Policies targeting the sale of tobacco and youth smoking behaviour

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CHAPTER 2

How can a ban on tobacco sales to minors be effective in changing smoking behaviour among youth? – A realist review

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ABSTRACT

The aim of the study was to understand, from the perspective of youth, how and under which circumstances a ban on tobacco sales to minors can be effective in influencing youth smoking behaviour. We searched Medline, Embase, and PsychINFO in February 2016. A systematic search for studies about a ban on sales to minors and smoking behaviour was performed. Only studies that addressed potential mechanisms were included, resulting in thirty-three studies. We extracted evidence from 26 quantitative, 5 qualitative, and 2 mixed-methods studies, explaining how the ban may be effective in reducing smoking behaviour, and contextual factors that may influence these mechanisms. We identified two mechanisms and three contra-mechanisms. First, when direct access to commercial sources is limited, cigarette consumption may be reduced because minors have restricted access to commercial cigarettes. Minors’ access to social sources and the various ways in which they continue to buy cigarettes by circumventing the ban, are two contra-mechanisms that undermine this effect. Second, when the ban is strongly enforced, an anti-smoking norm may be created and adolescents may smoke less as a result. One contra-mechanism may possibly undermine this effect: the ‘forbidden fruit’ effect. Whether these (contra-)mechanisms occur depends on contextual and individual factors such as level of enforcement, the minors’ social network, and their dependence on smoking. The ban can be effective if well enforced. However, minors’ access to social sources and their ways to circumvent the ban should be addressed to achieve its full potential.
BACKGROUND

Most people start smoking before the age of 18 years old and often transition to regular smokers during young adulthood. Current tobacco control policies to prevent and reduce smoking have a strong focus on youth. One of such policies is the ban on tobacco sales to minors that has been implemented in numerous countries. The ban aims to limit access to commercially-sold cigarettes by setting a legal purchasing age. This age varies between countries, ranging from 16 to 21 years old.

Several studies have explored the association between a ban on sales to minors and tobacco use among youth. All studies have highlighted the importance of enforcement in reducing illegal sales to minors. DiFranza (2011) finds that if the ban is successful in disrupting the commercial supply of cigarettes, then tobacco use among minors is expected to decline. However, many studies also emphasize the fact that adolescents do not exclusively make use of commercial sources. Minors also access social sources of cigarettes. The Institute of Medicine developed a logic model to explain the link between a minimum age policy and underage tobacco use, by examining behavioural mechanisms. The model emphasizes that the ban can affect smoking by deterring youth from using commercial sources. This is highly dependent on the level of enforcement of the ban. Moreover, according to this model, the ban can affect smoking by shaping the legal norm and changing beliefs and attitudes towards tobacco use.

While this model, as well as previous reviews, identify important ways in which the ban may affect smoking behaviour, the perspective of youth in relation to the ban has not been explored previously. The perspective of youth is important to examine as they are the target group of the ban. Their reaction will determine a substantial part of the effectiveness of the ban. With this in mind, we conducted a review with the aim to understand how youth respond to bans and sales on minors. We aim to understand, by taking a youth perspective, how and under which circumstances a ban on sales to minors can be effective in influencing youth smoking behaviour. This review can therefore provide evidence for the potential improvement of a ban on sales to minors.

METHODS

We used a realist review approach as developed by Pawson. This approach is particularly suited for understanding the ‘mechanisms’ through which a policy intervention may succeed or fail to achieve the expected outcomes. By identifying these mechanisms, a realist review will not only show how a policy may succeed in influencing youth smoking, but also how the outcomes may vary
across subgroups of youth, and how this may depend on wider circumstances such as forms of implementation.

In the review process, we followed the six steps formulated by Pawson: identifying the review question, formulating the initial programme theory, searching for primary studies, selecting and appraising included studies, extracting, analysing, and synthesizing relevant data, and refining the initial programme theory.8

Identifying the review question

This review aimed to answer the following question: how could a ban on tobacco sales to minors prevent or reduce smoking among adolescents? Among which groups and in which circumstances are such effects most likely to occur?

Formulating the initial programme theory

An initial programme theory was developed between November 2015 and February 2016, on the basis of a scoping review of the literature on tobacco age of sale policies. This review yielded ideas of how the ban might work and what contextual elements could influence the mechanisms involved. To systematize these initial ideas, a number of behavioural models was used: the Theory of Planned Behaviour, Social Cognitive Theory, and the Health Belief Model.9-11

From the Theory of Planned Behaviour we developed the idea that the ban may lead to potential changes in smoking norms, which could in turn influence smoking behaviour. The Social Cognitive theory elucidated the role of personal and environmental determinants that may influence the way an individual reacts to the ban. Lastly, the Health Belief Model underlined the role of perceptions and beliefs in health behaviour. According to this model, the influence of the ban on smoking behaviour depends on minors’ perception of access to cigarettes or acceptability of smoking. We also used elements from the conceptual model created by the International Tobacco Control Policy Evaluation Project, particularly its distinction between policy-specific variables and policy relevant outcomes.12

A summary of the resulting theory is presented in Table 1. Two core mechanisms were identified through which a ban on sales to minors may affect smoking behaviour. A ban can influence an individual’s access to cigarettes (M1) and it can affect an individuals’ norms and thereby his/her motivation to obtain cigarettes (M2), resulting in a change in smoking behaviour.6,13-16 How and whether these mechanisms take place depends on context.
Table 1. Initial programme theory illustrating the relationship between a ban on sales to minors and smoking behaviour, among adolescents.

<table>
<thead>
<tr>
<th>Contextual factors</th>
<th>Mechanisms</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level of enforcement</td>
<td>M1: The ban may lead to a reduction in perceived access to commercial cigarettes</td>
<td>Non-smoking minors are prevented from smoking</td>
</tr>
<tr>
<td>Gender</td>
<td>M2: The ban may create an anti-smoking norm (social and individual)</td>
<td>Smoking minors reduce their consumption of cigarettes</td>
</tr>
<tr>
<td>Age</td>
<td>Smoking minors quit smoking</td>
<td></td>
</tr>
<tr>
<td>Smoking experience</td>
<td>Smoking minors reduce their consumption of cigarettes</td>
<td></td>
</tr>
<tr>
<td>Social network</td>
<td>Smoking minors quit smoking</td>
<td></td>
</tr>
</tbody>
</table>

Searching and selecting primary studies

Guided by the initial programme theory, a systematic literature search was performed. A medical librarian assisted in the development of the search terms. These terms were constructed with the use of MeSH terms and concepts identified in previous literature on the topic (see Appendix I). The following databases were screened for relevant literature: Medline, Embase, and PsychINFO. The search was conducted in February 2016. No restriction on publication year was applied.

