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Review article

Understanding the impact of school tobacco policies on adolescent smoking behaviour: A realist review

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ABSTRACT

Background: Secondary schools increasingly implement school tobacco policies (STPs) to decrease adolescents' smoking. Recent studies suggested that STPs' impact depends on their implementation. We examined adolescents' cognitive and behavioural responses to STPs that impact adolescents' smoking and how these responses depend on elements of STPs' implementation.

Method: To examine STPs and adolescent smoking, we performed a realist review, which is an explanatory approach that synthesizes existing evidence into a program theory that links elements of STPs' implementation to outcomes by specifying its underlying generative mechanisms. The search was performed in MEDLINE/PubMed, PsycINFO, and Embase between January 1991 and 2016. Thirty-seven English language articles were identified for inclusion, reporting quantitative and/or qualitative primary evidence on STPs at secondary schools, adolescent smoking behaviour, and mechanisms. From these articles, evidence was extracted about mechanisms that decrease smoking and associated countervailing-mechanisms that reduce, nullify, or revert this positive impact.

Results: The program theory showed that STPs may trigger four mechanisms and seven associated countervailing-mechanisms. Adolescents' smoking decreases if STPs make them feel they can get sanctioned, feel less pressure to conform to smokers, internalise anti-smoking beliefs, and find it easier to stick to the decision not to smoke. This positive impact may reduce, nullify, or revert if the implementation of STPs cause adolescents to find alternative places to smoke, develop new social meanings of smoking, want to belong in smoker groups, internalise beliefs that smoking is not bad or that it asserts personal autonomy, or alienate from schools and schools' messages. The program theory, moreover, provided insights on how elements of STPs' implementation trigger mechanisms and avoid the countervailing-mechanisms.

Conclusion: STPs' impact can be influenced by adequate implementation and embedding them in continuous monitoring and adaptation cycles, so that schools can proactively deal with the cognitive and behavioural responses that lead to suboptimal or adverse outcomes.

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1. Introduction

Worldwide, policy makers increasingly adopt legislation that compels secondary schools to implement and enforce school tobacco policies (STPs). STPs limit tobacco use by defining whether or

where adolescents and adults are allowed to smoke and by defining the penalties for those caught violating the smoking rules (Evans-Whipp et al., 2004). The emphasis on STPs logically builds on adolescents' susceptibility to start smoking (Erikson et al., 2015) and the substantial role secondary school environments play in establishing adolescents' smoking behaviours (Aveyard et al., 2004). The aim of implementing and enforcing STPs is to avert or stop adolescents from smoking during and outside school hours and to protect all individuals from the harms of second hand smoke at school premises.

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Despite their growing popularity, the scientific evidence underpinning STPs' effectiveness is still largely inconclusive (Coppo et al., 2014; Galanti et al., 2014). The existing literature seems "not to have progressed beyond an initial stage" (Galanti et al., 2014, 5) because studies use different conceptualisations and measurements of STPs and few (quasi) experimental and longitudinal designs (Coppo et al., 2014; Galanti et al., 2014). Further adding to STPs inconclusive impact is the fact that some of the available observational studies suggest that STPs decrease the probability of adolescents' smoking (Øverland et al., 2010; Piontek et al., 2008a), whereas others suggest that STPs have no or even adverse impacts on adolescents' smoking (Darling et al., 2006; Kuipers et al., 2016).

Current efforts to understand STPs' inconsistent impacts primarily focus on the implementation of STPs. A recent systematic review identified five dimensions of STPs' implementation that have often been studied: (i) policy comprehensiveness or strength, (ii) enforcement, (iii) communication, (iv) degree of formality, (v) and emphasis/orientation (Galanti et al., 2014). Exact definitions of these policy dimensions vary greatly between studies, but can broadly be described as follows: Policy comprehensiveness or strength denotes where, for whom, and when it is prohibited to smoke and if it is combined with other smoking prevention efforts. Enforcement denotes the rules and practices for surveillance and sanctioning or referral when someone violates the policy. Communication denotes the mode of communication and whom is informed. Degree of formality denotes whether the policy is clear, written, and formally approved by the school board. The emphasis/orientation denotes the extent to which the 'policy inspiring principles' connected to prevention, harm minimisation, cessation, and discipline. Following this implementation perspective (Galanti et al., 2014, 5), tentatively suggested that comprehensive bans that are strictly enforced, have clear rules, and involve educational and prevention efforts are "often associated with decreased likelihood of smoking or decreased smoking prevalence at the school level."

