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Parental Smoking and Smoking Cognitions among Youth: A Systematic Review of the Literature

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Key Words

Parental smoking · Adolescents · Youth · Children · Explicit cognitions · Implicit cognitions

Abstract

Aims: We summarized and discussed the empirical evidence for an association between parental smoking and smoking-related cognitions among youth and for the mediating role of smoking-related cognitions in the relation between parental and youth smoking behaviour. **Methods:** We conducted a systematic review of articles published between 1980 and February 2015 using the databases PsychInfo and PubMed. **Results:** The systematic search resulted in 41 eligible studies. Only 4 studies investigated smoking-related cognitions as putative mediators in the association between parental and youth smoking. The synthesis of evidence showed a mix of significant and non-significant associations between parental smoking and smoking-related cognitions among youth. A majority of results reported positive associations even when non-significant findings were found. However, studies that report an effect suggest that the effect may be quite modest. **Conclusion:** Empirical evidence does not confirm the commonly applied assertions of social learn-

ing theories that parental smoking increases the risk of youth smoking through the development of favourable smoking-related cognitions. Methodological and theoretical aspects that might explain the lack of consistent findings are discussed.

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Introduction

A large body of research has provided evidence for the link between parental smoking and smoking in adolescents [1–3]. A recent meta-analysis concluded that the risk of smoking uptake is nearly threefold if both parents smoke [1], and numerous studies show that parental smoking and exposure to second-hand smoke constitute risk factors for higher rates of smoking and progression into nicotine dependence among youth [4–7]. Up to this point, however, it is yet unclear how parental smoking contributes to smoking in adolescents. Adolescents' smoking-related cognitions have been proposed to underlie the intergenerational transmission of smoking behaviour. Cognitive models have described 2 somewhat overlapping pathways, which may help to further under-

stand the mechanisms underlying the association between parental and youth smoking.

One line of research describes an explicit pathway of transmission, which involves conscious elaboration and explicit decision-making processes. Theories of health behaviour and social learning theories, such as the Theory of Planned Behaviour (TPB) [8] and the Social Cognitive Theory (SCT) [9] assume that the decision to engage in substance use is based on the rational evaluation of the positive and negative consequences of substance use. According to these theories, explicit cognitions (e.g. expectancies, normative perceptions, attitudes) are important predictors of the decision to engage in certain behaviours. For example, the TPB [8] postulates that behaviour is determined by behavioural intention which, in turn, depend on personal attitudes towards the behaviour, subjective norms, and perceived behavioural control over the behaviour (self-efficacy). In addition, explicit cognitions are hypothesized to mediate the influence of others on individual behaviour. For example, the SCT [9] posits that the observation of a certain behaviour by significant others shapes cognitions and leads to the adoption and imitation of this behaviour.

Recent literature describes a second possible pathway that also considers the role of implicit smoking-related cognitions [10–14]. Implicit transmission involves the formation of cognitive processes that are more automatic and less readily accessible by introspection or self-report (e.g. attentional processes, memory associations, information processing). Models and theories that consider implicit cognitions, such as dual process models (e.g. [14]), extend the assumption that the decision to engage in a certain behaviour is solely based on a rational process and hypothesize that substance use may also be affected by relatively automatic or impulsive processes that are formed and activated by environmental cues. While explicit (conscious, reflective, controlled) cognitive processes involve deliberate and conscious appraisals of available information, implicit (automatic, impulsive) processes refer to automatic associations that do not depend on deliberate or conscious recollection.

Both explicit and implicit cognitive processes are assumed to be influenced by the social environment. Parents are one of the most important sources that influence cognitions and behaviour of youth. The intergenerational transmission of smoking behaviour has been well established (for a review see [1]). The purpose of the current review is to summarize and discuss the empirical evidence for (1) an association between parental smoking and smoking-related cognitions among youth as well as

the empirical evidence for (2) the mediating role of smoking-related cognitions in the relation between parental and youth smoking. We did not conduct a formal meta-analysis due to the variation of cognitive outcome measures used in different studies, which did not allow for statistical comparisons to be performed between studies. The main aim of this review was to summarize and discuss the current state of the literature in this field and to suggest implications for theory and future research.

Methods

Data Sources

We conducted comprehensive searches of the databases PsychInfo and PubMed for studies assessing the association between parental smoking and youth smoking-related cognitions published between 1980 and February 2015. To be included, a study had to measure parental smoking as an independent variable and smoking-related cognitions in children/adolescents as an outcome variable/mediator. Measures of parental smoking included having at least one currently smoking parent, having at least one ever smoking parent, the number of currently smoking parents, and the frequency of parental smoking. Measures of explicit smoking-related cognitions in youth included smoking-related attitudes, beliefs, perceptions, expectancies, norms, prototypes, the inclination to smoke (i.e. willingness, susceptibility, motivation), and the intention to smoke. Due to a limited number of studies, the search on implicit cognitions was extended to smoking and implicit cognitions (i.e. automatic smoking-related memory associations, selective attention and automatic approach tendencies). The search terms are listed in the supplementary material (see www.karger.com/doi/10.1159/000446022). Other inclusion criteria were full-text availability, report published as a journal article, present original data, and the report had to be published in English. In cases in which multiple studies used the same dataset, we included the study with the greatest methodological quality as assessed by the Newcastle-Ottawa Scale (NOS) [15]. In cases in which analyses were conducted for different reporters, we reported the results based on child-report. If full-text articles were unavailable, attempts to obtain full-text articles from the authors were made. In addition, we hand-searched the reference lists from identified relevant articles. A systematic review was carried out in accordance with the PRISMA statement [16].

Data Extraction and Quality Assessment

All authors participated in the assessment of eligibility of abstracts and full-texts and the data-extraction process. First, titles and abstracts identified from database searches were assessed for eligibility, excluding irrelevant ones. Then, full-texts of papers were assessed for eligibility. Papers were sorted in a way that each paper was independently assessed by at least 2 authors. Disagreements were resolved through discussion with the other authors. Also, data extraction was conducted independently by at least 2 authors and by using a data extraction form. The NOS [15] was used to assess the quality of the included studies based on selection of subjects, comparability of subjects, and assessment of outcome.