Selecting and appraising studies

The selection of studies was done by two independent reviewers (PAWN and TGK) in two stages; one based on title and abstract and one on full-texts. Due to time constraints, the full-text screening was completed by PAWN after a random sample of 15 articles had been screened by both PAWN and TGK in order to test and fine-tune the selection criteria and ensure consensus. The content of the title/abstract had to include the words ‘adolescents’ (and synonyms), ‘smoking’ (idem), and ‘ban on sales to minors’ (idem). The full-text selection aimed to identify studies that included relevant evidence on the potential effect of the ban on adolescents’ smoking behaviour (see Appendix II for criteria). Studies testing retailer compliance were only included if compliance was linked to smoking behaviour, because we were interested in mechanisms at the level of the minor not the retailer. Six studies evaluated the USA Purchase, Use, Possession laws; these were excluded as they are a different intervention than a ban on sales to minors. We also excluded articles that focussed on illegal sales only, that lacked a smoking outcome, and/or that focused solely on minor’s attitudes towards the ban. Five studies were excluded because no full-text in English was available. Thirty-three studies were included in the final analysis, of which 26 quantitative, 5 qualitative, and 2 mixed-methods studies (see Figure 1).

Following Realist And Meta-narrative Evidence Syntheses: Evolving Standards (RAMESES) guidelines, the quality of studies was appraised in terms of rigor and
relevance. Rigor is the methodological quality of a study and it was assessed independently by two authors (PAWN and TGK). If both agreed that the quality of a study was weak, then the study was excluded. Rigor was not sufficient if the sample population was not suitable to investigate the research question and/or if the internal/external validity were inadequate. No articles were excluded based on rigor.

The relevance criterion refers to whether the evidence “can contribute to theory building and/or testing...” Relevance was determined by whether a study contained sufficiently detailed information on mechanisms proposed in our initial programme theory. Studies with high relevance were primarily used to test, substantiate and refine the mechanisms of interest. Studies with low relevance, i.e. with sparse evidence about mechanisms of interest, were only used to provide supporting evidence. No studies were excluded based on relevance. See Appendix III for relevant characteristics of studies.

Extracting, analysing, and synthesizing relevant data

The following information was extracted per study: title, author, year, setting, study design, aim, participants, legal purchasing age, outcome(s), and enforcement of policy (if mentioned). Moreover, we extracted all empirical
evidence on mechanisms of interest, using citations from parts of the text that contained this evidence. The evidence was organized in a matrix containing all available evidence.

Using this matrix, the evidence was juxtaposed with the initial theory, in order to test, substantiate and refine this initial theory. We integrated this evidence by formulating a series of mechanisms and contra-mechanisms. Mechanisms are the processes through which a ban could lead to a favourable change in smoking behaviour in minors. This positive change could be reduced or nullified by the occurrence of other processes, which we labelled “contra-mechanisms”. Identifying mechanisms and contra-mechanisms was done by the first author (PAWN) in collaboration with co-authors. The second author (TGK) read all included studies and critically evaluated the evidence with regards to their support for the proposed mechanisms. All authors contributed to the final step of refining the mechanisms.

FINDINGS

The initial programme theory was tested with the use of empirical evidence. This evidence is presented here as context-mechanism-outcome (CMO).

Mechanism 1: When access to commercial sources is limited and minors find direct access to be difficult, they may not try to access cigarettes, and may therefore reduce cigarette consumption.

Minors find it difficult to access commercial sources of cigarettes when a ban on sales to minors is in place.\textsuperscript{18, 19} The ban decreases cigarette purchasing behaviour among those underage.\textsuperscript{20} This reduction was most prominent among shops and kiosks.\textsuperscript{18, 20} A decrease in smoking experimentation was also observed in various underage groups (12-16 years old).\textsuperscript{20} One study found a reduction in regular smoking following an increase in minimum purchasing age.\textsuperscript{21} One study also found a reduction in the progression to established smokers.\textsuperscript{22} The ban seems to affect younger adolescents more than older as indicated by lower smoking prevalence among younger age groups.\textsuperscript{20, 23}

The extent to which smoking behaviour is influenced is strongly associated with context, e.g. the comprehensiveness of the ban. A community intervention tackling tobacco access by implementing license fees for retailers, compliance checks, vendor penalties, vending machine bans, self-service bans, and purchaser penalties, resulted in a lower smoking prevalence in intervention compared to control communities.\textsuperscript{24} Another intervention in the form of community education, retailer education, and policy discussions also showed a reduction in
commercial cigarette availability and a decrease in tobacco use among younger adolescents compared to control communities. Community interventions are also associated with lower perceived availability of commercial cigarettes. This low perceived availability, in turn, protects the transition to smoking in contexts with strict enforcement.

**Contra-mechanism 1.1:** When commercial sources are found to be less accessible, minors who depend on smoking may resort to social sources because they are easier to access, and may thus continue smoking.

The ban does not always positively influence smoking behaviour. Various studies have shown that minors “resort to social sources” when commercial sources become less accessible and minors find it difficult to access these sources. Whether this shift takes place depends on any of four contextual factors: an individual’s social network, reliance on commercial sources, gender, and age.

**Social network**

We defined an individual’s social network as someone’s friends and family. If adolescents have friends/family who smoke, then access to cigarettes remains possible. This is a primary source of cigarettes for many minors. Adolescents living in ‘smoking homes’ were more likely to obtain cigarettes from their family either by receiving them from parents or by stealing. One study also found that minors exposed to smoking family members try to buy cigarettes more often.

Some authors have mentioned the existence of a “commercial social market”. This so-called ‘market’ may take three forms. First, minors sell cigarettes to each other. This exchange takes place at school, parties, and via text messaging. The price of these cigarettes depends on who is selling and who is buying. Second, minors may put money together to buy a pack and share the cigarettes, this was referred to as “halved in”. Lastly, a system of reciprocity may be in place, with borrowing cigarettes in return for one later or in return for favours. This exchange of favours was also observed in families, adolescents mentioning ‘doing the dishes, making their parents a drink or coffee’ in return for cigarettes. These “internal markets” seem to create an additional platform for indirect cigarette access.

