

# Sales of cigarettes to pseudo-underage mystery shoppers: Experiences from Stockholm County

Nordic Studies on Alcohol and Drugs

2021, Vol. 38(6) 573–585

© The Author(s) 2021

Article reuse guidelines:

sagepub.com/journals-permissions

DOI: 10.1177/14550725211003423

journals.sagepub.com/home/nad




**Kristin Feltmann**

STAD, Centre for Psychiatry Research, Department of Clinical Neuroscience, Karolinska Institutet & Stockholm Health Care Services, Stockholm, Sweden

**Johanna Gripenberg**

STAD, Centre for Psychiatry Research, Department of Clinical Neuroscience, Karolinska Institutet & Stockholm Health Care Services, Stockholm, Sweden

**Tobias H. Elgán** 

STAD, Centre for Psychiatry Research, Department of Clinical Neuroscience, Karolinska Institutet & Stockholm Health Care Services, Stockholm, Sweden

## Abstract

**Aims:** There is an 18 years age limit for cigarette purchase in Sweden and in order to implement this law outlets need to perform ID checks. This study investigates the rate of cigarette sales and ID checks when pseudo-underage mystery shoppers attempted to purchase cigarettes. It explores possible factors associated with sales outcomes. **Design:** Nine mystery shoppers (6 females and 3 males) attempted to purchase cigarettes without providing ID. The mystery shoppers were 18 years old but had a younger appearance as judged by an expert panel. During each attempt, the adolescents worked in pairs (shopper and observer). A total of 320 outlets in 13 municipalities in Stockholm County were randomly selected based on an outlet type stratum (i.e., gas station, convenience store, kiosk, grocery store). Effects of variables on sales outcomes were analysed using Pearson's chi-square and binomial regression analysis. **Results:** In 25.4% of the purchase attempts (total  $n = 287$ ), cigarettes were sold although the pseudo-underage mystery shopper did not provide a valid ID. In 82.6% of the attempts, the shopper was asked to provide ID, and

Submitted: 11 February 2021; accepted: 1 March 2021

## Corresponding author:

Tobias Elgán, STAD, Centre for Psychiatry Research, Norra Stationsgatan 69, plan 7, SE-113 64 Stockholm, Sweden.  
Email: tobias.elgan@ki.se



Creative Commons Non Commercial CC BY-NC: This article is distributed under the terms of the Creative Commons Attribution-NonCommercial 4.0 License (<https://creativecommons.org/licenses/by-nc/4.0/>) which permits non-commercial use, reproduction and distribution of the work without further permission provided the original work is attributed as specified on the SAGE and Open Access pages (<https://us.sagepub.com/en-us/nam/open-access-at-sage>).

cigarettes were sold in 9.7% of these cases. The rate of sales was significantly higher among female mystery shoppers (29.5%) compared to male (15.0%). Age limit signs were observed in 89.5% of the outlets but they were not significantly associated with the success rate in a regression analysis.

**Conclusions:** The results of the present study indicate that cigarettes could potentially and frequently be sold to underage adolescents by outlets within Stockholm County. Therefore, routines established for checking IDs clearly need to be improved. For example, strategies to improve adherence to the legal age limit on the purchase of cigarettes, such as compliance checks using mystery shopping with feedback to retailers, are needed.

## Keywords

ID checks, minors, mystery shopping, sales rates, tobacco

## Background

Tobacco use causes about 8% of the disease burden in Sweden, more than twice as much as the illnesses caused by alcohol or narcotics (Agardh et al., 2014). Although many smokers attempt to quit, the success rate is known to be low (Zhou et al., 2009), likely due to the highly addictive effects of nicotine and other substances in cigarette smoke (Costello et al., 2014).

Adolescence is an especially vulnerable developmental period for becoming addicted to substances such as nicotine (Barron et al., 2005; Chambers et al., 2003). Several studies have shown that an early age of smoking onset is associated with remaining a smoker in adulthood (Breslau & Peterson, 1996; Chen & Millar, 1998; D'Avanzo et al., 1994; Eisner et al., 2000). Similarly, young age and heavy smoking are predictors of long-term smoking, as demonstrated by a 25-year longitudinal study (Nordstrom et al., 2000). It has also been shown that even light smoking (1–5 cigarettes per day) during adolescence increases the likelihood of smoking throughout adulthood (Wiener et al., 2016). Therefore, it is desirable to prevent adolescents from becoming smokers.

Since adolescents are a particularly vulnerable group, the availability of cigarettes to adolescents is of particular concern. Higher outlet density around schools or homes have shown to be positively correlated with smoking

prevalence among adolescents (Leatherdale & Strath, 2007; Schleicher et al., 2016), and adolescents who buy their own cigarettes have shown to smoke more than those obtaining them from non-commercial sources (Castrucci et al., 2002). To prevent adolescents from buying cigarettes, the legal age limit for purchasing tobacco products is 18 years or higher in many countries. The Nordic countries Finland, Norway, Sweden and Iceland, raised the age limit from 16 to 18 years during the years 1995 to 1997, while Denmark raised the age limit from 16 to 18 years in 2007. Several European countries have done the same during the last ten years (e.g., Germany, the United Kingdom (UK), Italy, Spain and Portugal). Tobacco policies, including raising the age limit, have the potential to reduce youth smoking rates (Kessel Schneider et al., 2016; Reynolds et al., 2019; Winickoff, 2018). An insufficient enforcement of age limit control could undermine the effectiveness of the law on age limits.

