

Suchtmonitoring Schweiz [5] indicated 15% ever-use of ENDS among people aged older than 15 years in 2016, with a major part of vapers being current smokers and young adults. In 2018, ever-use among minors was very high at 51% among boys and 35% among girls, which makes ENDS after alcohol the most often consumed psychoactive substance among minor, school-aged children [15]. Of the population older than 15 years, 0.4% indicated that they vape daily, 0.7% do so weekly and 1.6% indicated that they had used ENDS in the past 30 days before the inquiry [5, 15, 16].

Current research suggests that ENDS might function as a gateway to nicotine addiction, especially for young consumers and additionally often lead to dual use of combustible cigarettes and vaping devices [13, 17]. A recent study indicated that tobacco consumption among smokers slightly increased during the lockdown in 2020 [18]. Back in 2011, ENDS were considered as a smoking cessation aid (Motion Zanetti) and therefore excluded from tobacco taxation and regulated under food law (Foodstuffs Act) [1, 19]. Therefore, they were subject only to a value-added tax (VAT) of 7.7%.

Recent research suggests that smoking abstinence is more likely to be achieved with ENDS containing nicotine than with a placebo (ENDS not containing nicotine) or nicotine replacement therapy; however, the quality of evidence is low [20, 21]. Nonetheless, quit attempts by using ENDS are likely to lead to transition from smoking to vaping instead of complete absence of using nicotine products [17].

As ENDS are relatively new, clear evidence on their long-term health effects and long-term studies to evaluate the risk associated with their use are lacking [9]. Further studies have to examine if ENDS are efficient as a smoking cessation aid. Currently, the ESTxENDS study by the Institute of Primary Health Care Bern is examining vaporisers as an aid to smoking cessation in a multicentre randomised

controlled trial (RCT) and will provide further evidence on the beneficial and harmful effects of ENDS [22].

Although ENDS do not contain tobacco, they mostly contain nicotine, which is a highly addictive substance. Furthermore, their e-liquid contains numerous toxicants and carcinogens, including aldehydes, tobacco-specific nitrosamines, metals, tobacco alkaloids and polycyclic aromatic hydrocarbons. Moreover, refillable cartridges allow the user to deliver further psychoactive substances such as tetrahydrocannabinol (THC) [14]. In 2019, a substantial increase in acute lung injuries in the US due to the use of vaping products was probably associated with illicit substances added to the e-liquid. The Centers for Disease Control and Prevention (CDC) recommends, therefore, that consumers should not add any other substance not intended by the manufacturer (especially THC or vitamin E acetate), and that ENDS should not be used by youths, young adults, pregnant women or adults who do not currently use other nicotine products [23].

In contrast, Public Health England favours a shift from tobacco products to ENDS because ENDS have been stated to be substantially less harmful than combustible cigarettes [24].

ENDS are considered to contain less formaldehyde, which is a carcinogenic substance, than emissions from tobacco heating systems and conventional tobacco smoke, owing to the higher temperatures associated with the use of these tobacco products. In addition, ENDS contain substantially lower amounts of tobacco-specific nitrosamines than tobacco smoke. [13]

Excise taxes for tobacco and nicotine products as public health means

Increasing the price is considered to be the most efficient way to reduce tobacco consumption [26]. However, it is still unclear which tax on evolving, alternative nicotine products such as ENDS and tobacco heating systems would reduce overall consumption and associated morbidity and mortality. Tax and price hikes can lead to a cessation of consumption, to reduced consumption, a trade-down, which means switching from a higher to a lower priced brand [11], or discourage initiation. The World Health Organization (WHO) states that “simpler is better”, which means that complex tax structures tend to be more difficult to administer and furthermore can lead to tax avoidance and evasion.

As alternative nicotine products such as ENDS and tobacco heating systems are gaining popularity apart from smoking combustible cigarettes, serious price increases in one can shift to an increased consumption of the more affordable product [24, 26, 27]. Increases to comparable taxation levels on all nicotine products, in contrast, minimise opportunities for substitution among them [25]. The youth, young adults and persons of low socioeconomic status are considered to be more affected by price increases [28].