The importance of adequate implementation corresponds with the view that schools are complex adaptive systems because they involve "numerous, dynamic, highly interactive, learning and adaptive" actors who "act in ways that are based on a combination of their knowledge, experience, feedback from the environment, local values and formal system rules" (Keshavarz et al., 2010, 1468). This implies that adolescents' cognitive and behavioural responses to STPs – that subsequently impact adolescent smoking behaviour – depend strongly on the mode of implementation, the school and outer context, and the acts of others (Bonell et al., 2013). To illustrate the dependency on implementation, literature suggests that weak enforcement of STPs allowed adolescents to persistently look for and make use of ways to smoke at school premises (Turner and Gordon, 2004a). Strict enforcement, on the other hand, decreased adolescents' smoking on school premises, but simultaneously caused some adolescents to start smoking at alternative locations (Watts et al., 2010).

There is, however, still hardly any understanding about adolescents' cognitive and behavioural responses to STPs. The only study that specifically aimed to examine these responses shows that STPs negatively influenced adolescents' personal beliefs about smoking and subsequently decreased their smoking behaviour (Lippman-Kreda and Grube, 2009). Other studies have only been able to provide suggestions on "how the intervention might work" (Coppo et al., 2014, 4). For instance, Alesci et al. (2003) suggested that STPs can decrease adolescents' opportunities to smoke and access to tobacco. Such studies provide information about what STPs do, but not on adolescents' cognitive and behavioural responses.

We argue that STPs can be redesigned to be more effective in decreasing adolescent smoking behaviour if there is a better understanding of adolescents' cognitive and behavioural responses to STPs and how these responses depend on the way STPs are implemented. The realist perspective offers a suitable analytic approach because it posits that interventions trigger generative mechanisms (in our case adolescents' responses) that produce outcomes (in our case smoking behaviour), depending on whether the mode of implementation and context allow these to occur (Pawson, 2006). We therefore performed a realist review to develop an evidence-based program theory that answers the following research question:

How does the implementation of STPs trigger cognitive and behavioural responses that may impact adolescent smoking behaviour?

Ultimately, the aim was to set forth practical recommendations on how to improve the impact of STPs on adolescent smoking behaviour.

2. Method

A realist review is an explanatory approach that synthesizes existing evidence into a program theory. The program theory links elements of a program's implementation to outcomes by specifying its underlying generative mechanisms. These mechanisms operate through "human interpretation of social structures and events" (Astbury and Leeuw, 2010, p. 370) and therefore depend on how programs effect adolescents' experiences within the school context.

The realist review entails six steps (Pawson, 2006): 1) Identify the review questions. 2) Formulate the initial program theory. 3) Search for primary studies. 4) Select the studies and appraise their quality. 5) Extract, analyse, and synthesize relevant data. And 6) refine the program theory. The introduction addressed the first step and below; we report the next steps below. Our study is reported according to the RAMESES publication standards for realist reviews (Wong et al., 2013).

2.1. Formulating the initial program theory and mechanisms

The formulation of an initial program theory was done in November and December of 2015. This process involved a scoping literature search in combination with weekly discussions between the first and one or more co-authors to iteratively translate the insights into an initial program theory.

We started with searching for literature reviews on STPs' effectiveness (Aveyard et al., 2004; Coppo et al., 2014; Evans-Whipp et al., 2004; Galanti et al., 2014; Sellström and Bremberg, 2006; WHO, 2009). These were read to identify elements of the implementation of STPs and to develop preliminary thoughts on how these elements could impact adolescent smoking behaviour. Discussion among the authors led to the decision to search further for literature that links smoking to behavioural change theories. Using such theories, four mechanisms were identified that we included in our initial program theory. Mechanism 1 was based on the expectancy-value part of the theory of planned behaviour (Ajzen, 1991), hypothesizing that smoking during school hours may become less likely if it is associated with negative outcome expectations (i.e., sanctions). Mechanism 2 related to social identity theory (Tajfel, 2010), hypothesizing that smoking prohibitions may diminish the pressure to use smoking for establishing an identity. Mechanism 3 built on the theory of human functioning and school organisation (Markham and Aveyard, 2003), hypothesizing that adolescents develop anti-smoking personal beliefs by internalising their non-smoking environment. Mechanism 4 made use of the theory of triadic influence (Flay et al., 1999), hypothesizing that

decreasing opportunities to smoke make adolescents feel supported to stop smoking. A final discussion resulted in the initial program theory, shown in Fig. 1, which presents the implementation elements, mechanisms, and outcomes that were to be substantiated and refined with empirical evidence.