Mystery shopping with underage or pseudo-underage adolescents attempting to buy tobacco products – usually without providing ID – is an established method for assessing the compliance with the law on age limits (see the online supplementary material). Compared to studies from the early 90s (see online supplementary Table S1), US studies conducted during recent years report lower sales rates (between 7% and 28%) (Dai & Catley, 2018; Levinson, 2018; Levinson

et al., 2018; Schweitzer et al., 2017). In Europe, few studies investigating sales rates to pseudo-underage mystery shoppers have been conducted – especially in recent years – but they have generally found rather high sales rates. For example, mystery shopping in Switzerland revealed still comparably high sales rates (between 39.7% and 70.8%) three and six years after the implementation of a sales ban to the underaged (Kuendig & Astudillo, 2013). Similarly, in a Finnish study conducted in 2011, cigarettes were sold to pseudo-underage mystery shoppers in about 57% of the attempts (Warpenius et al., 2016).

The sex of the shopper seems to be an important factor when attempting to purchase tobacco products. Several mystery shopping studies found girls to be more successful in buying tobacco products compared to boys (Clark et al., 2000; DiFranza et al., 1996; Erickson et al., 1993; Forster et al., 1992; Kuendig & Astudillo, 2013). However, two studies found boys to be more successful in mystery shopping (Levinson et al., 2002; Sundh & Hagquist, 2004), while other studies found no sex differences (DiFranza, Savageau, & Bouchard, 2001; Krevor et al., 2011; Levinson, 2018; Radecki & Zdunich, 1993; Schweitzer et al., 2017). However, boys seem to be more likely to buy cigarettes themselves and girls are more likely to obtain them from other persons (Castrucci et al., 2002; Leatherdale & Strath, 2007), a result also seen in Sweden (see supplementary Table 40 in CAN report 187, 2019). Other factors that have been associated with success rates were outlet types, time and day of purchase, as well as the age and sex of the salesclerk (Clark et al., 2000; Dai & Catley, 2018; DiFranza, Celebucki, & Mowery, 2001; Erickson et al., 1993; Forster et al., 1992; Forster & Wolfson, 1998; Levinson et al., 2002). Nevertheless, these factors were not consistently associated with sales outcome across these and other studies (DiFranza, Savageau, & Bouchard, 2001; Levinson, 2018; Warpenius et al., 2016).

In Sweden, a decrease in successful purchases from 84% to 48% was found between

1996 and 2005 (Sundh & Hagquist, 2007), which was suggested to be related to the implementation and enforcement of the age limit law in 1997 by the municipalities (Sundh & Hagquist, 2007). Under this law, outlets selling tobacco have to display 18-year age limit signs; and, by performing an ID check, salesclerks have to ensure that the customer purchasing tobacco products is aged 18 years or older. Although smoking rates among adolescents in Sweden are below the average in Europe (The ESPAD Group, 2020), age limit controls could still be improved.

In the present study, the overall aim was to investigate the rate of cigarette sales to the underaged by conducting purchase attempts in outlets in Stockholm County, using pseudo-underage mystery shoppers. Furthermore, we evaluated the potential contribution of factors influencing this rate, such as the sex and age of salesclerks, sex of mystery shoppers, time of day, outlet type, and occurrence of age limit signs. The results may provide important information with regard to the need for implementing intervention strategies, such as compliance checks to decrease the availability of tobacco products to the underaged.

## Methods

### Participants

Eighteen-year-old adolescents were recruited as mystery shoppers through advertisements at high schools located in the central region of Stockholm. During a semi-structured interview with an expert panel, applicants were asked questions about their interests, school activities, and plans for the future. The age and suitability of the applicants were judged by the expert panel consisting of four persons who, through their professions (a social worker, a teacher, a bouncer, and a psychiatrist specialised in working with children and adolescents), had frequent contact with adolescents. Nine applicants (six females, three males) were selected based on their estimated age (mean perceived age =

17 years) and suitability. They all had to sign confidentiality agreements and were instructed to wear neutral and similar clothing (jeans and T-shirt) and no makeup during the study.

### *Study design and procedure*

The study was conducted in June 2017. Three hundred outlets in 13 municipalities within Stockholm County (26 municipalities in total) were randomly selected based on an outlet type stratum (i.e., grocery stores, convenience stores, gas stations, and kiosks). The relative distribution of those four outlet types was assessed for the selected communities and was maintained during the selection. In addition, 20 outlets were selected as back-ups in case outlets were closed. The outlets were randomly drawn by an external researcher from a register of outlets selling tobacco products, provided by the Stockholm County Administrative Board.

To avoid potential interference with the results of the present study, municipalities that had conducted compliance checks during the past two years were excluded from the study ( $n = 13$ ). Compliance checks are mystery shopping conducted by pseudo-underage adolescents, followed by feedback to the salesclerk and store manager. The municipal licensing board performs the compliance checks, and a supervising civil servant provides the feedback to the salesclerk and – if present – the store manager. The results will provide information as to whether there is a need for interventions to reduce sales rates to the underaged and can serve a purpose in the event that follow-ups are conducted. In the current study, mystery shopping alone was performed and no feedback was given to outlet personnel or owners.