The Swiss parliament is currently working on the legal basis for taxation of ENDS. In order to inform this process by scientific evidence, the aim of this article is to review taxation methods for ENDS and to describe how different taxation models serve specific public health goals by influencing smoking and vaping behaviour. We will start with

a description of taxation models and then summarise the rich experience with excise taxes on ENDS in the US at both state and federal levels. We will then discuss the current regulation in Switzerland and how different policy options for taxing ENDS could serve specific public health goals best.

ENDS taxation methods and their advantages and disadvantages

There are basically three different options in imposing excise taxes on ENDS: (1) a specific tax, (2) an ad valorem tax and (3) a combination of these two. Excise taxes on alcohol or traditional cigarettes are often levied on the basis of a specific tax, which is a fixed monetary amount based on a quantity (e.g., per weight, piece, pack), the volume of tobacco or, in the case of ENDS, the volume of liquid (amount per millilitre) or amount of nicotine (per milligram).

Specific excise taxes on ENDS are imposed in most European Union countries [29] and many US states [30]. A specific excise tax does not require expensive tax administration. Furthermore, it does not discriminate between disposable and reusable products. An increase in a specific tax leads to a reduction in the ratio of prices of higher priced brands relative to lower priced brands, which means that the tax as a percentage of the price is lower for higher priced brands than for lower priced ones. This could reduce downward substitution from higher to lower priced brands and could result in a higher willingness to pay for higher priced brands. A specific tax enables the tobacco industry to offer wider price ranges [31].

An excise tax ad valorem, in contrast, is a tax levied as a percentage of the value of a product (e.g., retail, wholesale or manufacturer price). The multiplier effect in ad valorem taxation means that an increase of USD 1.00 for a product with an ad valorem tax of 25% will lead to an increased price of USD 1.25, a part of which will go to the government as a revenue. The multiplier effect leads to a price increase higher than the increased costs and creates a gap in prices through greater price variability between brands. This might increase incentives for costumers to trade-down from higher to lower priced brands as a response to price increases and can influence consumer choice negatively, especially for price-sensitive customers such as the poor or youth. Whereas specific taxes remain the same without a hike, ad valorem taxes increase when prices increase. [11, 25, 32] In addition, ad valorem taxation requires strong tax administration with clearly defined products [32]. Poor definitions can lead to disproportionate treatment of similar products [11]. As ENDS are a very wide and rapidly evolving product class, findings from the US showed that defining these products is challenging [9]. In addition, reusable devices are bought less frequently than disposable ones. Disposable devices could be more affected by ad valorem taxation than by a specific tax [10].

Finally, a combination of specific taxes and ad valorem taxes is possible. This could mitigate some disadvantages of either tax method. For example, specific taxes could be applied for liquids and ad valorem taxes for vaping devices or cartridges in order to avoid discrimination between different products [30]. However, classifying and defining the

product to which the tax is applied is complicated and requires strong tax administration.

Regulation and taxation of ENDS in the United States

We previously published a policy analysis [9] of taxation methods in the US and give a short summary here. In the US, tobacco products have been regulated under the Food and Drug Administration (FDA) since 2009. The FDA's authority has been broadened to include the regulation of ENDS since the deeming rule in 2016 [14, 33]. To cope with a substantial increase in US youths using ENDS, the FDA has recently regulated ENDS more strictly on a federal level by raising the minimum age for sales of any nicotine product to 21 and extended the restriction on available flavours (other than tobacco or menthol) from combustible cigarettes to include unauthorised, cartridge based ENDS, as flavours seemed to appeal especially to young consumers [34, 35]. However, a federal tax is lacking. Whereas currently Switzerland does not yet levy a tax on ENDS, these devices have been taxed in the US on a state level since 2010.

The first state to tax ENDS was Minnesota in 2010, with more than 20 states having followed to date [37]. However, the level of the state excise taxes and the methods are very diverse, ranging from very small specific taxes per millilitre to substantial taxes ad valorem and combinations of specific and ad valorem taxes. Minnesota extended the existing legal definition of “tobacco products” to include ENDS [24], and is currently levying a high tax ad valorem of 95% of the wholesale price on “other tobacco products” including ENDS, chewing tobacco, snuff and non-premium cigars [9]. The ad valorem tax was increased in 2013 from 70% to 95% [9, 37]. Beside broadening the definition of a tobacco product to cover evolving nicotine products consumed in ways other than smoking, the bill required nicotine-related devices to be sold behind the counter and prohibited their sale to minors [38]. This led to stricter tobacco regulation on a state level than on a federal level.