However, whether this ‘commercial social market’ is successful depends on how many people smoke and where they smoke. Those smoking on school premises for example, had a larger exchange network than those who smoked outside of school.
Smoking status

The extent of the use of social sources also depends on an individual’s level of addiction. The ban might not be effective for occasional or experimental smokers. A minor in a smoking initiation and experimentation phase usually does not depend on commercial sources and relies more on social sources. Experiencing minors almost exclusively get their cigarettes from peers/family or other social sources. Therefore, the ban may not tackle individual smoking and purchasing behaviour of those who have always relied on social sources and who may continue to use social sources only, because “they did not want to break the law.”

This contra-mechanism primarily occurs among experimental smokers, and is less prominent among regular smokers. A regular smoker relies heavily on both commercial and social sources as social sources alone may not be enough to supply their continuous demand for cigarettes. The ban may limit access to commercial sources of cigarettes to a certain extent and thereby lead to a reduction in smoking frequency. However, despite the implementation of the ban, regular smokers continue to access social sources and continue smoking.

Gender and age

Gender and age also seem to influence which sources of cigarettes are used. Girls are more likely to use social sources to obtain cigarettes than boys. Older minors use commercial sources more often; as school grade increases, so does the likelihood that they buy their own cigarettes. A reason for this may be that older minors are able to access commercial sources more easily because they look more mature.

Contra-mechanism 1.2: When commercial sources are found to be less available, minors who depend on commercial sources, may find ways to circumvent the ban in order to meet their need for cigarettes, and thus to continue smoking.

In addition to the use of social sources, smokers have found ways to bypass age of sale laws. Several strategies are discussed below.

Familiarity effect and types of stores

One concept found by several studies is the ‘familiarity effect’. Retailers recognize regular customers, and minors know exactly which retailers are most lenient, “if you go to the wrong store you’re definitely going to get turned down, but most people who smoke know what stores to go to.” Regular customers are more likely to have a successful buy compared to strangers. Many minors
also have friends working in stores selling cigarettes, which increases the likelihood of getting direct access to commercial sources. Minors tend to choose the path of least resistance by going to local shops and “minimizing the risk of refusal.” Supermarkets were avoided as they were perceived to be stricter in enforcing the law. Minors mentioned that cigarettes could be easily purchased from local shops and kiosks. In addition, newsagents, ice-cream vans, or service stations were also mentioned as easy-accessible sources of cigarettes. These sources were known for selling to minors more easily than larger supermarkets.

**Direct purchases**

Beyond the familiarity effect and types of shops, minors may also use other tactics to ensure a successful purchase. When attempting to buy cigarettes themselves, minors have mentioned ‘looking in the clerks eyes’, acting ‘like you do it all the time’, ‘dangling car keys’, and/or borrowing ID cards as methods guaranteeing success. If minors are asked for ID, some “young people just said that they left it at home and would bring it next time […]” or go “…into shops with older siblings, pretending they had forgotten their ID, using fake ID, saying the cigarettes were for a parent, and asking older pupils to buy for them.” Similarly, electronic verification devices on vending machines requesting ID, were observed to be ineffective in one study, since minors borrow ID cards from friends to bypass the system. As Marsh states, “the more difficult it becomes for young people to source their tobacco, the more desperate measures they use to get it…”

**Proxy buys**

Another strategy that minors use to obtain cigarettes are proxy buys. Minors wait outside stores and ask strangers to buy cigarettes for them. When asking strangers, most minors target younger people (of legal age) as they are found to be most willing. “…they targeted under-25-year-olds…they sympathized with the young people, that they remember doing the same and so were willing to buy for them.” Others sometimes offer to “keep the change” or give a cigarette in exchange.

Whether minors use any of these strategies depends on contextual factors such as a minors’ addiction to cigarettes, age, and sex. Regular smokers apply this mechanism as they require more cigarettes and will continue to try and access commercial cigarettes. “When cigarettes stolen from home are no longer sufficient to satisfy young smokers, but they are still too young to buy in stores, it is commonplace for them to loiter in front of stores asking strangers to buy for them.” Older minors have also been found to be more successful in
circumventing the ban, because they ‘look older’. In addition, one study has also found that girls are more successful in purchasing cigarettes. However, girls are less likely to try using commercial sources compared to boys and may be less inclined to circumvent the ban.

**Mechanism 2:** When youth find access to commercial sources to be limited, a negative social norm towards tobacco smoking may be created, leading to a negative attitude and/or norm and a resultant reduction in smoking among minors.

We found no evidence for the importance of an intermediary role of social norms. One study shows that strong enforcement of clean air and youth access regulations, is associated with perceived anti-smoking norms. This association was stronger among adults than youth and “… among youth…who were younger, less rebellious and less sensation seeking, and by those whose parents were more educated, more affluent, and non-smokers.” This suggests that some youth populations may be more sensitive than others to the impact of regulations on social norms. The “commercial social market” as previously explained, may contribute to changes in norms. Smoking may be seen as a ‘sociable and acceptable activity’. Cigarette sharing among friends is common, and non-smokers often witness such exchanges. In this context, mechanism 2 does not lead to a positive change in norms but rather to a stimulus to smoke. Actual attitudes or norms of minors were not measured in these studies.

**Contra-mechanism 2.1:** When youth find access to commercial sources to be limited, and they perceive the ban as limiting their personal freedom, then they may rebel against the ban and continue to smoke.

The reactance theory and forbidden fruit effect provide explanation for the occurrence of contra-mechanism 2.1. The Reactance theory has been proposed to be related to anti-tobacco policies, suggesting that “adolescents who are most aware that anti-tobacco policies are restricting their freedom to smoke may be more likely to smoke as a way of reasserting their autonomy.” In addition, “…the absence of risk in obtaining cigarettes in the home may lead adolescents to purchase commercially to seek a risky behaviour” illustrates the role of the forbidden fruit effect. “Anti-tobacco policies may have the unintended consequences of motivating smokers to smoke more and encouraging non-smokers to experiment with smoking.”