2.2. Searching for primary studies

Next, a systematic literature search was undertaken to substantiate and refine the mechanisms with primary evidence. Realist reviews often do not use systematic searches, but we chose to do so to structure and limit the search process. A clinical librarian was consulted to develop a comprehensive search query and perform the search in MEDLINE/PubMed, PsycINFO, and Embase. The search included articles published between January 1991 and 2016. Main concepts searched for were adolescent, school, school environment, policy, smoking and their synonyms. [Supplementary file 1](#) illustrates the search query used in MEDLINE/PubMed. [Fig. 2](#) displays the search process in a flow diagram.

2.3. Selecting studies and their quality

The 5689 found titles and abstracts were screened independently by the first and second author. Articles were included if these were thought to report anything on STPs at secondary schools. The full-text screening of the remaining 355 articles entailed two steps. First, the inclusion and exclusion criteria were applied to each article. Studies had to focus on STPs at secondary schools in any country, include evidence on adolescents' smoking, and possibly provide insights on the mechanisms. The study population had to be adolescents (aged 10–18 years), school staff, or adolescents' parents. Any study design was accepted, as long as the study was written in English or Dutch and collected primary evidence. Second, the remaining 72 articles were subjected to a quality appraisal. The RAMESES guideline prescribes procedures that differ from conventional reviews: The quality appraisal takes place during the synthesis of evidence and uses no checklists to appraise articles on their overall quality. Realist quality appraisal, instead, focusses on assessing the *rigor* and *relevance* of the specific evidence that can be used in the synthesis.

Relevance was assessed by examining the extent to which an article substantiates and refines the initial program theory. Studies with evidence that provided rich and detailed descriptions on how STPs trigger mechanisms were classified as “thick” and were given priority and weighted more heavily in the synthesis. Studies with evidence were classified as “thin” if they provided little description

of how STPs trigger mechanisms, but provided other evidence of interest, such as greater impact of STPs among subgroups of adolescents. Such evidence could be used to contextualise or to check our synthesis of thick evidence. Thirty-five studies were excluded for insufficient relevance.

Rigor was assessed by examining the sample, methods of data collection, and analysis, with particular attention to problems that could have seriously affected the validity of the evidence. Articles were excluded if the first and second author agreed that such serious bias occurred, but this was hardly the case. Only [Alhyas et al. \(2015\)](#) was excluded because it did not provide any information on the implementation or impact of current STPs. The first author applied the above steps to all 355 full-text articles, including reference checking. Reference checking resulted in the inclusion of one article. The second author examined all articles that the first author included and randomly re-examined twenty articles the first author excluded. This re-examination led to the inclusion of no new articles, but did lead to the exclusion of two articles. Both authors agreed on the final selection of 37 articles.

2.4. Extracting, analysing, and synthesizing relevant data

For all 37 selected articles, the first author extracted information about where the study was conducted, its aim, study population, data collection and analysis, results, and how these substantiate or refine the initial program theory. The synthesis started with the thick evidence by discovering regularities in how STP implementation elements, mechanism, and outcomes combine. These regularities either contributed to decreasing adolescents' smoking behaviour (i.e., mechanisms) or reducing, nullifying, or reverting the positive impact of mechanisms (i.e., countervailing-mechanisms). Subsequently, the identified regularities were juxtaposed to the thin evidence for further substantiation and refinement. The second author carefully read all papers and assessed if the evidence was used properly in the synthesis. The final synthesis was agreed upon by both authors. [Supplementary file 2](#) presents key characteristics of included studies.

3. Results

The synthesis of evidence substantiated and refined the mechanisms presented in the initial program theory ([Fig. 1](#)). This section elucidates the mechanisms that were substantiated and refined, including a series of associated countervailing-mechanisms, and thereafter presents the refined program theory ([Fig. 3](#)). All results presented on (countervailing-) mechanisms should not be read as

Fig. 1. Initial program theory explaining how STPs impact adolescent smoking.