In the field work, girls were divided into three groups (pairs), while the three boys were placed in a single group. However, both girls and boys worked in pairs during each trial, with one pair entering an outlet together. A pair consisted of one person attempting to buy cigarettes and one observer appearing to be an accompanying friend,

discreetly observing the characteristics of the outlet and the purchase attempt. The role of shopper and observer alternated for each trial, and a standardised scene had been rehearsed. Shoppers were instructed to ask for “a packet of Marlboros” and to say that they were 18 if asked about their age. If the salesclerk requested ID, the shoppers put their hands in their pockets or looked briefly in their bag, whereupon they said that they had forgotten their ID and then kindly asked if they could buy cigarettes anyway. Observers noted the time; the number of counters; the occurrence of signs regarding the 18-year age limit for tobacco purchases at counters and/or entrances; the number of people in line behind them; the sex and estimated age of the salesclerk; colleague(s), if any, near the salesclerk; the salesclerk’s request, if it occurred, for the age and/or ID of the shopper and/or observer; and the price of the cigarette packet. These observations, together with the date, the name and ID of the outlet, the sex of the shopper, and other general comments were recorded by the pair according to protocol after they had left the outlet and moved out of sight. If needed, the shopper provided information to the observer about the purchase.

Of the 320 outlets, five were excluded due to logistic reasons, 17 were closed, four were not found, two were unnoticed by the driver, three did not sell tobacco, one did not sell single packets and one did not sell Marlboro brand cigarettes (the shopper did not think to ask for another brand). In total, 287 purchase attempts were conducted between 10 am and 9 pm from Monday to Thursday during school holidays in June 2017.

### *Ethics approval*

This study was approved by the Regional Ethical Review Board in Stockholm (registration no. 2013/435-31 and 2017/1029-32). Mystery shoppers were 18 years old, worked in pairs and were conveyed to the outlets by a driver. To protect the anonymity of the salesclerks their

**Table 1.** Characteristics of outlets ( $n = 287$ ) where mystery shoppers attempted to purchase cigarettes.

	% (n)
<b>Outlet type</b>	
Grocery store	34.8 (100)
Convenience store	30.3 (87)
Kiosk	21.6 (62)
Gas station	13.2 (38)
<b>Number of counters<sup>a</sup></b>	
1	32.8 (94)
2	34.8 (100)
3–4	22.3 (64)
≥ 5	9.4 (27)
<b>Visible signs regarding 18-year age limit</b>	
No signs	10.5 (30)
Sign at the counter	72.1 (207)
Sign at the door	3.8 (11)
Signs at the counter and the door	13.6 (39)

<sup>a</sup>Missing data,  $n = 2$ .

names were not noted. Similarly, the names of the outlets are not presented in the study.

### Statistical analysis

SPSS Statistics software (IBM Corporation, Version 24) was used for descriptive analyses of the data and for generating frequency and contingency tables. Effects of variables on sales outcome, as well as effects of the sex of the salesclerk or shopper on request of ID or age, were analysed using Pearson's chi-square ( $\chi^2$ ) test. Furthermore, a binomial logistic regression analysis was performed to analyse the effects of variables on sales outcome together. The significance level was  $p \leq 0.05$ .

## Results

### Characteristics of purchase attempts

The distributions of outlet types and purchase attempt characteristics can be found in Tables 1 and 2, respectively. Although the majority of the stores had visible 18-year age limit signs for tobacco purchase, in every tenth case no such

**Table 2.** Characteristics of mystery shoppers and shopping situations ( $n = 287$ ).

	% (n)
<b>Sex of salesclerk<sup>a</sup></b>	
Female	44.9 (129)
Male	54.7 (157)
<b>Estimated age of salesclerk (years)</b>	3.8 (11)
17–19	
20–29	46.7 (134)
30–39	26.1 (75)
40–49	12.5 (36)
50–59	8.0 (23)
60–70	2.8 (8)
<b>Sex of mystery shopper</b>	
Female	72.1 (207)
Male	27.9 (80)
<b>Number of people in line<sup>a</sup></b>	
0	49.8 (143)
1–2	32.8 (94)
≥ 3	17.1 (49)
<b>Colleague in close proximity<sup>a</sup></b>	40.8 (117)
<b>Day of the week<sup>b</sup></b>	
Monday	26.8 (77)
Tuesday	32.4 (93)
Wednesday	23.7 (68)
Thursday	15.7 (45)
<b>Time<sup>a</sup></b>	3.8 (11)
Before 3 pm	
3:00–3:59 pm	22.3 (64)
4:00–4:59 pm	13.7 (68)
5:00–5:59 pm	24.4 (70)
6:00–6:59 pm	17.4 (50)
7:00–7:59 pm	7.0 (20)
8:00–8:59 pm	1.0 (3)

<sup>a</sup>Missing data,  $n = 1$ .

<sup>b</sup>Missing data,  $n = 4$ .

signs were observed (Table 1). Over 60% of the outlets had between one and two counters (Table 1). As can be seen in Table 2, the gender distribution among salesclerks was similar, and about half of them were estimated to be below 30 years of age. Since six females and three males were hired as mystery shoppers, female mystery shoppers conducted more purchase attempts than males (Table 2). In half of the attempts there were no customers in line and most attempts were conducted in the afternoon.

