

Parents' Risk Perception of Second-hand Smoke in Children Followed Up in Paediatric Consultations at H.U.B Erasme Hospital

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Keywords

Tobacco Smoke Pollution; Risk Assessment; Perception; Paediatrics; Parents

Abstract

Introduction

Exposure to second-hand smoke (SHS) is associated with numerous adverse health effects in children and remains a major public health concern. Analysing parents' risk perception of SHS can help improve interventions aimed at reducing children's SHS-related health risks

Methods

This study was conducted using an anonymous online questionnaire. Participants rated the children's health risk, on a scale from 1 (no risk) to 7 (high risk), in described situations or photographs depicting an adult smoking in the presence of a child. A risk perception score (RPS) was calculated, with higher scores indicating greater perceived risk. Linear and multivariate regression analyses were performed to identify factors associated with risk perception

Results

A total of 112 parents or legal guardians who attended paediatric consultations at the Brussels University Hospital (H.U.B) – Erasme Hospital, fully completed the questionnaire. On average, participants perceived a high risk (5/7) to the child's health (mean RPS = 86.18/119, SD = 19.67). Participants aged 50–65 years ($p = 0.01$), of Caucasian ethnicity ($p = 0.045$), smokers ($p = 0.042$), and those who smoke both indoors and outdoors ($p = 0.022$) had a significantly lower RPS.

Conclusion

Firstly, parents should be aware that exposure occurs even in the absence of visible or perceptible signs. Secondly, measures aimed at shielding children from the harmful effects of SHS should focus on factors associated with lower risk perception. Finally, paediatricians should be encouraged to take SHS exposure into account when assessing paediatric illnesses

Introduction

Second-hand smoke (SHS) is defined as: "A mixture of the smoke from the burning tip of a cigarette and the smoke exhaled by a smoker." Both smokers and non-smokers are exposed to the harmful pollutants, particularly in enclosed spaces (1). Exposure can occur even without visible or perceptible signs, as 85% of tobacco smoke is invisible and many particles are odourless. Moreover, tobacco smoke can linger in the air for hours, leading to exposure even after smoking has ceased (2). SHS is a major public health concern, causing 1.2 million deaths annually. According to the World Health Organization (WHO), approximately half of all children are exposed to air polluted by tobacco smoke, with 65,000 children dying each year from SHS-related diseases (3). In Belgium, the report « Roken in het gezin » by Kom op tegen Kanker indicates that despite a significant decline in exposure, 29,000 children from Flemish families - 2.2% of Flemish children

— were still exposed daily to SHS in 2021 (4). Children's exposure to SHS is associated with numerous adverse health effects, including an increased risk of lower respiratory tract infections, acute otitis media, sudden infant death syndrome, and asthma (5). In addition to these well-known health risks, SHS is recognized as one of the main contributing factors to recurrent otitis media (6). Beyond postnatal exposure, tobacco exposure may already exert harmful effects during pregnancy, as numerous studies have established a link between maternal smoking and an increased risk of childhood obesity (7). In addition to physical harm, SHS also influences children's future smoking habits and addictive behaviours. Seeing others smoke encourages smoking. Children and adolescents often imitate adult behaviour, including tobacco use. Those exposed to smoking adults in their surroundings are therefore at greater risk of experimenting tobacco and becoming regular smokers (8). To reduce SHS exposure, Belgium enacted in 2009 a smoking ban in public places and, in 2020, a

TABLE 1: Participants inclusion and exclusion.

Participant's questionnaires after providing consent	Total N = 151	n (%)
Questionnaire not completed		8 (5%)
Questionnaire partially completed		31 (21%)
Questionnaire fully completed		112 (74%)
Type of consultation among fully completed questionnaires	Total N =112	n (%)
GPC		71 (63,4%)
PPAC		41 (36,6%)

ban on smoking in vehicles carrying minors under the age of 18 (9). However, these regulations do not extend to private settings, such as homes, where children spend a significant portion of their time - often near smoking parents or caregivers (10). To address SHS in private spaces, voluntary home smoking bans (HSB) can be implemented. A home with an HSB is defined as: "A home where the use of any tobacco product, as well as electronic cigarettes, is not permitted anywhere (including balconies and terraces)" (11). Parents' risk perception, regarding a specific threat to their children's health, influences their behaviours and their willingness to take measures to modify these behaviours - generally in a direction aimed at reducing health risks (12). Consequently, risk perception plays a key role in interventions designed to reduce SHS exposure. The objectives of this survey are fourfold: to assess parents' risk perception of SHS attending the paediatric consultation at Erasme Hospital; to identify risk factors associated with lower SHS risk perception; to compare parents attending general paediatric consultations (GPC) with those attending paediatric pulmonology-allergology consultations (PPAC); and to identify associations between risk perception and the implementation of measures reducing SHS exposure. A secondary objective of this survey is to improve interventions aimed at reducing SHS exposure, while raising parents' awareness and informing them about SHS and its harmful effects.

Materials and Methods

Study design

This is an epidemiological, observational, cross-sectional, single-centre study conducted using an anonymous online questionnaire. It was carried out from January 8, 2024, to March 12, 2024, at the Anderlecht site of the Brussels University Hospital (H.U.B) – Erasme Hospital. Eligible participants were recruited through posters displayed in waiting rooms as well as in nurses' and physicians' offices. In addition, physicians, postgraduate trainees, nurses, and medical students orally invited eligible participants to complete the questionnaire during paediatric consultations or through the distribution of flyers. This study was approved by the Ethics Committee of Erasme Hospital: P2023-351.

Study population

Parents or legal guardians of children attending the GPC or PPAC at H.U.B Erasme were eligible. Participants had to be more than 18 years old. A minimum of 40 participants, with at least 20 from each consultation type, was required by the Ethics Committee of Erasme Hospital.