Fig. 2. Flow diagram representing the search, screening and inclusion.

Fig. 3. Refined program theory explaining how school tobacco policies (STPs) impact adolescent smoking.

steadfast rules, but as possible pathways by which STPs may impact adolescent smoking.

Mechanism 1: When adolescents think that there is a high likelihood that they will get caught for violating the smoking policy and perceive staff to have the authority to sanction when someone violates the smoking policy, they feel they can get sanctioned and therefore may not start or continue smoking during and outside school hours.

Adolescents tend to smoke less at school locations where smoking is prohibited when they feel they can get sanctioned for violating policy (Clark et al., 2002, 1272). Studies showed that if adolescents think there is a high likelihood that they will get caught for violating the policy, and perceive school staff to have the authority to sanction or refer (i.e., referral to someone with formal responsibility) those violating the smoking policy, then this increases their feelings that sanctioning is possible and subsequently discourages them from smoking at school (Clark et al., 2002; Turner and Gordon, 2004a).

The importance for STPs to give adolescents the feeling that they can get sanctioned becomes clear in situations where this feeling is absent. One study shows that adolescents seeing other adolescents smoke whilst they are not allowed to (i.e., no strict enforcement), produces the perception they are impervious to schools' authority because "teachers cannot expel smokers (...) there are too many [students] that smoke" (Turner and Gordon, 2004a, p. 43). Another adolescent illustrated how parental approval may decrease perceptions of school authority and thereby the feelings to get sanctioned: "her mother lets her smoke and she just – Mr [assistant head] told her to put her fag out and she just took a draw and blew it in his face and he did not do anything because her mother knows she smokes" (p. 46).

Countervailing-mechanism 1.1: When adolescents feel they will get sanctioned for smoking at locations where it is prohibited, some of them find alternative locations where they do not have such feeling and therefore may start or continue smoking during and outside school hours.

Adolescents tend to look for locations where smoking is not or least associated with sanctions. In perspective of this tendency, adolescents are aware of weaknesses in the enforcement of STPs and utilize these weaknesses to smoke without being sanctioned (Turner and Gordon, 2004a, b). Similarly, many schools have a recognized location on or off school property where adolescents can go with little fear of sanctioning (Clark et al., 2002).

The exact location where adolescents believe they will not get sanctioned for smoking depends on schools' enforcement of STPs (Turner and Gordon, 2004b, 157). Specifically, gaps in the enforcement of STPs results in smoking inside the school area (Clark et al., 2002; Turner and Gordon, 2004a, b), whereas strictly enforced STPs are associated with increases in smoking outside the school premises (Northrup et al., 1998; Watts et al., 2010). This problem may be partly overcome by implementing additional guidelines that forbid adolescents from leaving school premises during school hours, considerably decreasing smoking inside and outside school premises during school hours (Kankaanpää et al., 2014). However, the aforementioned study also shows that such guidelines slightly increase adolescents' smoking on the way to school.

Mechanism 2: When adolescents see less smoking during school hours, they feel less pressure to conform to others' smoking behaviours and therefore may not start or continue smoking during and outside school hours.

STPs may decrease adolescents' experience of social pressures to smoke. This manifests itself in a decreased perception of peer smoking (Lippman-Kreda and Grube, 2009) and a decreased likelihood of smoking a cigarette offered by a best friend (Lippman-Kreda et al., 2009), both are associated with decreases in past 30-day smoking. Similarly, adolescents perceiving that STPs are strictly enforced as well as not seeing best friends smoking during school hours is associated with non-smokers being less susceptible to start smoking (Hock et al., 2013).

STPs seem to particularly decrease the social pressures to smoke for the younger adolescents as they tend to conform to the smoking behaviours of older adolescents (Murnaghan et al., 2008). This is underpinned by studies demonstrating that STPs are more strongly associated with decreases in the initiation of smoking of those in lower school grades (Feigl et al., 2015; Piontek et al., 2008b).

Countervailing-mechanism 2.1: When adolescents know that smoking is prohibited, some of them experience new social meanings of smoking and therefore may start or continue smoking during and outside school hours.