**Table 3.** Distribution of successful purchase attempts ( $n = 287$ ) of cigarettes across characteristics.

	Successful purchase in % ( $n$ )	$\chi^2$ ( $df$ )	$p$
<b>Total purchase attempts</b>	25.4 (73)		
<b>Sex of mystery shopper</b>			
Female	29.5 (61)	6.37 (1)	0.012
Male	15.0 (12)		
<b>Sex of salesclerk<sup>a</sup></b>			
Female	24.0 (31)	0.16 (1)	0.686
Male	26.1 (41)		
<b>Estimated age of salesclerk<sup>a</sup></b>			
< 30 years	27.1 (39)	0.37 (1)	0.543
$\geq$ 30 years	23.9 (34)		
<b>Colleague in close proximity<sup>a</sup></b>			
Yes	22.2 (26)	0.92 (1)	0.338
No	27.2 (46)		
<b>Outlet type</b>			
Gas station	31.6 (12)	2.21 (3)	0.529
Kiosk	29.0 (18)		
Convenience store	25.3 (22)		
Grocery store	21.0 (21)		
<b>Number of counters<sup>b</sup></b>			
1	26.6 (25)	1.69 (3)	0.639
2	27.0 (27)		
3–4	18.8 (12)		
$\geq$ 5	25.9 (7)		
<b>Number of people in line<sup>a</sup></b>			
0	28.7 (41)	2.99 (2)	0.224
1–2	19.1 (18)		
$\geq$ 3	28.6 (14)		
<b>Signs regarding 18-year age limit</b>			
No signs	43.3 (13)	5.66 (1)	0.017
Signs (counter/door)	23.3 (60)		
<b>Day of the week<sup>c</sup></b>			
Monday	29.9 (23)	1.20 (3)	0.754
Tuesday	24.7 (23)		
Wednesday	23.5 (16)		
Thursday	22.2 (10)		
<b>Time of day<sup>a</sup></b>			
Before 5 pm	26.6 (38)	0.30 (1)	0.586
After 5 pm	23.8 (34)		

<sup>a</sup>Missing data,  $n = 1$ .

<sup>b</sup>Missing data,  $n = 2$ .

<sup>c</sup>Missing data,  $n = 4$ .

### Success rate of purchase attempts and associated characteristics

In 25.4% ( $n = 73$ ) of the cases, the mystery shoppers were successful in buying cigarettes without showing ID (Table 3). The sales rate was

significantly higher among female (29.5%) compared to male (15.0%) mystery shoppers (Table 3). Moreover, the existence of visible age limit signs had a significant effect on the success rate since the frequency of successful purchases

**Table 4.** Logistic regression on successful purchase outcome.

	Wald (df)	OR	(95% CI)	p
Age of salesclerk (in years)	0.45 (1)	0.99	(0.96–1.00)	0.504
Sex of the mystery shopper (female vs. male)	4.78 (1)	2.42	(1.10–5.34)	0.029
Sex of the salesclerk (female vs. male)	0.42 (1)	0.81	(0.43–1.52)	0.516
colleague in close proximity (Yes versus No)	1.32 (1)	0.69	(0.37–1.30)	0.251
Outlet type	0.33 (3)			0.955
Number of counters	1.20 (3)			0.754
Number of people in line	2.27 (2)			0.322
Signs regarding 18-year age limit (Yes vs. No)	1.30 (1)	0.60	(0.25–1.44)	0.253
Day of the week	0.59 (3)			0.899
After 5 pm (vs. before)	0.24 (1)	0.86	(0.47–1.57)	0.622

Notes. Using a binomial logistic regression analysis, the influence of several factors on a successful purchase outcome was explored. For factors with more than two categories, only overall effects are shown (non-significant). Regarding those factors, the following categories were used: gas station, kiosk, convenience store, grocery store (outlet type); 1, 2, 3–4, 5 or more (number of counters); 0, 1–2, 3 or more (number of people in line); Monday, Tuesday, Wednesday, Thursday (day of the week).

was higher in outlets without visible signs compared to outlets with signs (43.3% and 23.3%, respectively). No other factors predicted success rate (Table 3). To explore whether sex and age limit signs were still predictive of successful purchase attempts when accounting for several recorded factors, a logistic regression analysis was performed, including all the factors analysed

**Table 5.** Distribution of age checks (n = 287) and effects of sex.

	Age checked % (n)	$\chi^2$ (df)	p
<b>Shopper’s ID requested</b>	82.6 (237)		
Female mystery shopper	80.2 (166)	2.94 (1)	0.087
Male mystery shopper	88.8 (71)		
Female salesclerk	83.7 (108)	0.12 (1)	0.728
Male salesclerk	82.2 (129)		
<b>Asked about age</b>	15.3 (44)		
Female mystery shopper	18.8 (39)	7.05 (1)	0.008
Male mystery shopper	6.3 (5)		
Female salesclerk	12.4 (16)	1.61 (1)	0.205
Male salesclerk	17.8 (28)		
<b>Observer’s ID requested</b>	13.2 (38)		
Female shopper/ observer pair	14.0 (29)	0.38 (1)	0.536
Male shopper/ observer pair	11.3 (9)		
Female salesclerk	15.5 (20)	1.00 (1)	0.317
Male salesclerk	11.5 (18)		

separately in Table 3. Results revealed that only the sex of the shopper remained significant, and females had a 2.4 times higher chance of completing a purchase relative to males (Table 4).