Data collection instrument

Data were collected through an anonymous online questionnaire (Appendix 1) hosted on the secure REDCap platform, approved by the Ethics Committee (13). Access was provided via QR code displayed on posters and flyers. An information letter outlining participants' rights and study objectives was presented on the questionnaire homepage, and completion implied informed consent. The questionnaire comprised 62 questions, divided into six categories: Parental and family characteristics, Tobacco use, Children's exposure to SHS, Characteristics of the child attending the consultation, Knowledge of SHS, Risk perception of SHS. The first question identified whether the participant was attending the GPC or the PPAC, in order to allow comparison between the two parent populations. Parental and family characteristics, as well as tobacco use, were recognized predictors of children's exposure to SHS and were therefore examined (10). The section on children's exposure to SHS included questions assessing whether the child was exposed, as well as whether parents had implemented a HSB or a vehicle smoking ban as preventive measures to protect their children from SHS. A section of the questionnaire assessed parents' knowledge of SHS in order to identify gaps and areas requiring further awareness. The section on parents' risk perception of SHS is an adapted version of the questionnaire by Myers et al., which measured both the perception of SHS exposure and parents' risk perception of SHS (14). Section C of the questionnaire, which focused on risk perception, was used and translated into French. The questionnaire contained various situations of children's SHS exposure through photographs or descriptive situations (e.g., smoking indoors or outdoors, using barriers such as doors or windows, smoking in a car with the window open, and varying distances between the smoker and the child), thereby capturing both sensory perception (smelling and seeing) and the physical context (distance, location, time, movement) of exposure. For each situation, participants were asked to rate the health risk to the child using a 7-point Likert scale, ranging from 1 (no risk) to 7 (high risk). A 7-point scale has been recommended for questions assessing risk perception (15). Two additional questions were included to determine whether participants wished to receive further information on SHS and smoking cessation. The questionnaire was designed, approved and used in the study in French. It was later translated in English for the publication.

Statistical analyses

Statistical analyses were performed using Jamovi 2.3.28, Redcap, and RStudio 4.2.2. Participant characteristics were summarized using descriptive statistics. For the final section on parents' risk perception of SHS, each question was scored on a scale from 1 to 7. Each question was considered to represent an equal health risk from SHS exposure (7/7), based on the statement: "There is no safe level of SHS exposure; even brief exposure can be harmful to health" (16). The Risk perception score (RPS) was calculated as the sum of the 17 items, with a maximum possible score of 119. To identify factors associated with a significantly different RPS (p-value < 0.05), univariate linear regression was performed. Multivariate linear regression was then conducted to evaluate the overall relationship between significant variables (alpha threshold < 0.025) and the RPS. Group comparisons (GPC vs. PPAC) were conducted using Pearson's χ^2 , Wilcoxon rank-sum, and Fisher's exact tests. The Durbin-Watson (DW) test was performed, assuming no autocorrelation. No evidence of multicollinearity was observed, and residuals were normally distributed.

TABLE 2: Descriptive statistics and consultations comparison. (Continued in next table)

	N	Total n (%)	GPC, N = 71 ¹	PPAC N = 41 ¹	p-value ²
Parental and Family Characteristics					
Gender	112				0.3
Female		80 (71,4%)	53 (75%)	27 (66%)	
Male		32 (28,6%)	18 (25%)	14 (34%)	
Other		0 (0%)	0 (0%)	0 (0%)	
Age	112				0.2
18–24		2 (1,8%)	2 (2.8%)	0 (0%)	
25–35		44 (39,3%)	25 (35%)	19 (46%)	
36–49		53 (47,3%)	33 (46%)	20 (49%)	
50–65		13 (11,6%)	11 (15%)	2 (4.9%)	
66+		0 (0%)	0 (0%)	0 (0%)	
Ethnicity	112				0.4
White/Caucasian		75 (67,0%)	49 (69%)	26 (63%)	
Black/African		17 (15,2%)	12 (17%)	5 (12%)	
Hispanic		7 (6,3%)	4 (5.6%)	3 (7.3%)	
Asian		1 (0,9%)	1 (1.4%)	0 (0%)	
Other		12 (10,7%)	5 (7.0%)	7 (17%)	
Education level	112				>0.9
No diploma		5 (4,5%)	4 (5.6%)	1 (2.4%)	
Primary school certificate		5 (4,5%)	0 (0%)	0 (0%)	
Secondary school certificate		20 (17,9%)	12 (17%)	8 (20%)	
Technical or vocational certificate		15 (13,4%)	10 (14%)	5 (12%)	
Higher education/university degree, PhD		67 (59,8%)	41 (58%)	26 (63%)	
Employment	112				0.7
Unemployed		25 (22,3%)	17 (24%)	8 (20%)	
Part-time employment		14 (12,5%)	7 (9.9%)	7 (17%)	
Full-time employment		66 (58,9%)	42 (59%)	24 (59%)	
Student		7 (6,3%)	5 (7.0%)	2 (4.9%)	
Marital status	112				0.14
Married		55 (49,1%)	29 (41%)	26 (63%)	
Divorced		9 (8,0%)	6 (8.5%)	3 (7.3%)	
Single		20 (17,9%)	15 (21%)	5 (12%)	
Widowed		0 (0,0%)	0 (0%)	0 (0%)	
Cohabiting		28 (25,0%)	21 (30%)	7 (17%)	
Number of children		2,2 (1, 6)3			
Parental composition	112				0.017
Single-parent		28 (25,0%)	24 (34%)	4 (9.8%)	
Two-parent		67 (59,8%)	38 (54%)	29 (71%)	
Blended family		17 (15,2%)	9 (13%)	8 (20%)	

TABLE 2: Descriptive statistics and consultations comparison. (Continued in next table)

	N	Total n (%)	GPC, N = 71 ¹	PPAC N = 41 ¹	p-value ²
Tobacco use					
Smoking status	112				0.8
Current smoker		13 (11,6%)	9 (13%)	4 (9,8%)	
Non smoker		78 (69,6%)	50 (70%)	28 (68%)	
Former smoker		21 (18,8%)	12 (17%)	9 (22%)	
Other smokers in the household	112		12 (17%)	9 (22%)	
Yes		17 (15,2%)	8 (11%)	9 (22%)	
No		95 (84,8%)	63 (89%)	32 (78%)	
Other smokers in regular contact with your child	112				0.3
Yes		34 (30,4%)	19 (27%)	15 (37%)	
No		78 (69,6%)	52 (73%)	26 (63%)	

Results

A total of 151 responses were collected in the study, of which 8 were excluded because participants provided only consent without completing the questionnaire, and 31 were excluded due to incomplete responses. Consequently, the final sample comprised 112 participants, including 71 in general paediatrics (63.4%) and 41 in paediatric pulmonology–allergology (36.6%) (Table 1).