Studies show that STPs may change the social meaning of smoking. These changes increase the social pressures to smoke for some adolescents, such as those who think it looks good to be sanctioned when they are with peers (Turner and Gordon, 2004a, 44). STPs can also increase the social exchange of cigarettes (Kankaanpää et al., 2014) as adolescents know exactly who to ask for cigarettes or where they will be offered cigarettes (Croghan et al., 2003). This social exchange makes adolescents start banding together, forming groups to obtain cigarettes and smoke as a means to challenge adults' opposition to their smoking (Croghan et al., 2003).

Countervailing-mechanism 2.2: When adolescents respond to school smoking bans by finding alternative locations to smoke, some of them will experience a wish to belong in these smoking groups and therefore may start or continue smoking during and outside school hours.

STPs may force adolescents to choose between spending school hours at alternative smokers locations or not (Baillie et al., 2008). Why this dilemma causes social pressures for some adolescents was captured by an adolescent who felt socially isolated because she did not go to the smoker's place as she was "trying to quit ... but most of my friends are there" (p. 1013). Similarly, smoking on the school periphery – that, as a result of STPs, often occurs at highly visible locations (Northrup et al., 1998) – is associated with increases in non-smokers' susceptibility to smoking (Leatherdale et al., 2005) and actual smoking behaviours (Lovato et al., 2010). This influence of smoking on the school periphery holds particularly true for non-smokers who have friends that disapprove of smoking (Leatherdale et al., 2005). STPs may thus bring about new temptations for non-smokers to belong in smoker's groups.

Mechanism 3: When adolescents experience schools that take actions against smoking, adolescents internalise anti-smoking beliefs and therefore may not start or continue smoking during and outside school hours.

STPs may cause adolescents to internalise anti-smoking beliefs. Evidence shows that the perceived enforcement of STPs is associated with decreases in the expected social benefits and increases in the perceived harm and personal disapproval of smoking

(Lippman-Kreda and Grube, 2009). These beliefs are subsequently associated with decreases in adolescents' past 30-day smoking.

Countervailing-mechanism 3.1: When adolescents experience contradictions between school's non-smoking messages and actual smoking practices and policy enforcement, some of them internalise the belief that smoking is not too bad and therefore may start or continue smoking during and outside school hours.

Whether STPs make adolescents internalise anti-smoking beliefs depends on the consistency of schools' non-smoking messages with the actual smoking practices and policy enforcement at the school. Adolescents who think there are contradictions may develop unintended beliefs that increase smoking (Clark et al., 2002, 1272).

Adolescents may start to believe that school staff do not take smoking seriously (Baillie et al., 2008, 1011) when they see staff members not strictly enforcing STPs (Booth-Butterfield et al., 2000; Clark et al., 2002; Gittelsohn et al., 2001; Nilsson and Emmelin, 2010) or not properly enforcing national minimum age laws during school hours (Baillie et al., 2008; Clark et al., 2002). These contradictory situations encourage the belief that smoking is "OK – because it's at school" (Baillie et al., 2008, 1011). Unenforced STPs are associated with increased chances to start smoking occasionally (Murnaghan et al., 2008, 2009b) and transition into an established/regular smoker (Wakefield et al., 2000), which is particularly the case for adolescents who are also exposed to family smoking (Wiiium and Wold, 2006).

Adolescents may also develop unintended beliefs when they see teachers smoke (Nilsson and Emmelin, 2010; Trinidad et al., 2005) or know that teachers are allowed to smoke (Kumar et al., 2005). Schools having STPs in place while adolescents see or know teachers who smoke during school hours can decrease adolescents' negative attitudes about other people's smoking behaviour (Kumar et al., 2005), their support for STPs (Trinidad et al., 2005), and STPs impact on reducing adolescents' smoking (Wiiium and Wold, 2011).

Countervailing-mechanism 3.2: When adolescents have no sympathy for schools' decision to prohibit smoking, some of them internalise the belief that smoking asserts personal autonomy and therefore may start or continue smoking during and outside school hours.

If schools have STPs, adolescents' dominant view that smoking is an individual's personal choice (Clark et al., 2002) and legal right (Turner and Gordon, 2004a) often conflicts with school's views that they have the authority to prohibit adolescents from smoking (Clark et al., 2002, 1277). This conflict may manifest itself in adolescents' disrespect and disregard towards STPs (Clark et al., 2002, 1277) and opposition against schools' authority (Clark et al., 2002; Turner and Gordon, 2004a) because smoking asserts adolescents' personal autonomy (Wiiium et al., 2009). It is therefore important for staff members to use educational efforts to address this discrepancy in views to have better impact on adolescents' smoking behaviours (Clark et al., 2002).