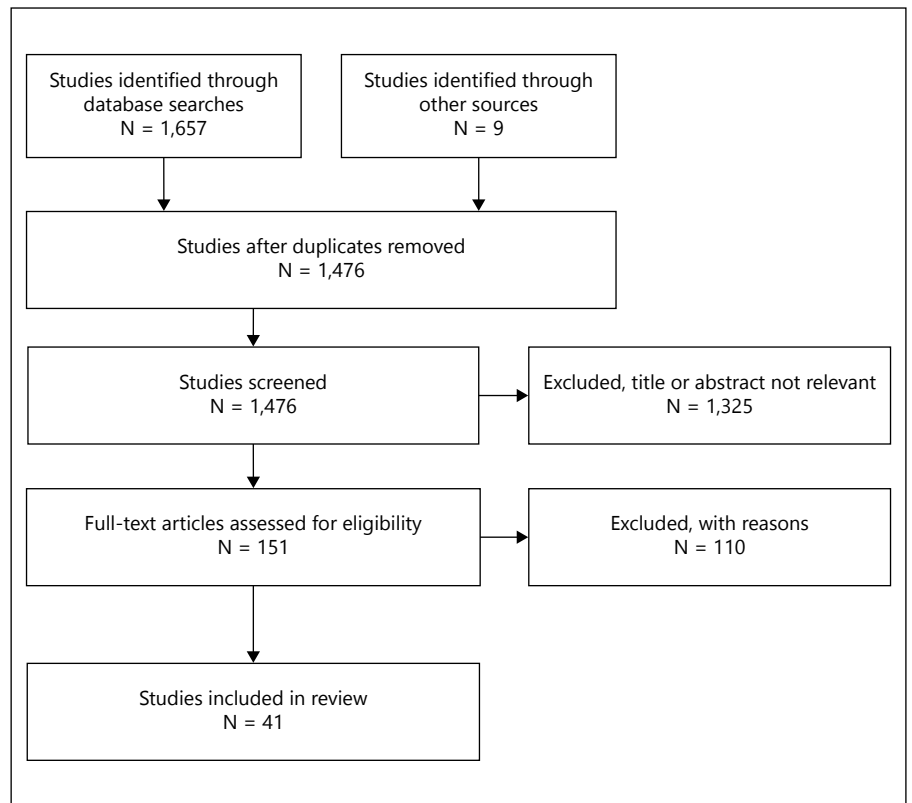


Fig. 1. Flowchart of included studies for explicit cognitions.

Results

Overview of Included Studies

Regarding explicit cognitions, the initial search identified 1,657 non-duplicated, potentially eligible studies. After reviewing the titles and abstracts, we retained 151 full-text articles for detailed evaluation. Review of their reference lists yielded 3 additional studies and 6 extra studies were identified by the authors. After examination of the full-text articles, 110 studies were excluded because parental smoking or smoking-related cognitions were not measured, relevant data were not provided, the study was not published in English, or the same dataset was used in another article, which yielded a higher quality. With regard to implicit cognitions, the initial search and the review of titles and abstracts resulted in 13 full-text articles that were reviewed for detailed evaluation. Of those, 3 studies fulfilled the criteria for inclusion. These 3 studies assessed both implicit and explicit cognitions and were also identified in the search for explicit cognitions. In total, 41 studies were included in this systematic review (see flowcharts, fig. 1 and 2).

A majority of studies were conducted in the United States or Europe and reviewed non-systematically ascer-

tained school-samples. Most studies measured parental smoking based on child reports. Of the 41 studies, 30 were cross-sectional. Eight studies used a longitudinal design to examine the association between parental smoking and smoking-related cognitions in youth. Four studies aimed at evaluating adolescent's cognitions as potential mediators in the association between parental and adolescent smoking. A majority of studies reported the effects of parental smoking on multiple smoking-related cognitions in adolescents. The age range of children was mainly between 9 and 18 years. Exceptions were 2 studies, in which older samples (14–24/13–21 years) were used [17, 18] and a study focusing on a younger sample (mean age 6.9) [19]. The quality of the studies ranged from 1 to 6 on the 9-point NOS [15], with a median score of 3.5. In the following sections, we present findings separately for cross-sectional, longitudinal, and mediation studies to distinguish between the methodological quality of studies and the quality of the evidence.

Cross-Sectional Studies

In this section, we focus on the results of constructs posited by the TPB [8], the SCT [20] and by dual process models: global attitudes towards smoking, normative be-