No empirical evidence has been found to fully support this contra-mechanism. Nevertheless, several authors have speculated about the relation between a ban and the forbidden fruit effect.
DISCUSSION

Key findings

While previous studies have evaluated the impact of a ban on sales to minors on youth smoking behaviour, few had taken the perspective of minors themselves. We reviewed the available evidence, in order to better understand how youth respond to bans on sales to minors, and any variations therein between persons and circumstances. We developed an initial programme theory that took into account current views, and we tested this theory against empirical evidence identified in a systematic review of the literature that followed a realist approach. This approach resulted in a refined theory that identified two mechanisms and three contra-mechanisms.

Mechanism 1 proposed that a strictly enforced ban on sales to minors reduces their perceived accessibility to cigarettes, which would reduce cigarette purchasing and consumption among minors. However, this effect may be undermined and even nullified by two contra-mechanisms, of which one relates to minor’s access to social sources and the other to the many ways in which minors could buy cigarettes at commercial outlets despite the ban.

Mechanism 2 suggested that the ban leads to negative social and individual norms towards smoking thereby reducing smoking. However, this effect may be countervailed by opposite effects such as the forbidden fruit effect. Empirical evidence on either mechanisms is virtually absent in the scientific literature.

Evaluation of the review

Despite the systematic search in various databases, we found only limited evidence from studies that take the youth perspective, to assess how minors respond to a ban on sales to minors and how this relates to their smoking behaviour. Most quantitative studies on the effectiveness of the ban solely focus on smoking outcomes and lack information on response patterns that would link these outcomes to the ban. Qualitative studies can provide richer evidence when they zoom in on the perceptions and reactions to the ban from a minor’s point of view. Unfortunately, the evidence from this type of studies is limited to only five qualitative and two mixed-method studies, out of a total of 33.

Nearly all studies are from English-speaking countries, with the exception of five studies from Finland, Germany, Japan, the Netherlands, and Taiwan. This geographical restriction may limit the generalisability of the evidence towards territories such as continental Europe. For example, whereas American research strongly emphasizes the role of communities in enforcement of the ban, in most
European countries enforcement may depend more strongly on national laws and enforcement organisations that operate at national or regional levels. Francis Castles distinguishes four families of public policy development (i.e. English-speaking, Continental, Scandinavian, and Southern families). This illustrates the important role of national policy context in understanding the effectiveness of the ban and in formulating lessons that can be transferred between countries.

Current literature has a strong focus on the success of policies in terms of retailer compliance and reducing illegal sales. When outcomes at the level of youth respondents are measured, the emphasis is not on smoking behaviour but on their perceived access to cigarettes. There is much less evidence on how reduced access affects cigarette consumption. As a result, there is limited evidence to understand how the ban affected youth smoking behaviour – an observation made in previous reviews.

Findings in context

The main question is whether a ban on sales to minors can be effective in preventing or reducing cigarette consumption by adolescents. The results of this review imply that there is not one universal effect, but that the effectiveness depends on several mechanisms and conditions.

Unsurprisingly, there is evidence to infer that inadequate forms of implementation may strongly reduce effectiveness. One issue is the minors’ continued access to cigarettes through small commercial outlets such as local shops, kiosks, newsagents, etc. These outlets may remain easily-accessible as enforcement of the ban tend to be more lenient in smaller retail outlets. Similar to our results, a previous review concluded that lack of full and sustained compliance by retailers limits the effect of the ban on youth smoking.

A number of studies demonstrated how strong enforcement does affect youth smoking behaviour. In these cases, community-based interventions included a wide array of enforcement measures ranging from retailer fines to community education. These findings suggest that a broad package of enforcement measures both at the level of retailers and communities can have a positive effect on smoking behaviour. However, it must be kept in mind that these effects were obtained under highly controlled settings, in which enforcement may have a larger effect on smoking than in settings where policies are more loosely implemented.

Based on our findings, the ban seems less effective for girls than boys. Our findings show that girls are more likely to use social sources of cigarettes and that girls often get their supply from boys, while boys more often want to take risks to buy cigarettes.
An important issue is to what extent the ban could be effective in changing social norms regarding smoking. Only one study found evidence to suggest that a change in norms could occur as a result of the implementation of several policies, although this was found primarily among adults and among non-smoking adolescents.16 Other adolescents may react to such a ban differently. Based on our review, we would expect a weaker response among smokers. In addition, some authors even suggested that reverse effects, such as a reinforcement of pro-social norms or the “forbidden fruit” effect. However, these possibilities have not been subjected to empirical tests.

A ban on tobacco sales to minors is usually enacted in synergy with other policies. We did not find studies that looked at the effects of the ban as separate from policies that are simultaneously enacted. It is therefore hard to attribute general declines in smoking prevalence to a ban on sales to minors specifically. Only one study looked at more than one policy, focusing on smoke-free and access policies and the influence on norms.16

**Implications for future policies**

Our findings show that a ban has the potential to contribute to the reduction of youth smoking. In order to realise its full potential, complementary measures are needed.

A main concern is the persistent role of social networks as a source of cigarettes, especially among initiating smokers. This underlines the importance of complementary policies to reduce youth smoking by targeting their social environments. Given that a considerable part of social exchange takes place at school premises, measures to ban smoking from these premises and nearby places may limit adolescents’ possibilities to exchange cigarettes. Furthermore, as parents often appear to promote their child’s access to cigarettes, educational campaigns may raise awareness of the smoking parent’s role in restricting their children’s access to cigarettes.

A common theme in many of the studies is the great agility that adolescents display to access cigarettes from commercial sources. This agility should not be underestimated in the enforcement of bans on sales to minors. Particular concern is the ease of access and frequent use of small shops such as kiosks. A fundamental measure would be restricting the number of retail outlets for example through licensing.47 Reducing the number of sales outlets would make enforcement measures more manageable and will allow governments to revoke licenses in case of repeated non-compliance.
REFERENCES


3. DiFranza JR. Which interventions against the sale of tobacco to minors can be expected to reduce smoking? Tob Control. 2011; 21: 436-42.