Parental and Family Characteristics (Table 2)

The majority of participants were women (71.4%), aged 36–49 years (47.3%), of Caucasian ethnicity (67%), holding a higher education degree, university diploma, or doctorate (59.8%), and employed full-time (58.9%). Families were primarily two-parent households (59.8%) with married parents (49.1%) and had an average of 2 children, with the maximum reported number being 6.

Tobacco use (Table 2)

Only 13 participants were current smokers (11.6%), while the majority were non-smokers (69.6%) or former smokers (18.8%). A small proportion of participants reported another smoker in the household (15.2%), yet one-third of children (30.4%) had regular contact with a smoker outside the home. No statistically significant association was found between consultation type and smoking status ($p = 0.8$).

Children’s Exposure to SHS

Among smoking parents, only one reported smoking in the presence of children, with most smoking outdoors (84.6%), often on the balcony (69.2%). Half smoked inside a ventilated room (53.8%), and nearly half smoked in their vehicle (46.2%), though never with children present (Table 2). Most participants had implemented a HSB (87.5%). A higher proportion of smokers reported not having an HSB (23%) compared with non-smokers (14%) and former smokers (0%), although this difference was not statistically significant ($p = 0.06$). When established, the HSB was strictly enforced in 92% of households. Similarly, most participants who owned a vehicle had implemented a vehicle smoking ban (88%). Smokers were more likely not to establish this ban

(27.3%) compared with non-smokers (11.8%) and former smokers (4.8%) ($p = 0.2$). No significant differences in the implementation of HSB or vehicle smoking ban were observed between consultation types or smoking status (Tables 2 and 3).

Characteristics of the child attending the consultation (Table 2)

Consultations concerned infants (25.9%), preschool-aged children (22.3%), and school-aged children (32.1%). Almost all participants in the GPC sought care for conditions other than lower respiratory tract infections, acute otitis media, or asthma (94%), in contrast to the Paediatric PPAC group (49%). A significant association was observed between consultation type and both the child’s diagnosis ($p < 0.001$) and the identification of a link between the illness and tobacco smoke exposure by a paediatrician ($p = 0.006$). In five PPAC cases, paediatricians established such a link; none were reported in GPC. Notably, these five children were regularly exposed to a smoker despite their parents being non-smokers.

Knowledge of SHS (Table 2)

The majority of participants were familiar with SHS (83%), with comparable proportions in both PPAC and GPC groups. Prenatal smoking was most often associated with recurrent respiratory infections (83%) and preterm birth (83%), but rarely with childhood obesity (5.4%). Postnatal SHS exposure was strongly linked to asthma (88.4%) and respiratory infections (87.5%), while fewer participants associated it with infant regurgitation (16.1%), infant colic’s (21.4%), Attention-Deficit/Hyperactivity Disorder (22.3%), or otitis media (25%). A majority considered their knowledge insufficient (63.4%). Significant differences were found between groups, with PPAC participants more frequently associating SHS with sudden infant death syndrome (prenatal $p = 0.049$; postnatal $p = 0.004$) and Attention-Deficit/Hyperactivity Disorder ($p = 0.022$).

Risk perception of SHS

The mean RPS was 86.18 (SD: 19.67) (Table 4), indicating a generally high perceived health risk (5/7). The highest RPS were assigned to a situation involving an adult smoking in the presence of a child in the kitchen (6.55/7; SD 0.97) (Table 5), followed by

TABLE 2: Descriptive statistics and consultations comparison. (Continued in next table)

	N	Total n (%)	GPC, N = 71 ¹	PPAC N = 41 ¹	p-value ²
Children's exposure to SHS					
Smoking in the presence of children	13				>0.9
Yes		1 (7,7%)	1 (11%)	0 (0%)	
No		12 (92,3%)	8 (89%)	4 (100%)	
Where do you smoke	13				>0.9
Inside the home		0 (0%)	0 (0%)	0 (0%)	
Outside the home		11 (84,6%)	8 (89%)	3 (75%)	
Both inside and outside the home		2 (15,4%)	1 (11%)	1 (25%)	
Set a HSB	112				>0.9
Yes		98, (87,5%)	62 (87%)	36 (88%)	
No		14 (12,5%)	9 (13%)	5 (12%)	
Home ban enforced by all household members	112				0.5
Yes		103 (92,0%)	64 (90.1%)	39 (95.1%)	
No		9 (8,0%)	7 (9.9%)	2 (4.9 %)	
In which situations do you smoke	13				
Under the kitchen hood		0 (0,0%)	0 (0%)	0 (0%)	
With the window open		1 (7,7%)	1 (1.4%)	0 (0%)	>0.9
With the window closed		0 (0,0%)	0 (0%)	0 (0%)	
On the balcony		9 (69,2%)	6 (8.5%)	3 (7.3%)	>0.9
Other		4 (30,8%)	3 (4.2%)	1 (2.4%)	>0.9
Does the room where you smoke have ventilation	112				0.5
Yes		7 (6,3%),	3 (4.2%)	4 (9.8%)	
No		6 (5,4%),	4 (5.6%)	2 (4.9%)	
Does not apply to my situation		99 (88,4%)	64 (90%)	35 (85%)	
Do you smoke in the vehicle	13				>0.9
Yes		6 (46,2%)	4 (44%)	2 (50%)	
No		5 (38,5%)	4 (44%)	1 (25%)	
I do not have a vehicle		2 (15,4%)	1 (11%)	1 (25%)	
Do you smoke in the vehicle with children	13				
No		13 (100%)	9 (100%)	4 (100%)	
Set a vehicle smoking ban	112				>0.9
Yes		88 (88%)	55 (77%)	33 (80%)	
No		12 (12%)	8 (11%)	4 (9.8%)	
I do not have a vehicle		12	8 (11%)	4 (9.8%)	
Vehicle ban enforced by all household members	112				0.7
Yes		75 (67,0%)	49 (69%)	26 (63%)	
No		4 (3,6%)	3 (4.2%)	1 (2.4%)	
Does not apply to my situation		33 (29,5%)	19 (27%)	14 (34%)	

an adult smoking inside a car with the window open while a child sat in the back seat (6.13/7; SD 1.21) (Table 5), and the scenario described as: "The child is in a car where someone smoked 20 minutes ago" (6.06/7; SD 1.39) (Table 5). The situation perceived as the lowest risk to the child's health was: "The child is in the

playground and sees their mother smoking but does not smell the smoke" (3.35/7; SD 2.13), followed by the scenario where a child plays in a yard while an adult smokes farther away on a bench (3.44/7; SD 1.9) (Table 5). Forty percent of participants wished to receive further information on SHS and 13% on smoking