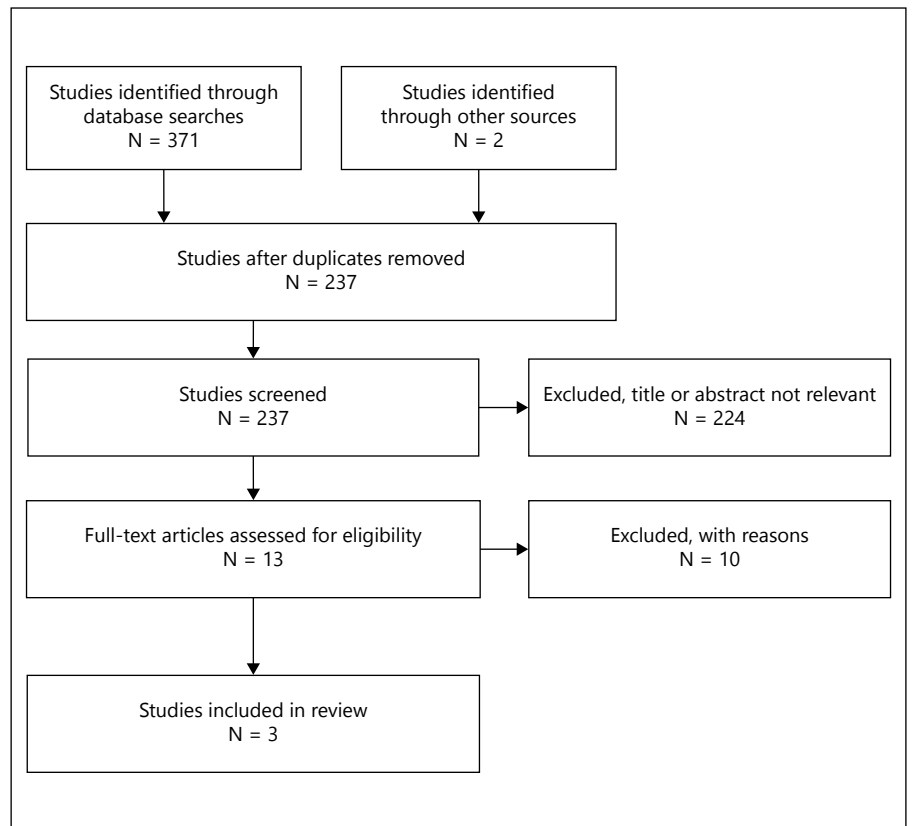


Fig. 2. Flow chart of included studies for implicit cognitions.

iefs, self-efficacy, smoking-related expectancies, intentions to smoke, and implicit smoking-related cognitions. Additionally, we present the results regarding susceptibility to smoking [21]. The results of all studies can be found in tables 1 and 2.

Of the 30 studies that employed a cross-sectional design to assess the association between parental smoking and adolescent's smoking-related cognitions, the 5 studies that investigated the association between parental smoking and global attitudes towards smoking showed inconsistent findings. One study reported evidence for a positive association between parental smoking and positive attitudes towards smoking [22], whereas 4 studies found no significant association [23–26].

With regard to injunctive norms, 3 studies found parental smoking to be associated with adolescent's perceived approval of smoking from their parents [27, 28] and with mothers' and friends' approval of smoking [22]. Three studies investigated the association between parental smoking and adolescent's descriptive norms (perception of adult and/or peer smoking prevalence). Two studies found evidence for an association between parental smoking and higher perceived adult smoking prevalence

[29, 30], whereas one study did not find this association [26]. Furthermore, 2 studies reported that adolescents with smoking parents overestimated the smoking prevalence of their peers compared with adolescents with non-smoking parents [26, 30].

In total, 3 studies investigated the association between parental smoking and self-efficacy. Two studies assessing the self-efficacy to resist smoking in samples of adolescent smokers found that adolescent smokers with smoking parents reported lower self-efficacy to resist smoking than adolescent smokers with non-smoking parents [31, 32]. In one other study, parental smoking was not associated with higher self-efficacy to refuse tobacco in a sample that tested smoking as well as non-smoking adolescents [22].

Two studies found that parental smoking increased general positive smoking-related expectancies [33, 34], while one study did not find this association [31]. A majority of studies showed no association between parental smoking and personal negative smoking-related expectancies [24] or personal positive smoking-related expectancies [29, 32]. Only one study found parental smoking to be positively related to positive personal smoking-related expectancies [24].

Table 1. Overview of included studies

Study	N	Age/ grade at baseline	Source of sample	Sample	Independent variable	Name of outcome measure	Results	Overall Controlled results for*	NOS score of quality
<i>Cross-sectional studies</i>									
Baška et al. [41], 2010	4,696	13–15	School-based (60 schools, elementary and study grammar schools), Slovakia	Non-smokers and smokers	At least one smoking parent	Susceptibility Thinking smoking peers are more attractive	p = ns p = ns	ns	2
Brook et al. [19], 1999	280	M = 6.9	School classes	Non-smokers	Smoking parents vs. non-smoking parents	Attitudes Knowledge about smoking Possibility of future smoking Willingness to try smoking	p = 0.001 p = ns p = 0.01 p = 0.00002	Mixed	3
Chassin et al. [23], 2002**	446	10–17, M = 12.8	Family-based lab or home interviews, USA	Non-smokers and smokers	Parental smoking status (non-smokers, ex-smokers, current smokers)	Explicit attitudes Implicit attitudes	p = ns Paternal smoking: F = 1.29, p = ns; Maternal smoking: F = 2.42, p = ns	ns	A, F
Engels et al. [31], 2012***	530	13–18 M = 15	School-based, The Netherlands	Daily and weekly smokers	Number of smoking parents	Pros of smoking Pros of quitting Self-efficacy to resist smoking	0.09/0.06, p = ns 0.05/0.02, p = ns -0.17/-0.15, p < 0.01	Mixed	E
Hiemstra et al. [22], 2012	1,478	8–12, M = 10.1	Family-based survey, Smoke-free Kids, The Netherlands	Non-smokers and smokers	Number of smoking parents	Attitudes Perceived social norm of mother Perceived social norm of friends Perceived social norm of best friend Self-efficacy	β = 0.08, p < 0.01 β = 0.13, p < 0.001 β = 0.08, p < 0.01 β = 0.07, p < 0.01 ns	Mixed	F
Kaplan et al. [17], 2001	1,411	14–24	Family planning clinics, Los Angeles, USA	Non-smokers and smokers (Latinas)	At least one smoking parent	Intention	OR = 1.59, p < 0.01	Sign	A, C, F
Kong et al. [28], 2012	319	14–18, M = 16.5	School-based (high schools), New Haven County, Conn., USA	Daily smoking adolescents seeking cessation treatment	Number of smoking parents	Parental disapproval	χ^2 = 17.84, p < 0.01	Sign	–
Kurtz et al. [76], 1996	675	5th–12th grade	School-based (5 public schools), Detroit, Mich., USA	Non-smokers and smokers (mostly African-American)	Paternal and maternal smoking (yes/no)	Attitudes toward ETS	Paternal smoking: F = 0.90, p = 0.34; Maternal smoking: F = 2.99, p = 0.08	ns	B, E, F