Currently, liquid not containing nicotine and reusable/refillable devices are not subject to the tax. If the device is sold separately from the cartridge, it is not taxed either, meaning the tax depends on the form of the products sold and applies mainly to ENDS cartridges with liquid containing nicotine and disposable ENDS as a whole device [31, 39]. The former definition applied to tobacco products “containing nicotine made or derived from tobacco”, but was broadened in 2020 to “regardless of whether the nicotine is made or derived from tobacco”, acknowledging evolving products with other nicotine sources [39]. These findings show the importance of product definitions for ad valorem excise taxation and the high administrative effort. With the tax hike in 2013 on ENDS, Minnesota also raised the excise tax on conventional cigarettes to achieve greater parity between those products, leading to an increase from USD 1.23 to 2.83 per 20-pack in 2013 and to USD 3.04 as of 1 January 2017, which is the state's current excise tax on a 20-pack of cigarettes, to which the federal tax of USD 1.01 is added on top [9, 40].

Saffer et al. [24] provided evidence that taxing ENDS influences smoking behaviour among current smokers. The authors showed that the substantial hike in ENDS excise

taxation increased adult smoking and reduced smoking cessation. They further assumed that substantial increases in cigarette and ENDS taxation at the same time, as happened in Minnesota in 2013, lead to increased smoking, implying that ENDS is a substitute for combustible cigarettes among current smokers. Excise taxes on potentially less harmful vaping devices at relatively high rates therefore might risk pushing vapers back to smoking or deterring them from quitting. Therefore, policies influencing one another need to be considered carefully.

Louisiana began to tax “vapor products” [41] as of August 2015 at a specific rate of USD 0.05 per millilitre of nicotine-containing liquid [11, 36]. Many US states similarly levy an excise tax on a specific base per millilitre, ranging from very small amounts of USD 0.01 such as in Ohio up to USD 0.40 (for closed, disposable cartridges) in Connecticut [9, 36]. Louisiana is one of the states that is taxing only nicotine-containing liquid, as do Connecticut, Delaware, Minnesota, New Jersey and Ohio. This can be critical, as nicotine is not the only harmful ingredient in the e-liquid and can lead to tax avoidance by selling the liquid and the nicotine solution separately [30].

The National Youth Tobacco Survey (NYTS) reported that ENDS have been the most frequently used nicotine product by youth in the US, with a current use (defined as use on at least one day in the past 30 days) among high school students of 21% in 2018 [42]. In contrast, the CDC reported a decline in smoking rates from 21% in 2005 to 14% in 2018, with the highest smoking participation among people aged 25–44 and 45–64 years and lowest among young adults aged 18–24 years [43].

Results from the US showed that an increase in young adults using vaping products not only needs to be coped with appropriate taxation, but also with stricter tobacco control policies on a federal level.

Regulation of ENDS in countries neighbouring Switzerland

Similarly to Switzerland, some neighbouring European countries, such as France and Austria, currently do not levy an excise tax on ENDS [30, 44]. Nevertheless, heated tobacco systems are taxed in most European countries, often based on the weight of the tobacco, such as in Austria [44]. Germany will be levying an excise tax of EUR 0.02 per milligram nicotine contained in the e-liquid used for ENDS from July 2022. The tax will be increased to EUR 0.04 by 2026. Heated tobacco systems, in contrast, will be taxed equally to combustible cigarettes and the excise tax on cigarettes will be raised [45].

Italy at first applied an excise tax ad valorem addressing all parts of the vaping device, but this approach was soon replaced by a specific tax on consumables only [29]. Italy has been levying a specific tax on ENDS of EUR 0.08 per millilitre of liquid with nicotine, and half of this amount per millilitre without nicotine [30]. However, the Italian government recently (January 2021) passed a bill to subsequently increase the excise tax from 10% to a planned 25% on products containing nicotine and 20% on products without nicotine until 2023 [46].

Most European countries that are currently taxing ENDS apply a specific tax, based on the quantity of liquid and in

some cases differentiate between nicotine-containing and nicotine-free liquid. By not addressing nicotine-free liquid, however, policymakers risk creating loopholes, which might risk the purchase of cheaper nicotine-free liquids in bigger amounts and mixing these with high-concentration nicotine solutions. Banning liquids with high nicotine concentrations or limiting the maximum amount allowed could decrease this risk [29, 30].