TABLE 2: Descriptive statistics and consultations comparison. (Continued in next table)

	N	Total n (%)	GPC, N = 71 ¹	PPAC N = 41 ¹	p-value ²
Characteristics of the child attending the consultation					
Child's age	112				0.10
Newborn (0–1 month)		5 (4,5%)	5 (7.0%)	0 (0%)	
Infant (1 month–2 years)		29 (25,9%)	17 (24%)	12 (29%)	
Young child (2–3 years)		6 (5,4%)	5 (7.0%)	1 (2.4%)	
Preschool-age child (3–5 years)		25 (22,3%)	11 (15%)	14 (34%)	
School-age child (6–12 years)		36 (32,1%)	26 (37%)	10 (24%)	
Adolescent (13–18 years)		11 (9,8%)	7 (9.9%)	4 (9.8%)	
Child's pathology	112				<0.001
Lower respiratory tract infections (pneumonia, acute bronchitis, bronchiolitis, ...)		9 (8,0%)	2 (2.8%)	7 (17%)	
Asthma		13 (11,6%)	0 (0%)	13 (32%)	
Acute otitis media		3 (2,7%)	2 (2.8%)	1 (2.4%)	
Other		87 (77,7%)	67 (94%)	20 (49%)	
Link made by a paediatrician between the child's illness and tobacco exposure	112				0.006
Yes		5 (4,5%)	0 (0%)	5 (12%)	
No		107(95,5%)	71 (100%)	36 (88%)	

cessation. Interest in smoking cessation information was significantly higher among PPAC participants compared with GPC ($p = 0.009$), regardless of their smoking status (Table 4).

Factors Associated with risk perception of SHS (Tables 6 and 7)

Significant lower RPS were observed among participants aged 50–65 ($\beta = -14.82$, $p = 0.01$), of Caucasian ethnicity ($\beta = -7.89$, $p = 0.045$), smokers ($\beta = -11.78$, $p = 0.042$), and those who smoked both indoors and outdoors ($\beta = -39.32$, $p = 0.022$). Higher RPS were associated with participants of “other” ethnicities ($\beta = 12.77$, $p = 0.033$), married participants ($\beta = 7.44$, $p = 0.045$), non-smokers ($\beta = 8.15$, $p = 0.043$), and those with a child suffering from lower respiratory tract infections ($\beta = 15.39$, $p = 0.024$). Multivariate analysis identified age 50–65 ($\beta = -13.58$, $p = 0.017$) and having a child with lower respiratory tract infections ($\beta = 13.68$, $p = 0.041$) as the strongest predictors of RPS. No significant associations were found between RPS and consultation type ($p = 0.9$), HSB ($p = 0.559$) or vehicle smoking ban ($p = 0.119$).

Discussion

Despite the relatively low proportion of participants who were active smokers, one third of the children was regularly in contact with smokers and therefore at risk of exposure to SHS. Having smoking parents or household members is among the primary risk factors for children's SHS exposure (17). Consequently, it is important during consultations to raise awareness among the child's accompanying parent or guardian about SHS and its harmful effects, even if they themselves are not smokers. Smokers - particularly those who reported smoking inside the home - demonstrated lower RPS, a finding consistent with previous studies (14,18–20). This may explain why children with smoking parents are at greater risk of SHS exposure at home

(10). Furthermore, lower RPS were observed among participants aged 50 to 65 years, which may be attributable to limited public education on this issue in the past (21). Similarly, Caucasian participants exhibited lower RPS compared with participants from other ethnic groups. Previous research has shown that members of these other groups are less frequently exposed to SHS than Caucasians, a difference that could be linked to the stronger social unacceptability of smoking - particularly among women - in certain cultures (22, 23). It is therefore essential to raise awareness among groups with lower risk perception of SHS to prevent children's exposure. Moreover, an increase in SHS risk perception has been associated with the implementation of complete HSB (24). Prevention strategies should also be extended to the child's household members, including grandparents. In our study, situations perceived with the lowest risk involved those in which the child was outdoors, in an open space, in the presence of a smoking adult at a considerable distance, regardless of whether or not the smoke was smelled. These findings align with Junus et al. (19). Another study report that some parents do not perceive a risk of SHS exposure when there is no smell, no visible smoke, or no visible smoker, or if the situation occurs outdoors or in a ventilated room (2). It is therefore crucial to include, in SHS prevention strategies, actions aimed at eliminating these misconceptions and raising parental awareness that exposure to tobacco smoke can occur even without visible or perceptible signs. As reported in previous studies, non-smokers and former smokers were more likely than current smokers to implement home and car smoking bans, although the difference was not statistically significant (25, 26). Non-smokers also demonstrated a significantly higher risk perception compared to smokers, which may partly explain this trend. In contrast to some reports, but consistent with Junus et al., no significant association was observed between voluntary HSB and risk perception of SHS exposure (19, 26, 27). The prevalence of home (87.5%) and car bans (88%) in our study was

TABLE 2: Descriptive statistics and consultations comparison. (End of table 2)