**Requests for shopper’s age or ID at purchase attempts**

During the purchase attempts, few salesclerks asked for the shopper’s age (15.3%), but many asked for the shopper’s ID (82.6%, Table 5). In contrast, the observer was asked for ID in 13.2% of the attempts. Interestingly, in 9.7% of the attempts when the salesclerk asked the shopper for ID (n = 237), cigarettes were sold (n = 23) even though the shopper did not show any ID. Since sex was predictive for the sales outcome in the regression analysis it was also investigated whether sex could predict a secondary outcome, the request of ID. There was

no significant effect regarding the sex of either the salesclerk or mystery shopper on the request for the ID of the shopper or the observer. Neither did the sex of the salesclerk influence the likelihood of the shopper's age being asked. However, female mystery shoppers were asked about their age more frequently than male shoppers (18.8% and 6.3%, respectively, Table 5).

## Discussion

Outlets frequently failed to comply with the Tobacco Act with regard to ensuring that mystery shoppers were above the legal age limit when buying cigarettes. In approximately one in four attempts, the mystery shoppers were successful in buying cigarettes without providing ID. The success rate does not measure the availability of cigarettes to underage teenagers, but rather the willingness of outlets to sell to them. A small number of outlets can provide cigarettes to a large number of adolescents, who, in turn, will quickly learn from which outlets to obtain cigarettes, as has been previously suggested by researchers (Forster & Wolfson, 1998) and smoking adolescents themselves (Robinson & Amos, 2010). In fact, the actual sales rates to underage consumers might be higher than those revealed in mystery shopping studies, since salesclerks could sell to young people they recognise who then will repeatedly shop in that respective outlet. Therefore, cigarettes could potentially be frequently sold to underage adolescents by outlets within Stockholm County, which is concerning considering the potential for addiction and the significant negative health effects of smoking.

The present finding that the absence of the required age limit signs was associated with higher sales rates in a separate chi-square analysis might indicate that certain retailers are less committed to performing ID checks and are more likely to sell to underage adolescents. Similar to this notion, a previous study conducted in Australia found that the presence of age limit signs was the only factor in a regression analysis predicting the sales outcome

(Sanson-Fisher et al., 1992). However, the presence of age limit signs did not remain significant in the logistic regression analysis, indicating that other factors might underlie this effect. Furthermore, the present study showed that in 9.7% of the cases where ID had been requested, the purchase was successful even though no ID was provided. This indicates that salesclerks knew about their responsibility to control the customer's age but chose to not refuse the cigarette sales even though ID was not provided. It is worth noting that some outlets deliberately did not accept credit cards (untypically in Sweden), refused to issue receipts, or requested that the consumer use another counter for the sale. This may indicate that sales to underage youth or the lack of ID checks in some instances was a conscious choice.

Female shoppers were significantly more successful in the purchase of cigarettes without showing ID compared to male shoppers, which is in line with many previous studies (Clark et al., 2000; DiFranza et al., 1996; Erickson et al., 1993; Forster et al., 1992; Kuendig & Astudillo, 2013). Since underage mystery shoppers (i.e. 12-17 years old) were used in many of these studies, girls might have appeared older than boys in the same age range, especially regarding the finding that an increased age (closer to the legal age) was associated with a higher success rate in these and other studies (DiFranza, Celebucki, & Mowery, 2001; DiFranza, Savageau, & Bouchard, 2001; Levinson et al., 2002). In fact, in a US study by DiFranza and colleagues (1996), increased apparent age was associated with higher success rates and was generally higher among girls than boys of the same chronological age – although there was still an effect based on gender when apparent age was controlled for. Another aspect could be a greater willingness to sell to girls, compared to boys, as shown in an early study in which adolescents attempted to buy cigarettes, but then did not complete the purchase by claiming not to have enough money. In the study, girls were more often



encouraged by the salesclerks to go through with the purchase even though they could not pay the full price, or they were offered to buy a cheaper brand of cigarettes, compared to when boys conducted the purchase attempt (Erickson et al., 1993). However, the evidence on the effect of the shopper's sex is mixed, as some studies found boys to be more successful than girls in purchase attempts of cigarettes (Levinson et al., 2002; Sundh & Hagquist, 2004), while others found that the shopper's sex had no effect on sales outcome (DiFranza, Savageau, & Bouchard, 2001; Krevor et al., 2011; Levinson, 2018; Radecki & Zdunich, 1993; Schweitzer et al., 2017). This discrepancy could be caused by cultural, regional or methodological differences between the studies.

In the present study, no significant differences were found between different types of outlets. Previous US studies have shown that the purchase rate of tobacco cigarettes to underage shoppers was highest in gas stations (Clark et al., 2000; Dai & Catley 2018; Erickson et al., 1993; Forster et al., 1992; Forster & Wolfson, 1998). The time of purchase (before or after 5 pm) did not significantly affect the success rate. By contrast, a larger study of 150,000 compliance checks with underage shoppers in the US showed that the success rate was higher after 5 pm than before (Clark et al., 2000). In addition, neither the number of people in line nor the age or sex of the salesclerk significantly affected the outcome in the present study. A previous study demonstrated that younger salesclerks were more likely to sell cigarettes to underage mystery shoppers than older ones (Levinson et al., 2002). Whereas one study found male clerks to be more likely to sell cigarettes than female clerks (DiFranza, Celebucki, & Mowery, 2001), the large study of 150,000 compliance checks found female clerks to be more likely to sell tobacco products to mystery shoppers (Clark et al., 2000). Although it cannot be excluded that adolescents obtain cigarettes through social sources, e.g., acquaintances, friends or family, the fact that adolescents who buy their own cigarettes smoke more than those

who obtain them through non-commercial sources (Castrucci et al., 2002), highlights the importance of age control in order to minimise smoking.