APPENDIX I: SEARCH TERMS

MEDLINE search

1. exp government/ or exp “legislation as topic”/ or exp formal social control/
3. (law? or ordinance? or jurisprudence or legal or legislation or ((control* or access) adj3 (tobacco or smoking)) or smoking ban?).ab,kf,ti.
4. or/1-3 [legal]
5. commerce/ or exp marketing/ or consumer participation/ or tobacco industry/
6. (economics or “supply and distribution”).fs.
7. (commerc* or tobacco industry or purchas* or sale? or (access adj3 (youth or minors)) or retail*).ab,kf,ti.
8. or/5-7 [purchase]
9. adolescent/ or young adult/ or Psychology, adolescent/ or adolescent behavior/ or adolescent health/ or students/
10. (student? or youth* or juvenile or teen or teens or teenage* or young people or pupil? or minors or adolescent*).ab,kf,ti.
11. or/9-10 [adolescents]
12. and/4,8,11
13. tobacco control.jn. and 11
14. 12 or 13 [legal purchase age adolescents]
15. smoking/
16. (smoker? or smoking or cigarette? or cigar?).ab,kf,ti.
17. 15 or 16 [smoking]
18. social facilitation/ or adolescent behavior/ or health knowledge, attitudes, practice/ or life style/ or social norms/ or social values/
19. (behavior* or behaviour or social facilitation or habit? or life style? or lifestyle? or norm? or value? or (health adj3 (knowledge or attitude? or practice))).ab,kf,ti.
20. 18 or 19 [behavior]
21. 17 and 20
22. exp “tobacco use”/ or exp “tobacco use cessation”/ or “tobacco use disorder”/
23. (smoking cessation or “tobacco use” or “use of tobacco” or “tobacco possession use” or “tobacco purchase use” or “cigarette use” or “use of cigarettes” or (nicotine adj3 (disorder or dependence))).ab,kf,ti.
24. or/21-23 [smoking behavior]
25. 14 and 24
26. animals/ not humans/
27. 25 not 26
28. remove duplicates from 27

Total number of articles initial search: 1456
Embase search

1. exp *government/ or exp legal aspect/ or *social control/
2. (law? or ordinance? or jurisprudence or legal or legislation or ((control* or access) adj3 (tobacco or smoking)) or smoking ban?).ab,kw,ti.
3. or/1-2 [legal]
4. *commercial phenomena/ or *consumer/ or *tobacco industry/
5. (commerc* or tobacco industry or purchas* or sale? or (access adj3 (youth or minors)) or retail*).ab,kw,ti.
6. or/4-5 [purchase]
7. *adolescent/ or *young adult/ or *youth/ or *adolescent behavior/ or *adolescent health/ or *student/
8. (student? or youth* or juvenile or teen or teens or teenage* or young people or pupil? or minors or adolescen*).ab,kw,ti.
9. or/7-8 [adolescents]
10. and/3,6,9
11. tobacco control.jn. and 9
12. 10 or 11 [legal purchase age adolescents]
13. exp **smoking and smoking related phenomena**/
14. (smoker? or smoking or cigarette? or cigar?).ab,kw,ti.
15. 13 or 14 [smoking]
16. *social behavior/ or exp *adolescent behavior/ or exp *health behavior/ or *life style/ or *social norm/
17. (behavior* or behaviour or social facilitation or habit? or life style? or lifestyle or norm? or value? or (health adj3 (knowledge or attitude? or practice?))).ab,kw,ti.
18. 16 or 17 [behavior]
19. 15 and 18
20. *"tobacco use"/ or *smoking cessation/ or *tobacco dependence/ or *smoking/ or adolescent smoking/ or *cigarette smoking/ or *smoking habit/
21. (smoking cessation or “tobacco use” or “use of tobacco” or “tobacco possession use” or “tobacco purchase use” or “cigarette use” or “use of cigarettes” or (nicotine adj3 (disorder or dependence??))).ab,kw,ti.
22. or/19-21 [smoking behavior]
23. 12 and 22
24. (animal/ or animal experiment/ or animal model/ or nonhuman/ or rat/ or mouse/ or (rat or rats or mouse or mice).ti.) not human/
25. 23 not 24
26. remove duplicates from 25

Total number of articles initial search: 979
PsychINFO search

1. exp “law (government)”/ or exp law enforcement/ or exp government policy making/
2. (law? or ordinance? or jurisprudence or legal or legislation or ((control* or access) adj3 (tobacco or smoking)) or smoking ban?).ab,id,ti.
3. “4230”.cc.
4. or/1-3 [legal]
5. exp consumer attitudes/ or exp consumer behavior/ or exp commerce/ or exp marketing/ or exp retailing/
6. (commerc* or tobacco industry or purchas* or sale? or (access adj3 (youth or minors)) or retail*).ab,id,ti.
7. or/5-6 [purchase]
8. adolescent attitudes/ or adolescent psychology/ or exp students/
9. (student? or youth* or juvenile or teen or teens or teenage* or young people or pupil? or minors or adolescen*).ab,id,ti.
10. (“200” or “320”).ag.
12. or/8-11 [adolescents]
13. and/4,7,12
14. “tobacco control: an international journal”.jn. and 9
15. 13 or 14 [legal purchase age adolescents]
16. exp tobacco smoking/ or *smoking cessation/
17. (smoker? or smoking or cigarette? or cigar? or smoking cessation or “tobacco use” or “use of tobacco” or “tobacco possession use” or “tobacco purchase use” or “cigarette use” or “use of cigarettes” or (nicotine adj3 (disorder or dependence?!))).ab,id,ti.
18. 16 or 17 [smoking behavior]
19. 15 and 18

Total number of articles initial search: 825

After removal of duplicates: 1680 articles are included for first screening (title and abstract).
APPENDIX II: IN- AND EXCLUSION CRITERIA

Inclusion:

• Ban on sales to minors policies (including other synonyms e.g. tobacco sales laws, sales to minors, access to minors, age of sales laws, minimum age laws, local tobacco sales ordinance, purchase use and possession laws, ban on sales to minors, legal tobacco purchasing age, etc.)

• Must be smoking-related (tobacco, smoking, cigarettes, smoking policy, characteristics of the smoking policy (such as retailer compliance, enforcement, fines, etc.)).

• Must have smoking/tobacco-related outcome: starting to smoke (initiation), smoking prevalence, smoking behavior, (perceived) access to cigarettes, sources of cigarettes, etc.

• Must have adolescent/youth focus.