Regulation of ENDS in Switzerland

Evidence from the US and European countries showed that governments differ in how they tax newer nicotine products and in what the tax is levied on.

In comparison with its neighbouring EU countries, Switzerland remains one of the countries with the weakest tobacco control regulation [47], especially concerning sponsoring, advertising and promotion. Although Switzerland signed the WHO Framework Convention on Tobacco Control (FCTC) in 2004, it could not be ratified yet because of weak tobacco control regulation. Tobacco legislation, especially concerning the advertising, promotion and sponsorship of tobacco products and ENDS, has to be regulated more strictly first to cope with WHO FCTC minimum standards [1, 2, 48].

ENDS are currently regulated under the Foodstuffs Act (FSA) as articles of daily use and are therefore available even for minors. Currently, ENDS containing nicotine can be sold as long as they satisfy the technical requirements of other EU or EEA countries and are legally marketed in these countries (Cassis-de-Dijon-principle) [12, 48].

The regulation of ENDS under tobacco legislation is now up for discussion at the Swiss Parliament. The aim is to regulate nicotine and tobacco products more strictly in order to fulfil the requirements for finally ratifying the FCTC of WHO but also to regulate ENDS [16]. In 2018, some Swiss cantons had already begun to regulate ENDS more strictly on a cantonal level [50]. First, regulation under tobacco product law should provide a framework for how ENDS and other newer tobacco products such as snus and tobacco heating systems should be regulated on a federal level, such as defining a minimum age of sales and regulating advertisement. In a next step, the Swiss parliament will introduce an excise tax on ENDS that considers the lower health risks compared with those of tobacco products [19].

Some policymakers, such as Public Health England [25], argue that ENDS are less harmful than conventional cigarettes and effective as a smoking cessation aid, and should therefore be taxed at a substantially lower rate than tobacco products. On the other hand, others argue that they function as a gateway to nicotine addiction, especially among young adults, by offering various youth appealing, sweet flavours [14]. In addition, dual or multiple use of different tobacco products is a frequent pattern of consumption [16].

Hence, there are arguments for and against low taxes on ENDS. The choice of the appropriate excise tax level is challenging. Different methods and levels of taxation are currently up for discussion, such as a tax ad valorem of around 12% comparable to tobacco heating systems, a specific tax of CHF 0.20 per millilitre or a combination of both forms, acknowledging the nicotine content [19].

Policy options and their consequences

Chaloupka et al. [50] proposed levying different taxes for products with reduced harm potential. But as these products are new, developing rapidly and vary widely in their appearance, the risks still need to be elaborated, although research suggests vaping products to be less harmful than tobacco products [25, 50]. If combustible cigarettes, tobacco heating systems and ENDS are considered substitutes, price increases in one are likely associated with an increased consumption of the other product, as research from Minnesota and the European Union showed [24, 26, 27]. Moving from combustible cigarettes to ENDS might have positive health effects if the switch is complete. However, a randomised controlled trial [17] showed that quit attempts using vaping devices often lead to transition from smoking to vaping instead of complete cessation. In addition, dual use was shown to be a frequent pattern of consumption [13].

Chaloupka et al. proposed differential taxes as an approach to maximise incentives for tobacco users to switch to potentially less harmful products [50, 51]. For that reason, policymakers basically have three different options in levying a tax rate based on different levels (table 1). One major public health goal is to prevent youth initiation from nicotine addiction. On the other hand, if ENDS were assumed to be less harmful, switching from smoking to vaping would be favourable for current smokers and reduce smoking-related morbidity and mortality. However, using ENDS as a cessation aid, out of curiosity or owing to the perception of reduced harm can lead to dual use of both products. Ideally, taxes are imposed to achieve public health goals while generating revenue [25].

Table 1 shows three possible options for taxing ENDS in Switzerland and what public health goals they pursue as well as likely negative effects.

Taxation option A applies little or no excise tax on ENDS. From a public health point of view, this would maximise incentives for smoking cessation by use of ENDS. As an unintended outcome, this is likely to lead to increased initiation among young users, could be a gateway for young users to nicotine addiction and later smoking, and furthermore lead to dual use of both products.