	N	Total n (%)	GPC, N = 71 ¹	PPAC N = 41 ¹	p-value ²
Knowledge of SHS					
Familiar with SHS	112				>0.9
Yes		93 (83%)	59 (83%)	34 (83%)	
No		19 (17,0%)	12 (17%)	7 (17%)	
Do you consider your knowledge sufficient	112				0.9
Yes		42 (37,5%)	44 (62%)	26 (63%)	
No		71 (63,4%)	27 (38%)	15 (37%)	
Tobacco exposure in utero increases the risk of	112				
Prematurity		93 (83,0%)	56 (79%)	37 (90%)	0.12
Low birth weight		79 (70,5%)	49 (69%)	30 (73%)	0.6
Small for gestational age		47 (42,0%)	27 (38%)	20 (49%)	0.3
Perinatal mortality		41 (36,6%)	24 (34%)	17 (41%)	0.4
Sudden infant death syndrome (SIDS)		44 (39,3%)	23 (32%)	21 (51%)	0.049
Obesity		6 (5,4%)	3 (4.2%)	3 (7.3%)	0.7
Recurrent respiratory infections (otitis, bronchiolitis, bronchitis)		93 (83,0%)	60 (85%)	33 (80%)	0.6
Effects of SHS on infants	112				
Sudden infant death syndrome (SIDS)		59 (52,7%)	30 (42%)	29 (71%)	0.004
Poor growth		60 (53,6%)	35 (49%)	25 (61%)	0.2
Infant colic		24 (21,4%)	15 (21%)	9 (22%)	>0.9
Physiological regurgitation		18 (16,1%)	11 (15%)	7 (17%)	0.8
Bronchiolitis		80 (71,4%)	51 (72%)	29 (71%)	>0.9
Respiratory infections		98 (87,5%)	61 (86%)	37 (90%)	0.5
Nicotine withdrawal syndrome		64 (57,1%)	38 (54%)	26 (63%)	0.3
Effects of SHS on children	112				
Asthma		99 (88,4%)	60 (85%)	39 (95%)	0.13
Acute otitis media		28 (25,0%)	17 (24%)	11 (27%)	0.7
Bronchiolitis		73 (65,2%)	46 (65%)	27 (66%)	>0.9
Bronchitis		86 (76,8%)	51 (72%)	35 (85%)	0.10
Pneumonia		74 (66,1%)	49 (69%)	25 (61%)	0.4
Cough		87 (77,7%)	56 (79%)	31 (76%)	0.7
Reduced lung function		77 (68,8%)	45 (63%)	32 (78%)	0.11
Attention-deficit/hyperactivity disorders (ADHD)		25 (22,3%)	11 (15%)	14 (34%)	0.022
Future tobacco addiction		54 (48,2%)	32 (45%)	22 (54%)	0.4

¹ n (%)

² Fisher's exact test; Pearson's Chi-squared test

³ Médian, (minimum, maximum)

notably high, diverging from actual smoking practices such as smoking in vehicles (46.2%) or on balconies (69.2%). This discrepancy may reflect overreporting or misinterpretation of the definition of smoking bans by smokers. Overestimation and overreporting of health-protective behaviours has been documented in the literature. For instance, one study showed an overreporting of smoking bans among caregivers of children with asthma (28). Our results are also in line with a qualitative study suggesting that parents often do not consider a closed balcony to be an indoor

space or part of the household environment (2). Awareness campaigns should highlight the health risks of SHS in private settings and clearly define which spaces are considered part of the household. The use of visual materials to illustrate SHS exposure, such as those used in our study questionnaire, may help parents better identify risk situations. Strengthening smokers' engagement to reduce SHS exposure is also crucial. Parents should be informed that such measures not only protect their children's health but also help preventing the normalization of smoking

TABLE 3: Comparison between smoking status and implementation of a smoking ban.

Smoking status					
		Current smoker	Non-smoker	Former smoker	p-value ¹
HSB					
Yes	N (%)	10 (76.9%)	67 (85.9%)	21 (100%)	0,06
No	N (%)	3 (23.1 %)	11 (14.1 %)	0 (0%)	
Vehicle smoking ban					
Yes	N (%)	8 (72.7 %)	60 (88.2 %)	20 (95.2 %)	0.2
No	N (%)	3 (27.3 %)	8 (11.8 %)	1 (4.8 %)	

¹ Pearson's Chi-squared test; Fisher's exact test.

and, ultimately, to reducing the likelihood of their children taking up smoking themselves. Smokers have an active role to play in awareness campaigns. In the project “tobacco-free generation”, smokers were more willing to engage when the underlying motivation of the campaign was explained to them (29). Although participants generally perceived SHS as posing a high risk to children’s health, the majority reported feeling insufficiently informed about the subject. Obesity was the condition least frequently associated with prenatal tobacco exposure, despite being a major public health concern. Physiological regurgitation, infant colic, attention-deficit/hyperactivity disorder, and otitis media were also among the conditions least associated with SHS exposure in infants and children. One study reported that between 1999 and 2006, risk perception of SHS in relation to otitis media even declined, unlike to other health outcomes (18). In contrast, respiratory conditions, including asthma and respiratory infections, were most commonly identified. These findings suggest that while awareness of respiratory risks is relatively high, knowledge gaps persist regarding non-respiratory consequences. This study therefore highlights the need for targeted parental and professional education, particularly regarding non-respiratory conditions and otitis media. We observed that the number of respondents from GPC was approximately twice that of PPAC. This difference may be explained by the substantially higher volume of GPC compared with PPAC at Erasme Hospital. Consequently, the greater exposure and patient flow in general paediatrics likely contributed to the higher response rate observed in this group. A

significant association was observed between consultation type and whether paediatricians associated children’s conditions with SHS. Paediatricians in PPAC occasionally made this connection, whereas none in the GPC did. Beyond parental education, these findings highlight the need to further raise paediatricians’ awareness of the importance of considering SHS when evaluating children’s conditions, even when the consultation is not for respiratory or allergic issues. Another difference between PPAC and GPC concerned the desire to receive additional information about smoking cessation. Parents attending PPAC were more likely to express interest in receiving information on smoking cessation after completing the questionnaire, reflecting a higher level of concern. Moreover, nearly half of all participants wished to receive further information about SHS. At the end of the questionnaire, participants were offered downloadable brochures on SHS and its impact on children, as well as two brochures on smoking cessation. These findings suggest that making SHS brochures available in the paediatric department at Erasme and providing smoking cessation materials in the PPAC could be beneficial.

Strengths and limitations

The primary strength of this study is the comparison between GPC and PPAC. In addition, the study provides data and proposes avenues for enhancing future interventions aimed at reducing SHS exposure. It also contributes to increasing parental awareness and knowledge about SHS and smoking cessation

TABLE 4: Descriptive and comparative analyses of consultations on RPS and additional information.