• Must contain mechanisms (explanations for findings).

Exclusion:

• Studies only looking at cessation of smoking

• Studies only looking at implementation challenges such as adoption of the policy

• Reviews, commentary/editor columns, model-based studies

• Studies only looking at e-cigarettes.

• Studies only looking at retailer interventions unless it’s comparing enforced vs. unenforced situations. If assessing access then include, unless it is solely-retailer focused (e.g. perceptions of retailers or looking at variables that influence a successful sale).
## APPENDIX III

### Table 1A. List of included studies and quality of evidence.

<table>
<thead>
<tr>
<th>Author (year)</th>
<th>Setting</th>
<th>Aim of study</th>
<th>Study design</th>
<th>Study outcomes</th>
<th>Study population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Altman, Wheelis, McFarlane, et al. 1999</td>
<td>California, U.S.</td>
<td>“The objective of this study was to examine the effectiveness of a longitudinal community intervention on the reduction of tobacco sales to minors and subsequent effects on tobacco consumption by youths” (p. 759)</td>
<td>Quantitative (longitudinal, paired experimental intervention study)</td>
<td>Retail tobacco sales and self-reported consumption of tobacco</td>
<td>Students grades 7-12 from four communities.</td>
</tr>
<tr>
<td>Borland &amp; Amos 2009</td>
<td>Lothian, Scotland</td>
<td>“To explore the perceived impact among a group of Scottish 16-and 17-year-old school leavers of the recent increase in age of sale of cigarettes (1 October 2007) from 16 to 18 years on their ability to purchase and access cigarettes” (p.673)</td>
<td>Qualitative (individual or friendship-pair semi-structure interviews)</td>
<td></td>
<td>Convenience sample of early school leavers aged 16 and 17 attending a work skills programme in Lothian, all regular smokers.</td>
</tr>
<tr>
<td>Castrucci, Gerlach, Kaufman, et al. 2002</td>
<td>U.S.</td>
<td>“The purpose of this study is to examine the association between demographic and smoking behaviour variables and the likelihood of acquiring cigarettes through non-commercial sources” (p.323).</td>
<td>Quantitative (survey)</td>
<td>Smoking status, sources of cigarettes, perceived ease of access</td>
<td>Nationally representative sample of students grades 9 to 12 from 202 schools in 200 counties.</td>
</tr>
<tr>
<td>Cummings, Hyland, Perla, et al. 2003</td>
<td>New York, U.S.</td>
<td>“…to investigate whether increases in retailer compliance with a youth access law were correlated with changes in adolescent smoking behaviour” (p.466).</td>
<td>Quantitative (retailers compliance data and survey data)</td>
<td>Prevalence of current smoking, frequent smoking, perceived access, sources of cigarettes.</td>
<td>9th grade students in 12 communities in Erie County, NY.</td>
</tr>
<tr>
<td>Dent &amp; Biglan 2004</td>
<td>Oregon, U.S.</td>
<td>“To examine the relation between rates of sales of tobacco to minors and youth smoking prevalence” (p.334).</td>
<td>Quantitative (survey data and retailer compliance data)</td>
<td>Smoking in last 30 days, sources of cigarettes, and frequency of source use.</td>
<td>8th and 11th grade students in 75 communities in Oregon.</td>
</tr>
</tbody>
</table>
# APPENDIX III - Table 1A. Continued

<table>
<thead>
<tr>
<th>Author (year)</th>
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</tr>
</thead>
<tbody>
<tr>
<td>DiFranza &amp; Coleman</td>
<td>Massachusetts, U.S.</td>
<td>“This study enlisted focus groups to investigate the methods used to obtain tobacco by underage smokers living in communities with strong enforcement programmes” (p.323)</td>
<td>Qualitative (Focus groups)</td>
<td></td>
<td>Regular smokers ages 12-19 years from 10 communities in Massachusetts with a merchant compliance rate above 90%.</td>
</tr>
<tr>
<td>Forster, Murray, Wolfson, et al.</td>
<td>Minnesota, U.S.</td>
<td>“This study tested the hypothesis that adoption and implementation of local policies regarding youth access to tobacco can affect adolescent smoking” (p.1193).</td>
<td>Quantitative (randomized community trial and surveys)</td>
<td>Prevalence of smoking, ease of cigarette access, source of cigarettes, number of purchase attempts</td>
<td>Students grades 8 to 10.</td>
</tr>
<tr>
<td>Gilpin, Lee, Pierce</td>
<td>California, U.S.</td>
<td>“…we examine whether adolescent perception that cigarettes are easy or hard to get is predictive of future experimentation during the period where access laws were less well enforced, compared to a period when enforcement (and compliance) increased”(p.486).</td>
<td>Quantitative (survey data)</td>
<td>Smoking behaviour, perceived ease of access to smoking, school performance, depressive symptoms, and adolescent rebelliousness.</td>
<td>12 to 15 year olds, never smokers</td>
</tr>
<tr>
<td>Gratias, Krowchuk, Lawless</td>
<td>North Carolina, U.S.</td>
<td>“… to identify where and how middle school students living in a tobacco growing state acquire cigarettes and to describe factors associated with the likelihood of being asked for identification while attempting to purchase cigarettes over the counter” (p.277)</td>
<td>Quantitative (survey data)</td>
<td>Smoking status, age of first use, sources of cigarettes.</td>
<td>Students in 6th-8th grade.</td>
</tr>
</tbody>
</table>
### Chapter 2