Option B taxes ENDS at a small or moderate level and maintains or increases the relative price of tobacco heating

systems and combustible cigarettes. If ENDS were still more affordable than tobacco heating systems and conventional cigarettes but current prices were raised, this would be an incentive to switch from smoking to vaping, discourage youth initiation, and if ENDS are sufficiently expensive, would discourage dual use. However, if prices for ENDS were similar to those of tobacco heating systems and conventional cigarettes, switching from smoking to vaping would be discouraged.

Option C would tax ENDS and tobacco products at a similar level. This tax would treat them the same, regardless of their risks, would likely lead to decreased consumption of either product if prices are further increased, would discourage youth initiation and dual use, but would also discourage substitution by switching from smoking to vaping. Depending on the intended main goal as a public health strategy, the respective options should be adopted. If youth protection from nicotine addiction was a major goal, the preferred option would likely be option C – taxing ENDS at similar rates relatively to tobacco heating systems and conventional cigarettes. Taxing these products consistently reduces the potential for substitution among them [25]. A tax for ENDS at a substantial level comparable to tobacco heating systems and combustible cigarettes combined with other restrictions in sales and advertising could deter minors from vaping and later smoking.

In contrast, if encouraging smokers to switch from smoking to vaping and potentially minimise harm from consuming more dangerous tobacco products were a major objective for implementing a tax, options A or B would be favoured – applying lower taxes to these products. However, dual use was shown to be a frequent pattern of consumption among vapers [16], which would be reinforced by applying little or no tax on ENDS.

Methods

Table 2 shows a possible application of the tax models presented in table 1, based on an ad valorem excise tax on electronic cigarettes with a pre-filled, pod-based product and a liquid based model with refillable tanks, a well-known tobacco heating system with a corresponding 20-pack of sticks compared to a 20-pack of combustible cigarettes.

Table 1:
Options for taxing electronic nicotine delivery systems (ENDS) in Switzerland.

	Option A	Option B	Option C
Tax level	Low or no tax on ENDS; taxes for tobacco products maintained or increased	Moderate tax on ENDS; taxes for tobacco products maintained or increased	Taxing ENDS and tobacco products at a similar level; taxes for both maintained or increased
Effects on current and possible users	Maximise incentives for current smokers to switch to ENDS	Increase incentives for current smokers to switch to vaping	Discourage youth initiation
		Discourage youth initiation	Discourage dual use
		Discourage dual use	Discourage smoking and vaping
Public health objective	Reduce smoking associated morbidity and mortality in adults	Reduce smoking associated morbidity and mortality in adults	Reduce smoking associated morbidity and mortality in adults
		Discourage youth to start with ENDS	Strongly discourage youth from starting to use ENDS and smoking
Unintended outcome	Increased vaping initiation among the youth	(Discourage switching from smoking to vaping if prices of ENDS and cigarettes were close)	Discourage switching from smoking to vaping
	Long-term use of ENDS (switching instead of cessation)		
	Vaping as a gateway to later smoking		

We made the simplifying assumption that taxes are passed on to retail prices. This may not always be the case, but it is difficult to foresee how prices develop in a highly dynamic situation of different products being marketed and adopted by consumers. We used sales prices according to the online shop of coop.ch and the FOPH [52] as a baseline and excise taxes ad valorem were calculated to examine per month expenditure for each product (table 3), according to the intended public health goals as described in the previous section. Graded ad valorem taxes based on sales prices were chosen to make risk-based excise tax levels for different tobacco and nicotine products more comparable to each other. However, Switzerland's neighbouring countries levy specific taxes for ENDS more often, in contrast to some states of the US. When levying a specific tax, policy makers have to decide whether to tax the quantity of liquid or the amount of nicotine contained in it.

In either way, to make clear to what the tax is levied on, ENDS would have to be defined properly in future tobacco legislation. In this case, we calculated the tax similarly to Italy on consumables only, by levying an ad valorem tax on the pods (one pack of two pods, of each 1.7 millilitres) in a pod-based model, and the liquid on base of 10 millilitres to refill a tank-based model. However, various designs and (disposable) products exist, which makes it difficult to cover all products equally. Also, starter kits vary in size, accessories and prices. These starting costs, however, exist only for electronic cigarette devices and are much higher than for conventional smoking, which might be a barrier for switching.