In a Swedish study conducted in 2005 by Sundh and Hagquist (2007), pseudo-underage mystery shoppers could purchase cigarettes in 48% of the purchase attempts (ranging from 40–58% in different areas). In the present study, 25% of purchase attempts were successful. Although not directly comparable because different regions were investigated, these results might indicate that the rates of cigarette sales to adolescents have declined in Sweden. A decline over time could be related to various changes. For example, in 2002 and onwards retailers were required to announce to the municipality the selling of tobacco products. The municipal licensing board had to conduct inspections to verify whether these outlets complied with the Tobacco Act (1993:581) with respect to advertisement, warning texts on cigarette packets and tobacco products age limit signs. Furthermore, reduced smoking rates and a denormalisation of smoking could potentially have been caused by smoking bans in bars and restaurants (in 2005), the requirement for warning texts and illustrations on tobacco products, the higher prices of cigarettes, and a reduced retail outlet density per capita for tobacco products (Sohlberg, 2019). Moreover, since the new *Law on tobacco and similar products* (2018:2088) was introduced in 2019, retailers need to apply for a tobacco selling license, and smoking has been prohibited in public outdoor places, which might further lower the sales rates. Sales rates have also declined over time in Switzerland (between 2007 and 2011). In the US, relatively low sales rates have been measured in recent years (Dai & Catley, 2018; Levinson, 2018; Levinson et al., 2018; Schweitzer et al., 2017) compared to earlier studies (see online supplementary material, Table S1), which could be related to a number of interventions, as well as tobacco and non-smoking policies implemented. Interventions that reduced sales rates were merchant and community

education, compliance checks (i.e., mystery shopping with feedback), as well as active enforcement, e.g., fines upon non-compliance. Mostly, active enforcement or a combination of the above strategies were effective, but no study achieved complete, sustained compliance (Richardson et al., 2009; Stead & Lancaster, 2005).

In Sweden, compliance checks are purchase attempts conducted by the municipality using a pseudo-underage mystery shopper, and include feedback about the outcome, which is given to the clerk and the outlet owner after the attempt. Administrative sanctions are not allowed in the event that the outlets do not comply with the law. The effectiveness of such compliance checks should be evaluated through a study using a control-experimental group and pre-post design. We believe that compliance checks conducted regularly could potentially result in large and sustained decreases in the number of outlets selling tobacco products to the underaged. Another measure that could be implemented is the education of salesclerks on age controls, which should be demanded by the municipality and tied to the tobacco selling license. Finally, stores that sell tobacco products to underage adolescents, should be identified, and upon repeated offences, they could be fined. However, both mandatory merchant education and law enforcement measures would require a legislative change.

### ***Strengths and limitations***

One strength is that several persons of both sexes were used as mystery shoppers to increase generalisability and reduce the effects of sex or individual behaviour on sales outcomes. The age of the mystery shoppers was evaluated by an independent expert panel, and the outlets were selected randomly by an external researcher. The inclusion of an observer ensured that several factors could be recorded reliably, and using an observer of the same age made the situation more similar to a real purchase attempt by teenagers compared with

using an older observer. Not including an observer could have affected the outcome of a purchase attempt, as the mystery shopper would have had to pay attention to many details during the attempt.

All purchases were made during the same week to avoid factors changing over time and influencing the results. Purchases took place during school summer holidays but were not conducted during the weekend, which may be seen as a limitation. Whereas one previous study showed higher success rates during weekend days (Clark et al., 2000) compared with weekdays, another study found the opposite (Levinson et al., 2002). Since only three male shoppers were recruited in the present study, resulting in a single team, more purchases were made by female shoppers. Ideally, an equal number of purchases would have been performed by both sexes. A moderate number of purchases were made, which might have prevented the study from gaining adequate power to detect differences between categories in some factors, such as outlet type.

The shopping attempts were made in 13 different municipalities, including urban areas within the city of Stockholm and more remote places on its outskirts. However, the study only included places within Stockholm County. Sales rates might be lower in municipalities that recently perform compliance checks, since those were excluded from the study, although the effectiveness of this method in Sweden is largely unknown. Similarly, although we excluded municipalities that had performed compliance checks during the last two years, we cannot rule out that municipalities included in the study might have used compliance checks before that time, which in turn, may have reduced sales rates. Future studies should include mystery purchases in other regions in Sweden and in European countries, including cities and towns of different sizes. This study was conducted in 2017, before the new *Law on tobacco and similar products* (2018:2088) became effective. This law includes further smoking bans in public spaces and a tobacco

license and, therefore, could have heightened awareness regarding the sales of tobacco to underage costumers. However, the municipality is not allowed to use the results of compliance checks to withdraw or not grant a tobacco license. Hence, it is not clear whether the sales rates would be lower after the new law became effective.

## Conclusions

The results of the present study indicate that cigarettes could potentially and frequently be sold to underage adolescents by outlets within Stockholm County. Therefore, routines established for checking IDs clearly need to be improved. For example, municipal inspections should ensure the presence of age limit signs as a condition of allowing the sales of tobacco products. Similarly, educating salesclerks on age controls could be demanded by the municipality and tied to the tobacco selling license. In addition, mandatory compliance checks, including mystery shopping followed by feedback, conducted regularly by municipalities could potentially reduce sales of tobacco products to adolescents. Further mystery shopping studies are needed to assess the effects of policy changes in Sweden.