Table 1. (continued)

Study	N	Age/ grade at baseline	Source of sample	Sample	Independent variable	Name of outcome measure	Results	Overall Controlled results for*	NOS score of quality
Leatherdale and Ahmed [77], 2009	71,003	5th–12th grade	School-based (public and private schools), Canadian Youth Smoking Survey, 10 Canadian provinces, Canada	Non-smokers and smokers	At least one smoking parent	Beliefs about smoking: Should smoking be allowed at home In the car	OR = 1.31, p < 0.001 (girls) OR = 0.91, p = ns (boys) OR = 1.35, p < 0.001 (girls) OR = 0.83, p < 0.01 (boys)	Mixed A, F	3
Lim et al. [40], 2014	18,870	13–17	School-based (234 schools), Global School-Based Student Health Survey, Malaysia	Non-smokers	Parental tobacco consumption	Susceptibility	Father: aOR = 1.48, 95% CI 1.21–1.82 Both parents smoked: aOR = 2.32, 95% CI 1.22–4.44	Sign A, B, D, E, F	4
Lochbuehler et al. [24], 2012**	30	10–13 M = 11.5	School-based (3 elementary schools), The Netherlands	Never-smokers*	At least one smoking parent	Pro-smoking attitudes Pros of smoking Cons of smoking Attentional focus to smoking cues	F = 0.27, p = 0.61 F = 10.36, p = 0.003 F = 2.84, p = 0.10 Number of fixations: F = 7.525, p = 0.01; Gaze duration: F = 5.012, p = 0.03	Mixed –	3
Loke and Wong [78], 2010	575	10–13, 4th–6th grade	School-based (2 primary schools), Hong Kong	Non-smokers and smokers	Smoking vs. non-smoking parents	Attitudes Knowledge on harmful effects of smoking	12 single items: p < 0.05 in 9 out of 12 items 2 single items: p < 0.01 and p < 0.001	Mixed –	2
Lorenzo-Blanco et al. [79], 2012	860	M = 14.7	Community-based, Santiago, Chile	Non-smokers and smokers	Parental smoking (yes/no)	Negative attitudes towards smoking	$\beta = -0.07$, p < 0.05	Sign A, B, C, E	5
Mahabee-Gittens et al. [39], 2011	272	9–16, M = 12.9	Recruited via a pediatric hospital, Cincinnati area, USA	Never smokers	Currently vs. not currently smoking as teen	Intention to smoke as an adult	p = 0.57 p = 0.02	Mixed –	2
Mak et al. [37], 2012	4,790	13–18	School-based, Hong Kong	Never smokers	Number of smoking parents	Intention	Paternal smoking: aOR = 1.53, p < 0.001; Maternal smoking: aOR = 1.58, p > 0.05; Parental smoking: aOR = 2.49, p < 0.001	Mixed A, B, F	4
McCool et al. [80], 2003	3,041	2nd grade, M = 12 and 6th grade, M = 16	School-based (10 secondary and 15 primary schools), New Zealand	Non-smokers and smokers	Parental smoking (yes/no)	Smoking expectations	Total sample: OR = 0.73, p = 0.002 Form 6 students (age 16): OR = 0.67, p < 0.01 Form 2 students (age 12): ns	Mixed B, D, F	3

Table 1. (continued)

Study	N	Age/ grade at baseline	Source of sample	Sample	Independent variable	Name of outcome measure	Results	Overall Controlled results for*	NOS score of quality
McCool et al. [38], 2011	515	11–13, M = 11.5	School-based (5 primary and intermediate schools), Auckland, New Zealand	Non-smokers and smokers	Paternal and maternal smoking (yes/no)	Positive image characteristics of smokers Negative emotion appraisals Intention	Paternal smoking: $\beta = 0.03$, $p = 0.53$; Maternal smoking: $\beta = 0.05$, $p = 0.60$ Paternal: $p = 0.34$; Maternal: $p = 0.85$ Paternal: OR = 1.95, $p = 0.03$; Maternal: OR = 1.48, $p = 0.244$	Mixed B, D, F	3
Meier [81], 1991	1,085	7th grade, M = 12.1, and 11th grade, M = 16.2	School-based (2 high schools, 3 middle schools), N.J., USA	Non-smokers and smokers	Paternal and maternal smoking (yes/no)	Attitudes	Maternal smoking: $F = 3.15$, $p < 0.10$ (ns); Paternal smoking: $p = ns$	ns	2
Murphy and Price [35], 1988	1,513	12–14, 8th grade	School-based (8 middle schools), N.C., USA	Non-smokers and smokers	At least one smoking parent	Intention	$\chi^2 = 27.5$, $p < 0.0001$	Sign	2
Piperakis et al. [18], 2008	699	13–21, M = 15.3	School-based, Central Greece	Non-smokers and smokers	Maternal/paternal smoking (daily/ occasionally/ never)	Intention	Paternal smoking: kendall's tau_b = 0.14, $p < 0.05$ Maternal smoking: not reported	Mixed	2
Sargent and Dalton [27], 2001	805	8–17, 4th–11th grade	School-based (3 schools), Vt., USA	Never smokers	Number of smoking parents	Parental disapproval	$p < 0.01$	Sign	3
Sargent et al. [29], 2002	3,702	9–15, 5th–8th grade	School-based (15 schools), N.H. and Vt., USA	Never smokers	Either parent smokes (yes/no)	Susceptibility Normative views of adult smoking Positive expectations	OR = 0.87, $p = ns$ OR = 2.55, 95% CI 2.16–3.03 OR = 0.89, $p = ns$	Mixed B, C, F	4
Schuck et al. [33], 2012	778	9–12	School-based (15 primary schools), The Netherlands	Never smokers	Number of smoking parents	Pros of smoking Perceived safety of casual smoking Susceptibility	$\beta = 0.13$, $p = 0.001$ $\beta = 0.12$, $p < 0.001$ $p = ns$, but in direct effect via perceived safety ($\beta = 0.02$, $p = 0.01$)	Mixed A, B	4
Scragg et al. [36], 2010	157,637	14–15, 10th grade	School-based (all New Zealand schools), New Zealand	Non-smokers and smokers	Paternal smoking (yes/no)	Susceptibility	RR 1.10, 95% CI 1.06– 1.13	Sign A, B, D	3