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<thead>
<tr>
<th>Author (year)</th>
<th>Setting</th>
<th>Aim of study</th>
<th>Study design</th>
<th>Study outcomes</th>
<th>Study population</th>
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</thead>
<tbody>
<tr>
<td>Hamilton, Biener,</td>
<td>Massachusetts, U.S.</td>
<td>“This study examines whether local regulations regarding clean indoor air and youth access to tobacco are associated with residents’ subsequent perceptions of smoking norms” (p.709)</td>
<td>Quantitative (survey data)</td>
<td>Perceived smoking norms, smoking status, rebelliousness, and sensation seeking.</td>
<td>All residents between 12 and 17 and adults (above 18).</td>
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<tr>
<td>Brennan 2008</td>
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<tr>
<td>Harrison, Fulkerson,</td>
<td>Minnesota, U.S.</td>
<td>“This study examines youth access to substances by investigating both commercial and social sources for alcohol, tobacco, and other drugs” (p.40).</td>
<td>Quantitative (survey data)</td>
<td>Substance use frequency, smoking status, access to cigarettes, source of cigarettes.</td>
<td>Students in grades 6, 9, and 12.</td>
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<tr>
<td>Park, et al. 2000</td>
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<tr>
<td>Jones, Sharp, Husten,</td>
<td>U.S.</td>
<td>“The purposes of this study were to examine: how high school students under 18 years (minors) who smoke usually obtain cigarettes; whether minors frequency of smoking is associated with their sources of cigarettes; secular trends in usual sources of cigarettes among minors 1995-1999; and whether minors are asked to show proof of age when they buy cigarettes in a store” (p.20).</td>
<td>Quantitative (survey data)</td>
<td>Smoking status, and sources of cigarettes</td>
<td>Students grades 9 to 12.</td>
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<tr>
<td>et al. 2002</td>
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<tr>
<td>Kanda, Osaki, Ohida,</td>
<td>Japan</td>
<td>“...aimed to clarify the relation between smoking behaviour among high school students and their usage of age verification cards by conducting a cross-sectional nationwide survey in Japan” (1).</td>
<td>Quantitative (survey data)</td>
<td>Smoking status, sources of cigarettes, prevalence of age verification card use, methods of obtaining cards.</td>
<td>High school students</td>
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<tr>
<td>et al. 2010</td>
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### Author (year) Setting Aim of study Study design Study outcomes Study population

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<th>Author (year)</th>
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<tbody>
<tr>
<td>Landrine &amp; Klonoff 2003</td>
<td>California, U.S.</td>
<td>&quot;We examined the standard compliance protocol and its validity as a measure of youth access to tobacco&quot; (p.1883).</td>
<td>Quantitative/qualitative (Youth Access Methods Interviews and retailer compliance rate data)</td>
<td>Buy cigarettes, where they buy cigarettes, compliance checks</td>
<td>15-17 year olds</td>
</tr>
<tr>
<td>Leatherdale 2005</td>
<td>Ontario, Canada</td>
<td>&quot;The purpose of the present study was to examine characteristics that predict whether occasional and regular smokers buy their own cigarettes, buy their cigarettes from friends, or get someone else to buy their cigarettes&quot; (p.348).</td>
<td>Quantitative (survey data)</td>
<td>Source of cigarettes, parental background, number of times asked for proof of age.</td>
<td>Students grades 9 to 13, regular smokers.</td>
</tr>
<tr>
<td>Leatherdale &amp; Strath 2007</td>
<td>Ontario, Canada</td>
<td>&quot;...to examine how the number of tobacco retailers surrounding a school, the prevalence of smoking within a school, and student characteristics are associated with the likelihood that underage smoking youth: usually buy their own cigarettes, usually get someone else to buy their cigarettes, or usually get their cigarettes from friends&quot; (p.105).</td>
<td>Quantitative (survey data)</td>
<td>Source of cigarettes, parental background, smoking status, how often smoke during the day or in the weekends, number of times asked for proof of age.</td>
<td>Students grade 9 to 12 ages 18 and younger.</td>
</tr>
<tr>
<td>Lee, Hsu, Chen, et al. 2014</td>
<td>Taiwan</td>
<td>&quot;This study assesses area disparities in perceptions of access to tobacco, cigarette purchasing experiences, and its related factors among elementary schoolchildren in Taiwan&quot; (p.508).</td>
<td>Quantitative (cross-sectional, survey data)</td>
<td>Perceived accessibility and purchasing experiences of cigarettes</td>
<td>Students aged 8-13 years old.</td>
</tr>
<tr>
<td>Author (year)</td>
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<tr>
<td>Loukas, Spaulding,</td>
<td>Texas, U.S.</td>
<td>“The current study examined the meaning of citation for 14- to 19- year-old</td>
<td>Qualitative (Focus</td>
<td>Youth aged 11 to 19 years old who “received an MIP citation when he or she</td>
<td>young adolescents who received an MIP of tobacco citation during high school and</td>
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<td>Gottlieb 2006</td>
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<td>adolescents who received an MIP of tobacco citation during high school and    groups)</td>
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<td>was younger than 18 years but did not complete the court-mandated class until</td>
<td>who were attending a court-mandated tobacco awareness and education class in one</td>
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<td>who were attending a court-mandated tobacco awareness and education class in</td>
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<td>1 or 2 years following citation” (p. 199).</td>
<td>Texas community” (p. 199).</td>
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<td>one Texas community” (p. 199).</td>
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<tr>
<td>Marsh, Dawson,</td>
<td>New Zealand</td>
<td>“This study seeks to examine young NZ smokers’ access to social supplies of</td>
<td>Qualitative (Focus</td>
<td>Youth aged 15-17 years old, regular smokers.</td>
<td></td>
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<tr>
<td>McGee 2013</td>
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<td>cigarettes” (p. 156).</td>
<td>groups)</td>
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<td>Millett, Lee,</td>
<td>England, U.K.</td>
<td>“… to examine the hypothesis that raising the age for the legal purchase of</td>
<td>Quantitative (survey</td>
<td>Smoking status, sources of cigarettes, and ease of access.</td>
<td>Youth aged 11-15 years.</td>
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<td>Gibbons, et al. 2011</td>
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<td>tobacco had a lesser impact on access to cigarettes and regular smoking</td>
<td>data)</td>
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<td>prevalence among young people from lower SES groups than those from more</td>
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<td>affluent groups because they were able to gain access to tobacco from other</td>
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<td>sources” (p. 863).</td>
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<tr>
<td>Minnaker, Soni,</td>
<td>Canada</td>
<td>“This paper… describes differences in youth retail tobacco access by province...</td>
<td>Quantitative (survey</td>
<td>Smoking status, access to cigarettes, sources of cigarettes, number of times</td>
<td>Students in grades 6 to 12</td>
</tr>
<tr>
<td>Nguyen, et al. 2015</td>
<td></td>
<td>explores youths’ perceptions of ease of access to tobacco and identifies</td>
<td>data)</td>
<td>asked for proof of age</td>
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<td>youth characteristics associated with the odds of purchasing cigarettes from</td>
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<td>stores” (p. 2).</td>
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</table>
### APPENDIX III - Table 1A. Continued