Monthly prices on ENDS and tobacco products with different tax models

In the example shown in table 2, option A would impose a very small tax, as currently on snus, of 6% for ENDS, increase taxes on tobacco heating systems to 40% and maintain the tax for conventional cigarettes. Option B would in-

crease taxes on ENDS to 20%, maintain the suggested 40% for tobacco heating systems and the 53% on conventional cigarettes. Option C, in contrast, would apply similar or equal taxes on ENDS and tobacco products, with an increase to 53% ad valorem per 10 millilitres of refillable liquid, per double-pack of prefilled pods and per 20-pack of sticks for tobacco heating systems, and maintain the 53% for conventional cigarettes. However, the excise tax level for combustible cigarettes suggested by the WHO is 75% [53].

A tax at a specific rate per millilitre would clearly lead to sales prices different from those presented in table 3, and whether to tax the liquid per millilitre or the nicotine per milligram would have to be discussed. Additionally, the tax on an ad valorem basis can lead to different forms of the products being sold in order to evade excise taxation, as evidence from Minnesota showed.

After imposing the increased taxes on the described products, we calculated per month prices based on assumptions of the average consumption. For cigarettes, we assumed an average consumption of 13.5 cigarettes per day [54], as well as 13.5 sticks for tobacco heating systems. However, we did not find any science-based information to quantify the average liquid or pod consumption for ENDS. We therefore did the calculation with information found in online forums [55, 56]. We estimated a tank of 10 millilitres to last for two to three days and therefore calculated with a daily consumption of 4 millilitres. Assuming an average consumption, we expected a pod for ENDS to last about one to three days. However, this also strongly depends on the amount of nicotine contained in the liquid and the frequency of the device being used.

In any case, in table 3 we calculated the monthly costs of an average consumption per nicotine product including initial costs for ENDS and tobacco heating systems (which clearly will decrease over time). We did not impose an excise tax on the electronic devices. As cigarettes do not have

Table 2:
Basic calculations for possible tax options.

	ENDS pod-based	ENDS liquid based	Tobacco heating systems	Conventional cigarettes
Current tax (in % of the sales price)	0	0	12	53
Tax option A	6	6	40	53
Tax option B	20	20	40	53
Tax option C	53	53	53	53

Table 3:
Taxation options applied on different nicotine products (prices in CHF).

	ENDS pod-based 2 x 1.7 ml	ENDS liquid-based 10 ml tank	Tobacco heating systems; 20-pack sticks	Conventional cigarettes; 20-pack cigarettes
Initial costs (starter kit)	30	40	109 device with 3 packs	0
Current prices per pack (CHF)	7.50 for 2 pods 1.7 ml each	6.90 for 10 ml liquid	8.00 for 20 sticks	8.50 for 20 pack
Current excise tax	0%	0%	12%	53%
Assumptions for monthly prices	1 pod/3days	4 ml/day	13.5 sticks/day	13.5 cigarettes/day
	10 pods/month	120 ml/month	20 packs/month	20 packs/month
Current prices per month (including initial costs)	67.50 (37.50 + 30)	123 (83 + 40)	245 (160 + 85)	170 (170 + 0)
Tax: no or low tax on ENDS	6%	6%	40%	53%
	40 + 30 = 70	88 + 40 = 128	235 + 85 = 320	170 + 0 = 170
Tax: moderate tax on ENDS	20%	20%	40%	53%
	45 + 30 = 75	99 + 40 = 140	235 + 85 = 320	170 + 0 = 170
Tax: similar tax on ENDS	53%	53%	53%	53%
	57 + 30 = 87	127 + 40 = 167	300 + 85 = 385	170 + 0 = 170

initial costs, they were cheaper than tobacco heating systems, despite the much higher tax currently, as well in all the applied tax models. If the current sales prices for tobacco heating systems are maintained, this results in substantially higher revenues for the producer with tobacco heating systems than with conventional cigarettes, but notably only a slight difference in prices for the consumer.

Regarding the calculations for ENDS, even with double the consumption compared to the assumptions made in table 3, prices appear very random in comparison to tobacco heating systems and conventional tobacco products. In addition, prices can be decreased when consumers mix their own the liquid.

To examine the willingness to pay for the different product types among current consumers or those susceptible in trying these products, a discrete choice experiment (DCE) focusing on the price of tobacco and nicotine products could provide further insight to examine when consumers would switch to less expensive substitution products or completely cease from consumption, which, however, is very challenging once addicted to nicotine. However, other DCEs showed that, beside the price, available flavours and the perception of ENDS as being less harmful appealed especially to adolescents [57], whereas the harms of use, the use as a cessation aid or the nicotine content seemed to influence adults [58] when choosing ENDS.