	Mean (SD) N = 112	GPC, N =71	PPAC, N =41	p-value ²
RPS				
Yes	86,18 (19.67)	89 (72, 102) ¹	85 (75, 98) ¹	0.9
More information on SHS				
Yes	45 (40%) ³	25 (35%) ³	20 (49%) ³	0.2
No	67 (60%) ³	46 (65%) ³	21 (51%) ³	
More information on tobacco cessation				
Yes	15 (13%) ³	5 (7%) ³	10 (24%) ³	0.009
No	97 (86%) ³	66 (93%) ³	31 (76%) ³	

¹ Median (IQR)

² Wilcoxon rank sum test, Pearson's Chi-squared test; Fisher's exact test

³ n (%)

TABLE 5: Analysis of the risk perception of SHS.

Risk perception of SHS	1 low risk ¹	21	31	41	51	61	7 high risk ¹	Mean score ²
Picture 1 (See questionnaire)	6 (5,4%)	6 (5,4%)	22 (19,6%)	22 (19,6%)	25 (22,3%)	11 (9,8%)	20 (17,9%)	4.49 (1.70)
Picture 2 (See questionnaire)	5 (4,5%)	7 (6,3%)	21 (18,8%)	26 (23,2%)	26 (23,2%)	9 (8,0%)	18 (16,1%)	4.43 (1.64)
Picture 3 (See questionnaire)	0 (0,0%)	1 (0,9%)	2 (1,8%)	1 (0,9%)	13 (11,6%)	8 (7,1%)	87 (77,7%)	6.55 (0.97)
Picture 4 (See questionnaire)	24 (21,4%)	17 (15,2%)	18 (16,1%)	19 (17,0%)	17 (15,2%)	7 (6,3%)	10 (8,9%)	3.44 (1.9)
Picture 5 (See questionnaire)	0 (0,0%)	2 (1,8%)	5 (4,5%)	3 (2,7%)	16 (14,3%)	26 (23,2%)	60 (53,6%)	6.13 (1.21)
Picture 6 (See questionnaire)	0 (0,0%)	1 (0,9%)	9 (8,0%)	3 (2,7%)	23 (20,5%)	20 (17,9%)	56 (50,0%)	5.96 (1.3)
Picture 7 (See questionnaire)	7 (6,3%)	5 (4,5%)	13 (11,6%)	16 (14,3%)	30 (26,8%)	15 (13,4%)	26 (23,2%)	4.84 (1.57)
Picture 8 (See questionnaire)	2 (1,8%)	5 (4,5%)	3 (2,7%)	16 (14,3%)	22 (19,6%)	23 (20,5%)	41 (36,6%)	5.54 (1.53)
The child is in the kitchen, someone is smoking on the adjacent service balcony	8, 7,1%)	11 (9,8%)	16 (14,3%)	21 (18,8%)	21 (18,8%)	14 (12,5%),	21 (18,8%)	4.45 (1.84)
The child is in a room where someone smoked 12 hours ago	7 (6,3%)	20 (17,9%)	16 (14,3%)	24 (21,4%)	20 (17,9%)	10 (8,9%)	15 (13,4%)	4.07 (1.78)
The child is in a room where someone smoked 2 hours ago	3 (2,7%)	5 (4,5%)	9 (8,0%)	20 (17,9%)	21 (18,8%)	24 (21,4%)	30 (26,8%)	5.17 (1.62)
The child is in a car where someone smoked 1 hour ago	4 (3,6%)	4 (3,6%)	6 (5,4%)	16 (14,3%)	21 (18,8%)	17 (15,2%)	44 (39,3%)	5.44 (1.68)
The child is in a room where someone smoked 30 minutes ago	3 (2,7%)	4 (3,6%)	3 (2,7%)	9 (8,0%)	21 (18,8%)	21 (18,8%)	53 (47,3%)	5.82 (1.51)
The child is in a car where someone smoked 20 minutes ago	3 (2,7%)	2 (1,8%)	2 (1,8%)	5 (4,5%)	12 (10,7%)	30 (26,8%)	58 (51,8%)	6.06 (1.39)
The child is in the playground and sees his mother smoking but does not smell smoke	32 (28,6%)	14 (12,5%)	19 (17,0%)	17 (15,2%)	8 (7,1%)	4 (3,6%)	18 (16,1%)	3.35 (2.13)
The child is in the playground and smells cigarette smoke but does not see the smoker	2 (1,8%)	4 (3,6%)	17 (15,2%)	21 (18,8%)	20 (17,9%)	21 (18,8%)	27 (24,1%)	5.00 (1.61)
The child is in the playground and sees his mother smoking and can smell the smoke	1 (0,9%)	2 (1,8%)	10 (8,9%)	19 (17,0%)	21 (18,8%)	20 (17,9%)	39 (34,8%)	5.44 (1.49)

¹ n (%)² Mean score (SD)

by allowing participants to download supplementary educational materials. For future research, it is recommended to provide participants with the correct answers at the end of the questionnaire, allowing them to identify misconceptions and improve their understanding. The limitations of this study include its cross-sectional design, which permits the identification of associations but does not allow for causal inferences. A larger sample size would also be necessary to adequately incorporate variables with few observations into the statistical model. The used questionnaire was specifically developed for this study and was not previously validated, which may have introduced measurement bias. Although it was approved by the institutional ethics committee, its reliability and validity were not formally established. In addition, some questions may have been suggestive, potentially influencing participants' responses and leading to response bias. A selection bias toward individuals with a higher educational level and likely higher socioeconomic status must be clearly acknowledged. Most participants held a higher education, university, or doctoral degree (59.8%), substantially exceeding the prevalence in the Belgian population aged 20 and older (32%) (30). Previous studies indicate that smoking prevalence is inversely correlated with educational level (31). This

overrepresentation of highly educated individuals likely contributed to the lower proportion of current smokers (11.6%) or former smokers (18.8%) observed in our sample, compared with the prevalence in Belgium in 2018 (15.4% daily smokers, 4.0% occasional smokers, and 23.1% former smokers). The lower prevalence of smokers in our sample may also be partly explained by the fact that 70.4% of participants were women, among whom smoking rates are generally lower (32). These findings highlight that our sample is not fully representative of the Belgian population. Furthermore, the questionnaire was provided exclusively in French. This represents an additional limitation, as it may have introduced a selection bias by restricting participation to French-speaking individuals. Future research should make the questionnaire available in multiple languages, particularly English and Dutch, to improve inclusivity and reduce language-related selection bias. Moreover, for future research, it is recommended to clearly specify the definition of a complete home or vehicle smoking ban, as well as to define which areas are considered inside the home (such as balconies), in order to avoid overestimation of HSB or VSR. Finally, it is recommended that future studies include age as a continuous variable rather than categorizing it, in order to avoid categorization bias.