Table 1. (continued)

Study	N	Age/ grade at baseline	Source of sample	Sample	Independent variable	Name of outcome measure	Results	Overall Controlled results for*	NOS score of quality
Sherman et al. [25], 2009**	940	10–18, M = 13.4	Web-based study, Indiana University Smoking Survey, USA	Never smokers	Parental smoking: currently vs. not currently smoking	Explicit attitudes Implicit attitudes	Paternal smoking: -0.14, p = ns; Maternal smoking: 0.03, p = ns Paternal smoking: 0.26, p = ns; Maternal smoking: 0.004, p = ns	ns A, F	4
Thomson et al. [30], 2005	3,831	12–17	Telephone survey, Mass., USA	Never smokers	Parental smoking (yes/no)	Perception of adult/ youth smoking prevalence	OR = 0.45, p < 0.001 (adult smoking) OR = 0.79, p < 0.05 (youth smoking) OR = 0.71, p < 0.05 (adult smoking) OR = 1.01, p = ns (teen smoking)	Mixed A, B, C, D, E, F	5
Thrasher et al. [26], 2008	3,876	11–16, M = 13.4	School-based (18 secondary schools), GYTS, Mexico	Selection of never smokers (2,098)	At least one smoking parent	Attitudes Perceived peer and adult prevalence Susceptibility	B = 0.06, p = ns B = -0.02, p = ns (peer smoking) B = 0.17, p < 0.01 (adult smoking) OR = 1.20, p = ns	Mixed A, B, F	4
Waa et al. [42], 2011	2,717	14–15	School-based, New Zealand Youth Tobacco Monitor, New Zealand	Non-smokers	Number of smoking parents	Susceptibility	0 vs. 1 smoking parent: OR = 0.89, 95% CI 0.86–1.16, ns 0 vs. 2 smoking parents: OR = 0.77, 95% CI 0.53–1.11, ns	ns A, B, C, D, F	4
Weiss and Garbanati [34], 2004	106	15–19, M = 16.3	School-based (2 school districts), Calif., USA	Non-smokers and smokers	Maternal and paternal smoking status (current, past, non-smoker)	Attitudes	Paternal smoking: F = 3.92, p = 0.05; Maternal smoking: not reported	Mixed -	1
Van Zundert et al. [32], 2007	998	14–18, M = 15.3	School-based (33 schools), The Netherlands	Regular smokers	Maternal and paternal smoking (yes/no)	Pros of smoking Pros of quitting Self-efficacy	-0.02, p = ns -0.03, p = ns -0.12, p < 0.05	Mixed F	2
<i>Longitudinal studies</i> Blanton et al. [43], 1997	463	8th and 10th grade, M = 14.8	Family-based (50 rural counties), Iowa, USA	Not reported	Smoking fre- quency (father/ mother)	Prototypes	Maternal smoking: $\beta = -0.11$, p < 0.01; Paternal smoking: $\beta = -0.13$, p < 0.01	Sign E, F	6

Table 1. (continued)

Study	N	Age/ grade at baseline	Source of sample	Sample	Independent variable	Name of outcome measure	Results	Overall Controlled results for*	NOS score of quality
Chassin et al. [44], 1998	192	10–16, M = 11.4	School-based, (Midwestern county schools), USA	Non-smokers and smokers	Maternal currently vs. not currently smoking	General and personally relevant beliefs about smoking	General beliefs: $\beta = 0.16, p < 0.05$; Personally relevant beliefs: $\beta = 0.18,$ $p < 0.05$	Sign A, E, F	6
Engels et al. [31], 2012***	530	13–18, M = 15	School-based, The Netherlands	Daily and weekly smokers	Number of smoking parents	Readiness to quit	0.01, $p = ns$	ns E	3
Forrester et al. [45], 2007	3,641	7th and 9th grade	Community-based (16 OR communities), USA	Non-smokers	At least one smoking parent	Susceptibility	OR = 1.18, $p = 0.13$	ns A, B, F	6
Morrell et al. [46], 2010	395	M = 14	School-based (2 secondary schools), USA	Non-smokers and smokers	Ever smoker or at least one smoking parent	Perception of short-term risk, long-term risk, and benefits of smoking	$p > 0.60$ (short-term risk) $p > 0.70$ (long-term risk) $p > 0.60$ (benefits)	ns B, E, F	6
Otten et al. [47], 2007	314	13–17	Family-based, Family and Health Project, The Netherlands	Non-smokers and smokers	Parental smoking status (never, tried, quit, occasional, regular)	Perceived social norm parents	Child report on mother: Mixed $\beta = 0.17, p < 0.05$; child report on father: $\beta = 0.14, p < 0.05$ (older child) Child report on mother: $\beta = 0.03, p > 0.05$; child report on father: $\beta = 0.03, p > 0.05$ (younger child) Child report on mother: $\beta = 0.08, p > 0.05$; child report on father: $\beta = 0.13, p > 0.05$ (older child) Child report on mother: $\beta = 0.21, p < 0.05$; child report on father: $\beta = 0.16, p < 0.05$ (younger child)	ns –	4
Polen et al. [48], 2004	418	10–12	Family-based, Pacific Northwest, USA	Non-smokers and smokers	Current parental smoking	Susceptibility	Cross-sectional: OR = 1.41, $p = 0.24$; Longitudinal: $p = 0.32$	ns –	4

Table 1. (continued)