Countervailing-mechanism 3.3: When adolescents believe that sanctions associated with smoking are not in place to help them, some of them alienate from schools and schools' messages on smoking and therefore may start or continue smoking during and outside school hours.

Teachers who intervene when they see adolescents smoking

may be seen as a sign that they care about adolescents (Nilsson and Emmelin, 2010; Turner and Gordon, 2004a). However, literature shows the precarious nature of sanctioning adolescents for smoking at school premises; adolescents often feel treated unfairly (Gittelsohn et al., 2001) and unjustly (Booth-Butterfield et al., 2000) because they feel that the sanctions are applied in a biased fashion (Clark et al., 2002; Turner and Gordon, 2004b) and are too severe (Clark et al., 2002). This experience of sanctioning makes adolescents wonder whether teachers care about and truly want to help them. One adolescent illustratively captured this by saying that "if they see a kid like that in their school then, instead of suspending them and getting them out of school, why don't they help, then?" (Brown and Clarey, 2012, p. 243). These feelings may alienate adolescents from schools and schools' messages on smoking (Brown and Clarey, 2012). In perspective of its impact, one study showed a positive association between the harshness of school smoking rules and current smoking (Reitsma and Manske, 2004).

The finding that sanctions may alienate adolescents from schools and schools' messages on smoking identifies a pitfall of STPs. Disciplining adolescents helps to decrease smoking, but only when they experience teachers' and parents' support (Wiiium and Wold, 2011). Complementing sanctions with education and counselling efforts (vs. discipline only) is associated with increases in adolescents' school connectedness, risk perceptions, negative attitudes about smoking, concerns about friends' smoking (Hamilton et al., 2003), and intentions to stay smoke free until the age of eighteen (Lee et al., 2007). Furthermore, STPs with less severe (Clark et al., 2002; Kumar et al., 2005), progressive, and consistently enforced (Leatherdale and Cole, 2015) sanctions are also suggested to be more effective in reducing smoking.

Mechanism 4: When adolescents find it difficult to smoke during school hours, they find it easier to stick to their decision not to smoke and therefore may not start or stop smoking during and outside school hours.

School environments that make it difficult to smoke during school hours may make it easier for adolescents to stick to their decision not to smoke. Literature showed that STPs are associated with increases in adolescents' experience of perceived behavioural control over smoking, which is subsequently associated with increases in the intention to remain smoke-free for the next 30 days (Murnaghan et al., 2010) as well as smoke-free behaviour over the past 30 days (Murnaghan et al., 2009a). This is consistent with the finding that STPs are associated with decreases in the ease of access to cigarettes and subsequently with past 30-day smoking (Lippman-Kreda and Grube, 2009).

The experience of perceived behavioural control is important for adolescents who want to quit smoking. These adolescents say that STPs at school make it hard to smoke and therefore may encourage adolescents to quit smoking (Balch et al., 2004, 13). One adolescent stressed the impact of STPs on quitting smoking by saying that "If they had the no smoking policy at school, then I probably wouldn't smoke now that I'm trying to quit ... but when I switch my classes, I'll run by the smoke pit [official designated smoking area] and have a couple of puffs from one of my friends" (Baillie et al., 2008, 1013). This notion that STPs can encourage adolescents to quit smoking is further underpinned by studies that show a positive association of an anti-smoking atmosphere and no-smoking signs with smokers' attempts to quit (Wen et al., 2007) and increases in the smoking cessation success rate of adolescents (Kim et al., 2013). However, the extent to which STPs increase smokers' behavioural control is dependent on the level of nicotine addiction. Those who are nicotine dependent tend to violate STPs more often than unaddicted adolescents (Soteriades et al., 2003).

3.1. Refined program theory

In comparison to its initial version, the refined program theory (Fig. 3) links elements of the implementation of STPs to how these make adolescents experience the school context. It also provides more detailed views on how elements of STPs' implementation may lead to mechanisms and the associated countervailing-mechanisms. It also shows that adequate implementation contributes to preventing most countervailing-mechanisms, but that there was no evidence on how implementation can prevent sub-optimal impacts resulting from changes in the social meaning of smoking (CM2.2).