## Acknowledgments

We thank all the participants acting as mystery shoppers. In addition, we thank Frida Bergenblad for organising and coordinating the data collection process and Erik von Essen for assistance with data collection.

## Declaration of conflicting interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

## Funding

This study was funded by the Stockholm County Administration.

## ORCID iD

Tobias H. Elgán  <https://orcid.org/0000-0001-6406-4685>

## Supplemental material

Supplemental material for this article is available online.

## References

- Agardh, E., Boman, U., & Allebeck, P. (2014). *Hur stor del av Sveriges sjukdomsburden orsakas av alkohol, narkotika och tobaksrökning? – Kartläggning utifrån "DALY-metoden" 1990–2010 [To what extent is Sweden's disease burden caused by alcohol, narcotics and tobacco smoking? Mapping after the "DALY-method" 1990–2010]*. Stockholm: Karolinska Institutet: Institutionen för Folkhälsovetenskap.
- Ambrose, J. A., & Barua, R. S. (2004). The pathophysiology of cigarette smoking and cardiovascular disease: An update. *Journal of the American College of Cardiology*, 43(10), 1731–1737.
- Barron, S., White, A., Swartzwelder, H. S., Bell, R. L., Rodd, Z. A., Slawewski, C. J., Ehlers, C. L., Levin, E. D., Rezvani, A. H., & Spear, L. P. (2005). Adolescent vulnerabilities to chronic alcohol or nicotine exposure: Findings from rodent models. *Alcoholism, Clinical and Experimental Research*, 29(9), 1720–1725.
- Breslau, N., & Peterson, E. L. (1996). Smoking cessation in young adults: Age at initiation of cigarette smoking and other suspected influences. *American Journal of Public Health*, 86(2), 214–220.
- CAN report 187. (2019). Skolelevers drogvanor 2019 [Drug consumption among students 2019]. Centralförbundet för Alkohol- och Narkotikaupplysning.
- Castrucci, B. C., Gerlach, K. K., Kaufman, N. J., & Orleans, C. T. (2002). Adolescents' acquisition of cigarettes through noncommercial sources. *The Journal of Adolescent Health*, 31(4), 322–326.
- Chambers, R. A., Taylor, J. R., & Potenza, M. N. (2003). Developmental neurocircuitry of motivation in adolescence: A critical period of addiction vulnerability. *The American Journal of Psychiatry*, 160(6), 1041–1052.
- Chen, J., & Millar, W. J. (1998). Age of smoking initiation: Implications for quitting. *Health reports / Statistics Canada, Canadian Centre for Health Information = Rapports sur la sante /*

- Statistique Canada, Centre canadien d'information sur la sante*, 9(4), 39–46(Eng); 39.
- Clark, P. I., Natanblut, S. L., Schmitt, C. L., Wolters, C., & Iachan, R. (2000). Factors associated with tobacco sales to minors: Lessons learned from the FDA compliance checks. *The Journal of the American Medical Association*, 284(6), 729–734.
- Costello, M. R., Reynaga, D. D., Mojica, C. Y., Zaveri, N. T., Belluzzi, J. D., & Leslie, F. M. (2014). Comparison of the reinforcing properties of nicotine and cigarette smoke extract in rats. *Neuropsychopharmacology*, 39(8), 1843–1851.
- Dai, H., & Catley, D. (2018). The effects of assurances of voluntary compliance on retail sales to minors in the United States: 2015–2016. *Preventive Medicine*, 111, 410–414.
- D'Avanzo, B., La Vecchia, C., & Negri, E. (1994). Age at starting smoking and number of cigarettes smoked. *Annals of Epidemiology*, 4(6), 455–459.
- DiFranza, J. R., Celebucki, C. C., & Mowery, P. D. (2001). Measuring statewide merchant compliance with tobacco minimum age laws: The Massachusetts experience. *American Journal of Public Health*, 91(7), 1124–1125.
- DiFranza, J. R., Savageau, J. A., & Aisquith, B. F. (1996). Youth access to tobacco: The effects of age, gender, vending machine locks, and “it’s the law” programs. *American Journal of Public Health*, 86(2), 221–224.
- DiFranza, J. R., Savageau, J. A., & Bouchard, J. (2001). Is the standard compliance check protocol a valid measure of the accessibility of tobacco to underage smokers? *Tobacco Control*, 10(3), 227–232.
- Eisner, M. D., Yelin, E. H., Katz, P. P., Shiboski, S. C., Henke, J., & Blanc, P. D. (2000). Predictors of cigarette smoking and smoking cessation among adults with asthma. *American Journal of Public Health*, 90(8), 1307–1311.
- Erickson, A. D., Woodruff, S. I., Wildey, M. B., & Kenney, E. (1993). A baseline assessment of cigarette sales to minors in San Diego, California. *Journal of Community Health*, 18(4), 213–224.
- Forster, J. L., Hourigan, M., & McGovern, P. (1992). Availability of cigarettes to underage youth in three communities. *Preventive Medicine*, 21(3), 320–328.
- Forster, J. L., & Wolfson, M. (1998). Youth access to tobacco: Policies and politics. *Annual Review of Public Health*, 19, 203–235.
- Kessel Schneider, S., Buka, S. L., Dash, K., Winickoff, J. P., & O'Donnell, L. (2016). Community reductions in youth smoking after raising the minimum tobacco sales age to 21. *Tobacco Control*, 25(3), 355–359.
- Krevor, B. S., Ponicki, W. R., Grube, J. W., & DeJong, W. (2011). The effect of mystery shopper reports on age verification for tobacco purchases. *Journal of Health Communication*, 16(8), 820–830.
- Kuendig, H., & Astudillo, M. (2013). Learning from the chaos: Heterogeneous age limits of bans on tobacco sales to young people in Switzerland. *Drugs: Education, Prevention and Policy*, 20(6), 482–487.
- Leatherdale, S. T., & Strath, J. M. (2007). Tobacco retailer density surrounding schools and cigarette access behaviors among underage smoking students. *Annals of Behavioral Medicine*, 33(1), 105–111.
- Levinson, A. H. (2018). Nicotine sales to minors: Store-level comparison of e-cigarette versus cigarette violation rates. *Nicotine & Tobacco Research*, 20(2), 267–270.
- Levinson, A. H., Hendershott, S., & Byers, T. E. (2002). The ID effect on youth access to cigarettes. *Tobacco Control*, 11(4), 296–299.
- Levinson, A. H., Ma, M., Jason, L. A., Lee, J. G. L., Landrine, H., Glueck, D. H., & DiFranza, J. R. (2018). Assessment of the US federal retailer violation rate as an estimate of the proportion of retailers that illegally sell tobacco to adolescents. *JAMA Pediatrics*, 172(10), 966–972.
- Nordstrom, B. L., Kinnunen, T., Utman, C. H., Krall, E. A., Vokonas, P. S., & Garvey, A. J. (2000). Predictors of continued smoking over 25 years of follow-up in the normative aging study. *American Journal of Public Health*, 90(3), 404–406.
- Radecki, T. E., & Zdunich, C. D. (1993). *Tobacco sales to minors in 97 US and Canadian communities*. Tobacco Control.
- Reynolds, M. J., Crane, R., & Winickoff, J. P. (2019). The emergence of the Tobacco 21 Movement from Needham, Massachusetts, to throughout the