Study	N	Age/ grade at baseline	Source of sample	Sample	Independent variable	Name of outcome measure	Results	Overall Controlled results for*	NOS score of quality
Schultz et al. [49], 2013	71,003	5th–9th and 10th– 12th grade	School-based, Youth Smoking Survey, Canada	Non-smokers and smokers (parameters pertain to non- smokers only)	At least one smoking parent	Susceptibility	Time 1: 5th–9th grades: OR = 1.03, 95% CI 0.84–1.26; Time 2: 5th–9th grades: OR = 1.17, 95% CI 1.00–1.38; Time 2: 10th–12th grades: OR = 0.94, 95% CI 0.75–1.17	ns B, F	4
<i>Mediational studies</i>									
Flay et al. [50], 1994	1,402	7th grade	School-based (47 public schools), Television, School and Family Project, USA	Non-smokers and one or more than one cigarette smokers	Currently vs. not currently smoking parent	Intention, negative perceived parental approval, refusal self-efficacy	Indirect effect for smoking intentions, negative outcome expectations, and perceived parental approval	Mixed F	5
Harakeh et al. [51], 2004	1,070	10–14, M = 12.3	School-based (6 secondary schools), The Netherlands	Non-smokers and smokers	At least one smoking parent	Attitudes, self-efficacy, perceived social norm, intention	Indirect effect for attitudes	Mixed F	5
Otten et al. [52], 2009	6,769	11–16, M = 12.9	School-based (33 secondary schools), The Netherlands	Regular and non-regular smokers	At least one smoking parent	Perception of smoking prevalence	Indirect effect for perceived prevalence	Sign A, F	5
Wyszynski et al. [53], 2011	2,230	3rd grade	School-based (14 schools), the HSPP project, Wash., USA	Not reported	At least one current smoker vs at least one quitter	Attitudes, intention, normative beliefs, self-efficacy, negative expectations	Indirect effect for attitudes and self-efficacy	Mixed E	5

A = Age; B = gender; C = SES; D = race/ethnicity; E = adolescent smoking; F = other; ns = non-significant.

* 1 child reported having a puff once.

** Studies assessed implicit smoking-related cognitions.

*** Study assessed cognitions cross-sectionally and longitudinally.

Table 2. Direct effects of parental smoking on explicit cognitions

Study	General global attitude	Injunctive norms	Descriptive norms	Self-efficacy	Smoking-related expectancies (positive/negative)	Susceptibility	Intention	Other constructs
<i>Cross-sectional studies</i>								
Baška et al. [41], 2010						ns		Thinking smoking peers are attractive: ns
Brook et al. [19], 1999							+	Attitude: + knowledge: ns willingness to try smoking: +
Chassin et al. [23], 2002	ns							
Engels et al. [31], 2012				-	Positive: ns (+)			Pros of quitting: ns (+)
Hiemstra et al. [22], 2012	+	+		ns				
Kaplan et al. [17], 2001							+	
Kong et al. [28], 2012		+						
Kurtz et al. [76], 1996								Attitude towards ETS: ns
Leatherdale and Ahmed [77], 2009								Attitude towards ETS: girls (+), boys (-)
Lim et al. [40], 2014							+	
Lochbuehler et al. [24], 2012	ns (+)				Positive: + negative: ns (+)			
Loke and Wong [78], 2010								Knowledge: + attitudes: sig (+)/ns (+)
Lorenzo-Blanco et al. [79], 2012								Attitude: +
Mahabee-Gittens et al. [39], 2011								Intention to smoke as teen: ns (+) as an adult: +
Mak et al. [37], 2012								Sign (+)/ns (+)
McCool et al. [80], 2003								Total sample: + Age 16: + Age 12: ns
McCool et al. [38], 2011								Maternal smoking: ns (+) Paternal smoking: +
Meier [81], 1991								Attitude: ns (+ mother)
Murphy and Price [35], 1988							+	
Piperakis et al. [18], 2008								Maternal smoking: ns Paternal smoking: +

Table 2. (continued)

Study	General global attitude	Injunctive norms	Descriptive norms	Self-efficacy	Smoking-related expectancies (positive/negative)	Susceptibility	Intention	Other constructs
Sargent and Dalton [27], 2001	+							
Sargent et al. [29], 2002			+		Positive: ns (-)	ns (-)		
Schuck et al. [33], 2012					Positive: +		ns	Perceived safety of casual smoking: +
Scragg et al. [36], 2010							+	
Sherman et al. [25], 2009	Maternal smoking: ns (+) paternal smoking: ns (-)							
Conley Thomson et al. [30], 2005			+					Perceived adult disapproval teen smoking: ns (+) Perceived adult disapproval of adult smoking: -
Thrasher et al. [26], 2008	ns (+)		Peer prevalence: ns (-) Adult prevalence: +			ns (+)		
Waa et al. [42], 2011						ns (-)		
Weiss and Garbanati [34], 2004					Positive: paternal smoking: +			
Van Zundert et al. [32], 2007				-	Positive: ns (-)			Pros of quitting: ns (-)
<i>Longitudinal studies</i>								
Blanton et al. [43], 1997								Prototypes: -
Chassin et al. [44], 1998								Beliefs: +
Engels et al. [31], 2012								Readiness to quit: ns (+)
Forrester et al. [45], 2007							ns (+)	
Morrell et al. [46], 2010								Risk perceptions: ns (+/-)
Otten et al. [47], 2007	Older sibling: + younger sibling: ns (+)							Older sibling: ns (+) Younger sibling: +
Polen et al. [48], 2004						ns		
Schultz et al. [49], 2013						ns (+/-)		

Table 2. (continued)

Study	General global attitude	Injunctive norms	Descriptive norms	Self-efficacy	Smoking-related expectancies (positive/negative)	Susceptibility	Intention	Other constructs
<i>Mediational studies</i>								
Flay et al. [50], 1994		+		ns	Negative: -	+	+	
Harakeh et al. [51], 2004	+	ns		ns				
Otten et al. [52], 2009			+					
Wyszynski et al. [53], 2011	+		+	-	Negative: -		+	

+ = Positively significant; - = significant but negative; ns = non-significant.
 Global attitudes towards smoking: positive or negative evaluation of self-performance of smoking. Injunctive norms: adolescent's perceived approval of smoking from their parents and friends. Descriptive normative beliefs: adolescent's perception of adult and/or peer smoking prevalence. Self-efficacy regarding smoking: self-efficacy to resist smoking/refuse tobacco. Smoking-related expectancies: general smoking-related expectations: positive and negative consequences of smoking; personal smoking-related expectations: personal outcome of smoking. Intention to smoke: intention to initiate smoking in the future. Susceptibility to smoking: cognitive predisposition to start smoking.