4. Discussion

This realist review examined how elements of the implementation of STPs influence adolescents' cognitive and behavioural responses to STPs ('mechanisms'), which may subsequently impact adolescent smoking behaviour. The refined program theory (Fig. 3) shows that STPs trigger four mechanisms that decrease smoking, but may also trigger associated countervailing-mechanisms (CM) that reduce, nullify, or revert this positive impact:

Mechanism 1: Adolescents who think there is a high likelihood that they will get caught smoking and perceive staff to have authority, feel they can get sanctioned for violation the smoking rules. This does not necessarily result in less smoking because adolescents may start smoking at alternative locations where they do not have such feeling (CM 1.1).

Mechanism 2: Adolescents who see less smoking feel less pressure to conform to others' smoking behaviours. Yet, the social pressures to smoke may increase because STPs create new social meanings (e.g., smoking means challenging adult opposition) of smoking during school hours (CM 2.1) and attract non-smokers in the physically separated smokers' groups (CM 2.2).

Mechanism 3: Adolescents' experiences of school actions against smoking makes them internalise anti-smoking beliefs. However, weak enforcement of STPs and teacher smoking may make adolescents internalise the belief that smoking is not too bad (CM 3.1). Also, a lack of sympathy for STPs may cause adolescents to internalise the belief that smoking asserts personal autonomy (CM 3.2), while unfair sanctioning may alienate adolescents from schools and schools' messages on smoking (CM 3.3).

Mechanism 4: The difficulties of smoking during school hours make it easier for adolescents to stick to their decision not to smoke. There was no evidence for countervailing-mechanisms.

4.1. Limitations

This synthesis of evidence encountered important limitations of contemporary literature. First, quantitative studies that assess the impact of STPs rarely analyse individual, policy, and socio-environmental predictors of smoking as mediating factors in the association between STP and smoking outcomes. Consequently, they scarcely explain how STPs impact adolescents' smoking behaviour. This limitation is reflected by the few quantitative studies that could provide thick evidence on how STPs trigger mechanisms. Future studies should quantitatively test the mechanisms outlined in our refined program theory.

Second, qualitative studies hardly place STPs at the focus, but often address STPs as a subtopic or only when participants mention

them. As a result, qualitative evidence is fragmented and particularly focuses on the negative impact of STPs. Our synthesis could consequently provide far less empirical evidence on positive impacts of STPs than on negative impacts. Future research that qualitatively examines the positive as well as the negative impacts of STPs on adolescents' smoking are needed to further substantiate and refine the mechanisms and possibly identify additional mechanisms.

Third, the synthesis was unable to report on comparisons between "contexts" such as groups (e.g., age, sex) or settings (e.g., culture). This is a limitation because the realist approach assumes personal characteristics or settings have strong influences on the occurrence of mechanisms (Pawson, 2006). For instance, girls may be influenced more strongly by school norms than boys (Barnett et al., 2007) and collectivistic cultures may enhance the impact of school-based smoking control efforts (Osaki et al., 2008). Future research therefore ought to include comparative elements to develop more understanding about how the impact of STPs varies between groups and settings. Also, as 27 of 37 studies included in our synthesis were conducted in an Anglo-Saxon context, we think that more studies should be conducted in other countries to allow for better socioenvironmental comparisons.

Lastly, the synthesis could not assess how often the (countervailing-) mechanisms occur and how much they impact adolescents' smoking behaviours. This makes it hard to quantify, with the available evidence, the relative contributions of (countervailing-) mechanisms into perspective of STPs' overall impact.

4.2. Practical recommendations to improve STPs' effectiveness

The program theory shows the elements of STPs' implementation that contribute to making adolescents experience a school context that averts or stops adolescents from smoking. These translate into recommendations for making STPs consistently effective in decreasing adolescents' smoking.

A first recommendation is that STPs ideally involve all school buildings and premises, do not allow students to leave school premises, entail clear rules, are strictly enforced, apply to all individuals, and are complemented with education, prevention, and counselling. To illustrate how these elements can trigger positive responses, strict enforcement leads to the belief that there is a high likelihood to get caught smoking, which, in turn, results in feelings they can get sanctioned for smoking at prohibited places, and subsequent positive impacts on adolescents' smoking behaviours. Strict enforcement also avoids the experience of contradictory situations, which, in turn, abates the development of the belief that smoking is not too bad. Though, adequately implementing STPs cannot always avoid the triggering of countervailing-mechanisms, such as the experience of new social meanings of smoking.