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Nelson, Paynter, Arroll 2011</td>
<td>New Zealand</td>
<td>“...investigates more recent trends in sources of cigarettes for youth in New Zealand” (p.115).</td>
<td>Quantitative (survey data)</td>
<td>Tobacco access behaviour, smoking environment</td>
<td>Students in grade 10, regular smokers.</td>
</tr>
<tr>
<td>Proctor, Barnett, Muilenburg 2012</td>
<td>Southeastern, U.S.</td>
<td>“The purpose of this study is to examine race and gender as potential predictors for access to cigarettes and purchasing behaviours among an adolescent population” (p.514).</td>
<td>Quantitative (survey data)</td>
<td>Smoking behaviour, sources of cigarettes, purchasing behaviour, and access to cigarettes</td>
<td>Students 14 to 19 years old</td>
</tr>
<tr>
<td>Rimpela, Rainio 2004</td>
<td>Finland</td>
<td>“The aim of the study is to assess the effects of the tobacco sales bans in Finland from 1977 to 2003 in a quasi-experimental design using tobacco purchase from commercial sources as well as from friends as indicators” (p.167).</td>
<td>Quantitative (survey data)</td>
<td>Purchasing behaviour, sources of cigarettes, ease of access</td>
<td>Students 12, 14, 16, and 18 years old</td>
</tr>
<tr>
<td>Robinson &amp; Amos 2010</td>
<td>Birmingham, U.K.</td>
<td>“…to explore how 12-15 year olds living in disadvantaged areas in one part of the United Kingdom access cigarettes from non-social sources, to help inform future prevention and enforcement policy and activity” (p.1836).</td>
<td>Qualitative (Focus groups)</td>
<td></td>
<td>Students from secondary school and 12 to 15 year olds outside of schools.</td>
</tr>
<tr>
<td>Author (year)</td>
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<tr>
<td>Robinson, Klesges, Zbiwoski 1998</td>
<td>Memphis, U.S.</td>
<td>“…to assess the popularity of a variety of sources through which young adolescents obtain cigarettes. To determine whether sources vary with smoking frequency, data are presented separately for experimental smokers and those who consume cigarettes regularly” (p.354).</td>
<td>Quantitative (survey data)</td>
<td>Perceived availability of cigarettes, ease of access, attitude towards price of cigarettes, family smoking status, sources of cigarettes, rebelliousness, smoking status</td>
<td>Seventh grade students</td>
</tr>
<tr>
<td>Schneider, Meyer, Yamamoto, et al. 2009</td>
<td>Germany</td>
<td>“...the aim of the study was to compare the number of tobacco vending machines and other commercial sources before and after the enactment of the new law in a geographically defined area” (p.295).</td>
<td>Quantitative (commercial tobacco sources data and survey data)</td>
<td>Smoking status, proportion of smokers within class, ease of access, and sources of cigarettes.</td>
<td>Students between 12 and 15 years old.</td>
</tr>
<tr>
<td>Siegel, Biener, Rigotti 1999</td>
<td>Massachusetts, U.S.</td>
<td>“This paper reports the results of the first state-wide, longitudinal study of the impact of local tobacco sales ordinances on youth smoking initiation...to determine whether living in a town with a local tobacco sales ordinance in place in 1993 reduced the rate of smoking initiation of a 4-year follow-up period” (p. 335).</td>
<td>Quantitative (longitudinal, telephone survey data)</td>
<td>Smoking initiation and local tobacco sales legislation</td>
<td>Youth between ages 12 and 15 years old.</td>
</tr>
<tr>
<td>Speizer, Bean, Obando, et al. 2008</td>
<td>Virginia, U.S.</td>
<td>“The purpose of this study is to examine correlates of perceived access to cigarettes at home, school, and commercially in a large sample of Virginia youth” (p.400).</td>
<td>Quantitative (survey data)</td>
<td>Perceived access at home, school, and at the store, smoking status, peer smoking, and family smoking status.</td>
<td>Students in grades 6 to 12.</td>
</tr>
</tbody>
</table>
### APPENDIX III - Table 1A. Continued

<table>
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<tr>
<th>Author (year)</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Thomson, Hamilton, Siegel, et al. 2007</td>
<td>Massachusetts, U.S.</td>
<td>&quot;...to test whether community-level restrictions on youth access to tobacco (including both ordinances and enforcement) are associated with less smoking initiation or less progression to established smoking among adolescents&quot; (p.119).</td>
<td>Quantitative</td>
<td>Strength of local youth access policy, smoking status, and rebelliousness</td>
<td>12 to 17 year old youth</td>
</tr>
<tr>
<td>Turner, Gordon, Young 2004</td>
<td>Scotland, U.K.</td>
<td>&quot;...assesses whether variation in pupil access to commercial and/or social sources could contribute to school differences in pupil smoking rates, and considers how levels of peer smoking affect adolescents' access to cigarettes&quot; (p.429).</td>
<td>Quantitative/ qualitative (survey data and focus groups)</td>
<td>Smoking behaviour, ease of access, family smoking status, peer smoking, source of cigarettes</td>
<td>Students 13 and 15 years old in 2 state schools.</td>
</tr>
<tr>
<td>Unger, Rohrbach, Howard, et al. 1999</td>
<td>California, U.S.</td>
<td>&quot;...examined awareness of anti-tobacco policies and support for anti-tobacco policies among 10th grade youth in California...&quot; (p.754).</td>
<td>Quantitative (survey data)</td>
<td>Smoking status, attitudes towards anti-tobacco policies, awareness of policies, support for policies, perceived access, perceived consequences of smoking.</td>
<td>10th grade students</td>
</tr>
<tr>
<td>Verdonk-Kleinjan, Knibbe, Bieleman, et al. 2008</td>
<td>Netherlands</td>
<td>&quot;This study aims to assess the effect of the introduction of a legal tobacco sales ban in the Netherlands for adolescents &lt;16 years, on tobacco purchasing among adolescents aged 13 through 15 years&quot; (p.498).</td>
<td>Quantitative (survey data)</td>
<td>Smoking status, purchasing behaviour, frequency of buying</td>
<td>Adolescents aged 13 to 15 years.</td>
</tr>
</tbody>
</table>