Of the 9 studies that investigated the association between parental smoking and intentions to smoke, 5 studies reported significant associations [17, 19, 35–37], while non-significant associations were found in one study [33]. When analyses were conducted separately for paternal and maternal smoking, only fathers seemed to affect adolescent's intentions to smoke [18, 37, 38]. Mahabee-Gittens et al. [39] found that parental smoking was positively related to the intention to smoke as an adult, but not to the intention to smoke as a teen.

The findings were also inconsistent regarding susceptibility for smoking [21]. In one study, significant findings were found for the association between parental smoking and susceptibility to smoking [40]. When analyses were conducted separately for paternal and maternal smoking patterns, significant effects were found only for paternal smoking [38]. In a majority of studies, it was found that parental smoking was not associated with susceptibility to smoking [26, 29, 41, 42].

Three studies investigated the association between parental smoking and implicit smoking cognitions [23–25]. Two studies found no significant association between parental smoking and adolescent's automatic smoking-related memory associations [23, 25]. A study by Lochbuehler et al. [24] found an increased attentional focus on smoking-related cues in children with smoking parents, compared to children with non-smoking parents.

Longitudinal Studies

A total of 8 studies [31, 43–49] employed a longitudinal design to assess the effect of parental smoking on adolescent's smoking-related cognitions. In summary, these studies reported mixed findings. One study [44] reported that parental smoking increased favourable smoking-related beliefs (i.e. less risk perceptions) in children. One study [43] reported that parental smoking decreased favourable smoking-related beliefs (i.e. more negative prototypes of smokers) in children. Five studies [31, 45, 46, 48, 49] reported no effect of parental smoking on smoking-related cognitions in children and adolescents (i.e. risk and benefit perceptions, susceptibility to smoking, readiness to quit). Finally, one study [47] reported mixed findings depending on the age of the child. While parental smoking increased favourable smoking-related cognitions (i.e. more normative perceptions of smoking), but had no effect on intentions to smoke in older siblings, the opposite effect was observed in younger siblings (i.e. parental smoking increased intentions to smoke, but had no effect on normative perceptions).

None of these studies assessed the effect of parental smoking on adolescent's implicit smoking-related cognitions.

Mediation Studies

Four longitudinal studies [50–53] examined smoking-related cognitions as putative mediators in the association between parental and adolescent smoking. The direct effects of parental smoking on smoking-related cognitions are displayed in table 2. All 4 studies reported a statistically significant indirect effect from parental smoking on youth smoking through at least one putative mediator (indirect effects not displayed). In general, parental smoking increased favourable smoking-related cognitions (i.e. more perceived parental approval of smoking, higher intention to smoke, more positive attitudes towards smoking, higher perceived prevalence of smoking, lower self-efficacy), which in turn increased the likelihood of adolescent smoking. Only in one instance, parental smoking predicted less negative outcome expectations (i.e. perceiving more risks of smoking), which was inversely associated with smoking intentions [50]. Up to now, no study has investigated the role of adolescent's implicit smoking-related cognitions as a putative mediator in the association between parental and adolescent smoking.

Discussion

The aim of this review was to summarize and discuss the empirical evidence for an association between parental smoking and smoking-related cognitions among youth as well as the evidence for a potential mediating role of smoking-related cognitions in the association between parental and youth smoking. A majority of the 41 included studies had a cross-sectional study design; only 8 studies employed a longitudinal design. Beside this, only 3 studies examined implicit smoking-related cognitions among the youth. Overall, findings across studies showed weak and inconsistent (significant and non-significant) associations between parental smoking and smoking-related cognitions among youth. When examining the results by study design, by type of smoking-related cognition or by taking the study year into account, no distinct pattern in associations could be identified. Results were somewhat more consistent across the mediation studies. Three of the 4 identified studies [50–53] showed that parental smoking increased favourable smoking-related cognitions, which in turn increased the

likelihood of adolescent smoking. However, it needs to be emphasized that the number of these mediation studies was quite small. The synthesis of evidence showed that a majority of results reported positive associations between parental smoking and smoking-related cognitions among youth even when non-significant findings were found (table 2). In the following section, we will discuss methodological and theoretical aspects that might explain the mixed pattern of significant and non-significant findings.