- United States (2003–2019). *American Journal of Public Health*, 109(11), 1540–1547.
- Richardson, L., Hemsing, N., Greaves, L., Assanand, S., Allen, P., McCullough, L., Bauld, L., Humphries, K., & Amos, A. (2009). Preventing smoking in young people: A systematic review of the impact of access interventions. *International Journal of Environmental Research and Public Health*, 6(4), 1485–1514.
- Robinson, J., & Amos, A. (2010). A qualitative study of young people's sources of cigarettes and attempts to circumvent underage sales laws. *Addiction*, 105(10), 1835–1843.
- Sanson-Fisher, R. W., Schofield, M. J., & See, M. (1992). Availability of cigarettes to minors. *Australian Journal of Public Health*, 16(4), 354–359.
- Sasco, A. J., Secretan, M. B., & Straif, K. (2004). Tobacco smoking and cancer: A brief review of recent epidemiological evidence. *Lung Cancer*, 45(Suppl 2), S3–S9.
- Schleicher, N. C., Johnson, T. O., Fortmann, S. P., & Henriksen, L. (2016). Tobacco outlet density near home and school: Associations with smoking and norms among US teens. *Preventive Medicine*, 91, 287–293.
- Schweitzer, R. J., Wu, Y. Y., & Nigg, C. R. (2017). Compliance checks for underage cigarette and alcohol purchase attempts and associated factors in retail outlets in Hawaii. *Drugs: Education, Prevention and Policy*, 24(5), 384–391.
- Sohlberg, T. (2019). In favour of tobacco control? Former smokers' support for tobacco policies. *Nordic Studies on Alcohol and Drugs*, 36(6), 496–510.
- Stead, L. F., & Lancaster, T. (2005). Interventions for preventing tobacco sales to minors. *Cochrane Database of Systematic Reviews*, 1, Article CD001497.
- Sundh, M., & Hagquist, C. (2004). The importance of a minimum age law for the possibility of purchase of tobacco by adolescents: A study based on Swedish experiences. *Scandinavian Journal of Public Health*, 32(1), 68–74.
- Sundh, M., & Hagquist, C. (2007). Does a minimum-age law for purchasing tobacco make any difference? Swedish experiences over eight years. *European Journal of Public Health*, 17(2), 171–177.
- The ESPAD Group. (2020). *ESPAD report 2019: Results from the European School Survey Project on Alcohol and Other Drugs*. EMCDDA.
- Warpenius, K., Holmila, M., & Raitasalo, K. (2016). Compliance with the legal age limits for alcohol, tobacco and gambling: A comparative study on test purchasing in retail outlets. *Drugs: Education, Prevention and Policy*, 23(5), 435–441.
- Wiener, R. C., Shockey, A. K. T., & Morgan, S. K. (2016). Adolescent light cigarette smoking patterns and adult cigarette smoking. *Advances in Epidemiology*, 2016, 1–7.
- Winickoff, J. P. (2018). Maximizing the impact of tobacco 21 laws across the united states. *American Journal of Public Health*, 108(5), 594–595.
- Zhou, X., Nonnemaker, J., Sherrill, B., Gilsenan, A. W., Coste, F., & West, R. (2009). Attempts to quit smoking and relapse: Factors associated with success or failure from the ATTEMPT cohort study. *Addictive Behaviors*, 34(4), 365–373.