A second recommendation is to embed STPs in continuous monitoring and adaptation cycles to proactively deal with the suboptimal or adverse outcomes. The monitoring process best focusses on adolescents' experiences of the school context and their cognitive and behavioural responses to STPs. Schools can monitor themselves by periodically talking with students, ideally those who smoke or are susceptible to start smoking (e.g., those with low academic well-being as these individuals are more likely to smoke). The adaptation process ought to ensure that adolescents' experiences and responses contribute to decreasing adolescent smoking behaviour. Overall, schools should not merely implement STPs, but instead continuously assess STPs' impact and look for ways to improve the impact on adolescent smoking behaviour.

4.3. Brief reflections

The program theory offers a nuanced view about the contentious topic of sanctioning. Advocates argue that sanctioning provides a coherent anti-smoking message, whilst opponents argue it alienates adolescents from schools (Evans-Whipp et al., 2007; Poulin, 2007). Sanctioning may sometimes be necessary for school staff to acquire and keep authority over adolescents' smoking at school premises. If staff members are not allowed to sanction adolescents who violate the rules at all, adolescents may disobey the rules and will experience considerable contradictions between school's non-smoking messages and actual smoking practices and policy enforcement. Sanctioning should, however, avoid the triggering of countervailing-mechanisms. It needs to be done progressively and consistently, and should be accompanied by considerable educational, counselling, and prevention efforts so that adolescents understand that schools are truly there to help them grow up in a healthy environment.

The program theory supports the necessity for WHO's "Health Promoting School Framework." This framework holistically addresses adolescents' health by activities at distinct levels, including teaching formal health curricula, improving the school environment, and engaging with families and communities (Langford et al., 2014). Formal health curricula provide the opportunity to address the conflict between schools' decision to prohibit smoking and adolescents' notion that smoking is a personal choice. Complementing STPs with other environmental efforts provides the opportunity to decrease smoking at alternative locations and reach more consistency (i.e., less contradictory situations) between anti-smoking norms across social environments (e.g., adolescents' homes or communities).

The program theory not only substantiates and refines the mechanisms hypothesized in the initial program theory, but also complements these with associated countervailing-mechanisms. Like we briefly outlined for the mechanisms in the Method section, the countervailing-mechanisms also show strong parallels with existing behavioural theories. Adolescents' search for and use of alternative – non-sanctioned – places (CM1.1) corresponds with the expectancy-value part of the theory of planned behaviour (Ajzen, 1991) as it can be understood as a means to recover the positive outcome expectation of smoking. The finding that STPs could increase the social pressures to smoke corresponds with social identity theory (Tajfel, 2010) because STPs allow adolescents to bond with peers who rebel against the rules of adults (CM 2.1) or get together frequently at distinct smoking areas (CM 2.2), and for them smoking may symbolize their group identity. The finding that adolescents may internalise wrong beliefs about the harmfulness of smoking (CM3.1), the view that smoking asserts personal autonomy (CM 3.2), and negative perceptions about schools' intentions (CM 3.3) corresponds with the 'theory of human functioning and school organisation' (Markham and Aveyard, 2003). This theory posits that adolescents only internalise schools' values if they are committed to the school, its values, and its staff. Students who do not feel such commitment may find affiliation with anti-school peer groups and become more likely to engage in risk behaviours, like smoking (Bonell et al., 2013).

5. Conclusion

There is increasing political will and electoral support for realizing a world that is free of tobacco. STPs have the potential to contribute to this cause, yet its true impact depends on the cognitive and behavioural responses it triggers in adolescents. Schools can improve the impact of STPs by adequately implementing STPs and embedding them in continuous monitoring and

adaptation cycles so that schools can proactively deal with the responses that lead to suboptimal or adverse outcomes. This strategy is warranted to make certain that schools will cease from functioning as places that entice adolescents to smoke.

Contributorship statement

AEK and MS conceptualized the study. AEK, BvdP and MS designed the initial program theory. MS executed the search, managed the review process and drafted the manuscript. PAWN and MS selected, appraised and synthesized the evidence. All authors contributed to the writing of the final manuscript and approved the final manuscript.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at <http://dx.doi.org/10.1016/j.socscimed.2017.04.031>.

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