Methodological Explanations

A possible explanation for the inconsistent findings relates to the quality of the studies. A majority of the studies had a cross-sectional study design and only a few studies had the primary aim to investigate the association between parental smoking and adolescent's smoking cognitions. In addition, inconsistencies in findings might be due to differences in assessment instruments. Most studies employed survey instruments with unknown reliability and validity, and some cognition measures might be more sensitive for detecting small changes in cognitions than others. Also, several studies used a different operationalization for the same concept, which makes a comparison of the results difficult. Furthermore, a majority of studies failed to consider the smoking status of the child as a potential covariate and did not distinguish between the different stages in the process of smoking. Therefore, most samples include children and adolescents with a diverse background of smoking behaviour (e.g. never-smoking, initiation, experimentation, occasional smoking, regular smoking, established smoking). It has been shown that smoking status in children and adolescents affects attitudes towards smoking [54, 55]. Moreover, previous research indicates that young children are generally negative about smoking [19, 56] and that the unfavourable smoking-related cognitions in children undergo a developmental shift and reduce when they grow older [54, 57]. Adolescents, compared with children, reported more favourable subjective norms [58], perceived the instrumental benefits of smoking, while retaining a general negative attitude toward smoking [59], and saw smokers in a more positive and non-smokers in a more negative light [60]. Also, in the time from early to middle adolescence, negative consequences of smoking were perceived as more likely than potential benefits [10, 61]. However, older adolescents perceived the benefits of smoking as more likely and the costs as less likely than younger adolescents [10, 61], indicating that the discrepancy between cost and benefits of smoking narrows as children get closer to the risk-age of initiation [10]. Therefore, the results of future research may be more consistent when considering

the developmental period of youth (child, pre-adolescent, early adolescent, late adolescent) as well as the stage within the process of smoking among youth.

Theoretical Explanations

A theoretical explanation that may account for the inconsistent findings, relates to the assessment of parental smoking. A majority of studies assessed the current smoking status of parents. However, this does not provide any information about the way that children can be exposed to parental smoking. Exposure to parental smoking consists of different aspects including knowledge of parental smoking, exposure to parental smoking-related cognitions (e.g. attitudes, norms, expectancies), and physiological exposure to second-hand smoke [62]. Smoking-related cognitions in youth may be more strongly related to one of these aspects. Furthermore, the relationship between parental smoking and smoking-related cognitions might be moderated by situational and/or individual characteristics. A relevant factor that might moderate this relationship is smoking-specific parenting or anti-smoking socialization. Previous research has shown that parents who discuss smoking-related issues in a respectful and constructive way can prevent their children from the initiation of smoking [63–67]. Moreover, parental monitoring, rule-setting, and home smoking restrictions have been shown to reduce the risk of smoking initiation [63, 68–71]. Therefore, smoking-specific parenting may moderate the relationship between parental smoking and smoking-related cognitions. The role of smoking-specific parenting has not been examined in a majority of the studies included in this review.

Implications for Theory

Social learning theories propose that role models shape cognitions and behaviour among youth. The present findings indicate that the formation of smoking-related cognitions cannot be explained entirely by the smoking behaviour of parents. Other sources of environmental smoking (i.e. siblings, peers, media, society as a whole) may also explain the formation of smoking-related cognitions in youth. Moreover, it is possible that the impact of different exposure sources in the social environment varies within different age groups [50, 72]. Also, different sources of exposure may communicate different messages regarding smoking, and children may hold positive as well as negative smoking-related cognitions simultaneously. For example, children may observe parental smoking in a positively valued context, which may lead to the formation of positive smoking associations. At the same

time, children may perceive a general anti-smoking attitude in society, which may lead to the formation of negative associations with smoking. This indicates that exposure to parental smoking is rather complex and embedded in a broader social environment. Up to now, it is unclear whether exposure to smoking may activate both favourable and unfavourable smoking cognitions in youth and whether different exposure sources may shape different types of cognitions.

Furthermore, it remains unclear how positive and negative smoking-related cognitions relate to the onset of smoking. It may be expected that positive smoking-related cognitions increase the risk of initiation, while negative cognitions prevent the uptake of smoking. The initiation of smoking could depend on whether positive smoking-related cognitions outweigh negative smoking-related cognitions.

Finally, the interplay between explicit and implicit smoking-related cognitions remains unclear. From a theoretical point of view, it is expected that explicit and implicit smoking-related cognitions underpin different cognitive motivational systems; they should be relatively independent of each other [13, 73, 74]. One empirical study showed that explicit and implicit smoking-related cognitions uniquely predict the onset of smoking [25]. Prospective, longitudinal studies are needed to investigate how explicit and implicit processes develop and interact with each other to influence the initiation of smoking.

Implications for Future Research

First, the results of this review call for more carefully designed studies in the future. The use of validated instruments, the inclusion of relevant covariates, and the use of prospective study designs and mediation analyses is needed to better understand the mechanisms underlying the transmission of smoking behaviour.

Fundamental research investigating the development of positive and negative explicit and implicit smoking-related cognitions is needed [25, 75]. It is important to gain a better understanding of how positive and negative explicit and implicit smoking-related cognitions develop among youth and to determine under which circumstances such cognitions increase the risk of smoking.

A majority of studies did not distinguish between different stages within the process of smoking uptake or the age of the child. Further research on the effect of parental smoking on smoking cognitions during different stages within the process of smoking is needed as the impact of parental smoking on smoking cognitions may fluctuate depending on the age and the smoking status of the child.

Future research should assess different aspects of parental smoke exposure (e.g. knowledge of parental smoking, exposure to smoking-related attitudes of parents, physiological exposure to second-hand smoke) in order to understand the mechanisms that underlie the effects of parental smoking.

Future research should take other relevant variables into account, which may moderate the relationship between parental smoking and the development of smoking-related cognitions. As mentioned above, smoking-specific parenting might be a relevant factor. Therefore, future research should investigate whether smoking-specific parenting or other putative moderators can buffer against the effects of parental smoking and prevent children from developing favourable smoking-related cognitions.

Conclusion

This review examined 41 studies showing inconsistent associations between parental smoking and smoking-related cognitions among youth. The quality of the major-

ity of studies as assessed by the NOS [15] was relatively low; the findings suggest that the effects of parental smoking on smoking-related cognitions may be rather modest, and when effects are observed they are usually small. Research has not been able to confirm the commonly applied social learning or cognitive theories in the area of parental smoking and the development of smoking-related cognitions among youth. In order to draw firm conclusions on how parental smoking affects smoking initiation, well-designed studies that examine the mediating role of explicit and implicit smoking cognitions are needed.

Funding

This study was funded by The Behavioural Science Institute, Radboud University Nijmegen.

Disclosure Statement

The authors declare that they have no conflict of interest.

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