TABLE 6: Results of the multivariate analysis.

Risk perception of SHS	N	R ²	IC ³	p-valeur ¹
Age 50-65		-13.58	-24.69 – -2.47	0.017
Child's pathology: lower respiratory tract infections		13.68	0.59 – 26.77	0.041

¹ Simple multivariable linear regression

² regression coefficient

³ 95% confidence interval

Conclusions

This study highlights that one-third of children are regularly in contact with smokers and are therefore at risk of SHS exposure. Raising awareness among parents and the child's social environment about the risks of SHS is therefore essential. Smokers, particularly those who smoke indoors, participants over 50 years of age, and those of Caucasian ethnicity, showed lower risk perception regarding SHS. Consequently, these groups should be specifically targeted when designing educational programs aimed at raising awareness of the health risks of SHS in children. These interventions should emphasize the importance of smoking restrictions in private spaces, especially among smokers. It is also crucial to define high-risk SHS exposure scenarios for children and to educate parents that exposure can occur even in the absence of visible or perceptible signs. Furthermore, PPAC paediatricians occasionally recognized a link between SHS exposure and the child's illness, unlike GPC paediatricians. This underlines the need to sensitize all paediatricians to consider SHS and the child's environment when evaluating paediatric illnesses. Finally, the majority of participants reported insufficient knowledge about SHS and expressed a desire to receive more information on this topic, as well as on smoking cessation. These findings underscore the importance of implementing educational programs for parents to raise awareness about the harmful effects of SHS on children's health.

Statements

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TABLE 7: Factors associated with parents' risk perception of SHS.

	N	R ²	IC	p-valeur ¹
Parental and Family Characteristics				
Age	112			
18–24		21.200	13.952 – 1.519	0.132
25–35		1.652	3.820 0.433	0.666
36–49		3.028	3.728 0.812	0.418
50–65		-14.82	-26.03 – -3.62	0.010
66+		-	-	-
Ethnicity	112			
White/Caucasian		-7.89	-15.61 – -0.16	0.045
Black/African		2.70	-7.60 – 13.00	0.604
Hispanic		-0.04	-15.32 – 15.25	0.996
Asian		-	-	-
Other		12.77	1.06 – 24.49	0.033
Marital status	112			
Married		7.44	0.17 – 14.70	0.045
Divorced		-7.93	-21.45 – 5.60	0.248
Single		-0.40	-10.06 – 9.26	0.935
Widowed		-6.48	-14.93 – 1.98	0.132
Cohabiting		0.95	-1.90 – 3.81	0.509
Tobacco use				
Smoking status	112			
Current smoker		-11.78	-23.11 – -0.44	0.042
Non-smoker		8.15	0.26 – 16.05	0.043
Former smoker		-3.38	-12.84 – 6.07	0.480
Other smokers at home	112			
Yes		-	-	-
No		10.61	0.50 – 20.73	0.040
Characteristics of the child attending the consultation				
Child's pathology	112			
Lower respiratory tract infections (pneumonia, acute bronchitis, bronchiolitis, ...)		15.39	2.10 – 28.69	0.024
Asthma		-2.20	-13.75 – 9.34	0.706
Acute otitis media		10.78	-12.05 – 33.60	0.351
Other		-6.88	-15.67 – 1.91	0.124
Children's exposure to SHS				
Where do you smoke	13			
Outside the home		-	-	-
Both inside and outside the home		-39.32	-71.74 – -6.90	0.022
Set a HSB	112			
Yes		-	-	-
No		-3.31	-14.48 – 7.86	0.559
Set a vehicle smoking ban	112			
Yes		-	-	-
No		-9.48	-21.45 – 2.48	0.119

¹ Simple multivariable linear regression; ² regression coefficient; ³ 95% confidence interval

Parental and family characteristics	
Which consultation did you attend?	- General paediatric consultations (GPC) - Paediatric pulmonology–allergology consultations
What's your gender?	- Female - Male - Other
How old are you?	- 18–24 - 25–35 - 36–49 - 50–65 - 66+
What's your ethnicity?	- White/Caucasian - Black/African - Hispanic - Asian - Other
What's your postal code?	
What's your education level?	- No diploma - Primary school certificate - Secondary school certificate - Technical or vocational certificate - Higher education/university degree, PhD
Do you have an employment?	- Unemployed - Part-time employment - Full-time employment - Student
What's your marital status?	- Married - Divorced - Single - Widowed - Cohabiting
How many children does your household count?	
What's the parental composition of your household?	- Single-parent - Two-parent - Blended family
Tobacco use	
What's your smoking status?	- Current smoker - Non smoker - Former smoker
Are there other people than you smoking in the household?	- Yes - No
Are there smokers, other than you, who are regularly in contact with your child (grandparents, nanny, ...) ?	- Yes - No
What do you smoke?	- Cigarette - Electronic cigarette - Hookah/ shisha - Cannabis - Other
How often do you smoke?	- Daily - Several times per week - Once per week