Challenges of achieving any public health goals

Whatever calculation is made, it becomes evident that, at the current price level of the different products, any public health goal is difficult if not impossible to achieve. Any desired effects on the health of the Swiss population are likely to happen only if taxes for all products are increased very substantially. At the current price level (comprising the product price and the tax), it is unlikely that any of the public health goals outlined for options B and C would be achieved.

Beside the low price level, a further challenge for achieving any public health goal is the broad price range both for combustible cigarettes and for ENDS, as there are cigarette packs that only cost CHF 5.50, whereas commonly known brands cost around CHF 8.50. Also, ENDS vary widely in product appearance and nicotine concentration. Smaller taxes imposed on ENDS would not help to achieve public health goals, whereas higher tax levels, which might have a public health impact, require a major increase of current sales prices for a pack of cigarettes to maintain a risk-based taxation. These results indicate that current prices for a pack of cigarettes are too low in Switzerland when sales prices are compared and Switzerland's spending capacity relative to its neighbouring countries are taken into account [59]. In contrast, tobacco heating systems seem to be too expensive considering the much lower tax compared with combustible cigarettes, as they currently only differ slightly in the price for a pack of 20-sticks.

Table 4 shows hypothetical sales prices that could be implemented by corresponding price increases for tobacco and nicotine products in Switzerland. First of all, the price for conventional cigarettes has to be increased substantially. The price of around CHF 20 would correspond to the current cigarette prices in the United Kingdom, where cigarette prices have risen up to around EUR 12–13, which makes them the most expensive in Europe [60, 61]. Currently, Swiss cigarette prices differ only slightly from neighbouring countries such as Germany or France. However, Switzerland's gross domestic product and purchasing power parity are higher. Prices at this level would acknowledge the Swiss higher purchasing power [62–64].

Nevertheless, Switzerland is not an island and inbound smuggling needs to be considered when raising prices compared to neighbouring countries. Prices should be set high enough to encourage smokers to quit and deter non-smokers from starting. Tobacco heating systems should be a little less expensive and ENDS much less expensive when expecting a reduced harm potential, corresponding to our taxing option B. In any case, with the current sales prices and no minimum price it will be almost impossible to achieve any public health goals.

Conclusions

Draft tobacco product law being discussed in the Swiss Parliament is controversial. Clarity on harms and risks of evolving nicotine products such as ENDS relative to combustible cigarettes still need to be investigated by independent studies. In comparison to its neighboring countries, Switzerland ranks lower in the Tobacco Control Scale 2019 [47], with weaker regulations on outdoor tobacco advertising, printed tobacco advertising, minimum age of sales, sponsoring and the use in indoor spaces, which do not meet WHO FCTC minimum standards [16].

Further policies need to be adopted, especially in order to prevent young adults from nicotine addiction. If further research could provide evidence that ENDS are less damaging than combustible cigarettes even when used long-term, encouraging the use of reduced-risk products rather than encouraging complete abstinence with corresponding tobacco policies could have positive impacts on public health [9]. If youth protection from nicotine addiction was a major objective in excise taxation, high or similar tax rates on both ENDS and tobacco products would be recommended. On the other hand, if switching from smoking to vaping was favoured, ENDS would have to be taxed at lower rates than combustible cigarettes to support substitution. Both excise taxation at a specific rate and ad valorem taxation applied in different US states proved to be challenging. Mixed systems could lead to a more equal treatment of differently designed vapor products, but would require high administrative effort.

Depending on the intended public health goal, and assuming substitution between vaping products and combustible cigarettes, relative prices influencing the consumption of

Table 4: Hypothetical increased and risk-adjusted pricing for electronic nicotine delivery systems (ENDS) and tobacco products.

	ENDS pod-based	ENDS liquid-based	Tobacco heating systems; 20-pack	Conventional cigarettes; 20-pack
Hypothetical prices in CHF	8	8	15	20

the other products need to be considered when implementing the appropriate level of an excise tax for ENDS. However, to achieve any public health goal with a certain tax model, the prices for tobacco heating systems and combustible cigarettes need to be increased substantially.

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