	- Less often
What is the mean number of cigarettes smoked each day?	- Less than 5
	- 6–10
	- 11–20
	- 21–30
	- More than 30
How soon after waking up do you smoke your first cigarette?	- Less than 5 minutes
	- 6–30 minutes
	- 31–60 minutes
	- More than 60 minutes
Have you ever tried to quit smoking?	- Yes, successfully
	- Yes, unsuccessfully
	- Never tried
What is your attitude toward quitting?	- I am not ready to quit
	- I think I should consider quitting one day
	- I think I should quit but I'm not ready yet
	- I'm thinking about quitting
	- I'm taking steps to quit
Are you ready to quit smoking?	- I don't think I will quit in the next 6 months
	- I am planning to quit within 6 months
	- I am planning to quit within 30 days
Children's exposure to Secondhand smoke	
Do you smoke in the presence of children?	- Yes
	- No
Where do you smoke?	- Inside the home
	- Outside the home
	- Both inside and outside the home
Have you introduced a smoking ban inside your home?	- Yes
	- No
Is this ban respected by all smokers in the home?	- Yes
	- No
In which situations do you smoke? (check all that applies)	- Under the kitchen hood
	- With the window open
	- With the window closed
	- On the balcony
	- Other
Does the room where you smoke have ventilation?	- Yes
	- No
	- Does not apply to my situation
Do you smoke in your vehicle?	- Yes
	- No
	- I do not have a vehicle
Do you smoke in your vehicle in the presence of children?	- Yes
	- No
Have you introduced a smoking ban in your vehicle?	- Yes
	- No
	- I do not have a vehicle
Is this ban respected by all smokers using the vehicle?	- Yes
	- No
	- Does not apply to my situation
Have you ever been pregnant?	- Yes
	- No
What was your tobacco use during pregnancy?	- Stopped smoking
	- Reduced smoking
	- No change

	- Not applicable
If you quit during pregnancy, when did you quit?	- Before pregnancy - First trimester - Second trimester - Third trimester - Not applicable
If you smoked during pregnancy, how much did you smoke?	- Less than 5 cigarettes - 6–10 cigarettes - 11–20 cigarettes - 21–30 cigarettes - More than 30 cigarettes - Not applicable
Did you think about quitting during pregnancy?	- Yes, successfully - Yes, unsuccessfully - No - Not applicable
Characteristics of the child attending the consultation	
What is your child's age? (For whom you're consulting)	- Newborn (0–1 month) - Infant (1 month–2 years) - Young child (2–3 years) - Preschool-age child (3–5 years) - School-age child (6–12 years) - Adolescent (13–18 years)
What pathology is your child being seen for?	- Lower respiratory tract infections (pneumonia, acute bronchitis, bronchiolitis, ...) - Asthma - Acute otitis media - Infant (1 month–2 years)
Has a pediatrician linked your child's pathology to tobacco smoke exposure?	- Yes - No
Knowledge of Secondhand smoke	
Do you know what secondhand smoke is?	- Yes - No
Prenatal tobacco exposure increases the risk of: (more answers possible)	- Prematurity - Low birth weight - Small for gestational age - Perinatal mortality - Sudden infant death syndrome (SIDS) - Obesity - Recurrent respiratory infections (otitis, bronchiolitis, bronchitis)
Effects of secondhand smoke on infants: (more answers possible)	- Sudden infant death syndrome (SIDS) - Poor growth - Infant colic - Physiological regurgitation - Bronchiolitis - Respiratory infections - Nicotine withdrawal syndrome
Effects of secondhand smoke on children: (more answers possible)	- Asthma - Acute otitis media - Bronchiolitis - Bronchitis - Pneumonia - Cough - Reduced lung function

	- Attention-deficit/hyperactivity disorders (ADHD)
	- Future tobacco addiction
Do you think your knowledge about secondhand smoke is sufficient?	- Yes
	- No

Risk perception of secondhand smoke

Would you like information about secondhand smoke and children?	- Yes
	- No
Would you like information about quitting smoking?	- Yes
	- No

Risk perception of secondhand smoke

In the following questions you will be asked to rate the health risk to the child in various situations (depicted or described)

Health risk to the child?



	1	2	3	4	5	6	7	
no risk	☐	☐	☐	☐	☐	☐	☐	high risk

Health risk to the child?



	1	2	3	4	5	6	7	
no risk	☐	☐	☐	☐	☐	☐	☐	high risk

Health risk to the child?



	1	2	3	4	5	6	7	
no risk	☐	☐	☐	☐	☐	☐	☐	high risk

Health risk to the child?



	1	2	3	4	5	6	7	
no risk	☐	☐	☐	☐	☐	☐	☐	high risk

Health risk to the child?	1	2	3	4	5	6	7	
	no risk	☐	☐	☐	☐	☐	☐	high risk
Health risk to the child?	1	2	3	4	5	6	7	
	no risk	☐	☐	☐	☐	☐	☐	high risk
Health risk to the child?	1	2	3	4	5	6	7	
	no risk	☐	☐	☐	☐	☐	☐	high risk
Health risk to the child?	1	2	3	4	5	6	7	
	no risk	☐	☐	☐	☐	☐	☐	high risk
The child is in the kitchen, someone is smoking on the adjacent service balcony. Health risk to the child?	1	2	3	4	5	6	7	
	no risk	☐	☐	☐	☐	☐	☐	high risk
The child is in a room where someone smoked 12 hours ago.	1	2	3	4	5	6	7	
Health risk to the child?	no risk	☐	☐	☐	☐	☐	☐	high risk
The child is in a room where someone smoked 2 hours ago.	1	2	3	4	5	6	7	
Health risk to the child?	no risk	☐	☐	☐	☐	☐	☐	high risk
The child is in a car where someone smoked 1 hour ago.	1	2	3	4	5	6	7	
Health risk to the child?	no risk	☐	☐	☐	☐	☐	☐	high risk
The child is in a car where someone smoked 30 minutes ago.	1	2	3	4	5	6	7	
Health risk to the child?	no risk	☐	☐	☐	☐	☐	☐	high risk
The child is in a car where someone smoked 20 minutes ago.	1	2	3	4	5	6	7	
Health risk to the child?	no risk	☐	☐	☐	☐	☐	☐	high risk

The child is in the playground and sees his mother smoking but does not smell smoke. Health risk to the child?	1	2	3	4	5	6	7
no risk	☐	☐	☐	☐	☐	☐	high risk

The child is in the playground and smells cigarette smoke but does not see the smoker. Health risk to the child?	1	2	3	4	5	6	7
no risk	☐	☐	☐	☐	☐	☐	high risk

The child is in the playground and sees his mother smoking and can smell the smoke. Health risk to the child?	1	2	3	4	5	6	7
no risk	☐	☐	☐	☐	☐	☐	high risk

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