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New anti-smoking legislation on second-hand smoke exposure of children in homes

Key Messages

1. The implementation of the smoke-free legislation has shown no evidence of displacement of smoking from restricted smoking venues to home, and there was a decline in the prevalence of fathers smoking at home and around children. Hence, second-hand smoke exposure at home was reduced.
2. Mothers responded positively to the legislation as reflected by a substantial increase in their actions to protect their children from second-hand smoke exposure and a moderate increase in advising the smoking fathers to quit.
3. Only a small proportion of the smoking fathers showed changes in their smoking-related psychological factors suggesting the need for a comprehensive and strategic promotion of smoking cessation services to support smokers in the community.

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Introduction

Exposure to second-hand smoke is harmful to health and causes death, disease, and disability.[1] The Hong Kong SAR government has implemented a comprehensive smoke-free legislation that bans smoking in all indoor places in workplaces, restaurants, karaokes, schools and universities (indoor and outdoor), parks, and beaches on 1 January 2007. Non-smokers are better protected by the smoking restriction in public places, but their second-hand smoke exposure at home depends on the smoker's behaviour inside the household. Although previous studies showed no evidence of displacement of smoking from public areas to the homes after legislation,[2] it is unclear whether this would also be observed in Hong Kong given the uneven distribution of smokers by gender.[3]

We aimed to study whether smoking fathers would smoke inside their homes owing to the restriction in non-smoking areas, and hence lead to an increase in second-hand smoke exposure to their spouse and children.

Methods

This study was conducted from May 2007 to December 2008, using a prospective survey of two cohorts of families recruited before legislation and a cross-sectional survey of families after legislation. Families with a non-smoking mother and a child aged <12 years living in the same household for at least 5 days in the past week, and a smoking father who smoked at least one cigarette daily in the past week but not partaking in a smoking cessation programme were recruited at four Maternal and Child Health Centres and five Student Health Service Centres. We administered two standardised and structured questionnaires developed from previous telephone instruments directed at mothers and fathers in June 2007 to August 2008.

Regarding the pre-legislation groups, the 2005 and 2006 studies were pilots of randomised controlled trials to test a nurse-delivered smoking hygiene intervention to the non-smoking mothers to reduce the second-hand smoke exposure in the household, and a low-intensity smoking cessation intervention to the smoking fathers with feedback on second-hand smoke exposure among non-smoking mothers and children in the home. The 2005 group comprised 186 families (95 interventions, 91 controls) and the 2006 group comprises 114 families (34 interventions, 80 controls).

Regarding the post-legislation groups, 742 non-smoking mothers and 608 smoking fathers completed the survey and formed the 2007a group, whereas 101 mothers and 90 fathers in the 2005 study and 88 non-smoking mothers and 84 smoking fathers in the 2006 study completed the survey and formed the 2007b group (189 mothers, 174 fathers).

The primary outcome was the parent-reported second-hand smoke exposure of the children in the home. Secondary outcomes included mother's actions in (1) protecting their children from second-hand smoke exposure in the home, (2) helping the father in quitting, and (3) parents' perceived impact of the legislation on their behaviours regarding father's smoking behaviour.

Results

Characteristics of the subjects of the 2007a group

The mean age of fathers was 39.3 years; 75.1% had secondary education; 95.4% were currently employed; and 74.5% had monthly personal income of ≤$20 000. They were significantly older, more diverse in terms of educational level, and had higher monthly personal income than the 2005 group. They were also significantly younger than the 2006 group and had similar educational profiles.

The mean age of mothers was 36.6 years; 82.6% had secondary education; 51.7% were housewives; 56.3% reported a monthly household income of ≤$20 000; 65% perceived having good physical health; and 98.1% reported a good relationship with their spouse. They were similar in educational profiles to mothers in the 2006 group, but were significantly older. Fewer of them were housewives, had monthly household income of ≤$20 000, and perceived good physical health than the 2005 group.

The mean age of children was 6.4 years; 50.3% were boys; 65.8% had never been hospitalised since birth; and 72.3% did not consult doctors in the past month. They were also significantly younger, had more hospitalisations since birth, and consulted doctors more in the past month than the 2005 group.

Parent-reported second-hand smoke exposure of the children

About 26.7% and 63.8% of the fathers reported they had never smoked and smoked at specific areas/time period at home, respectively, whereas 59.7% and 34.2% never and sometimes smoked around their children, respectively (Table 1). Significantly more fathers in the 2007a group than the 2006 group never smoked at home (26.7% vs 14.0%), and never smoked around their children (59.7% vs 30.7%). The differences remained significant after adjusting for the father's educational level and age using MANOVA ($F=9.24$, $P<0.001$). Regarding 60.6% of fathers who smoked at home and 45.3% of fathers who smoked around children in the 2007a group, they only smoked one to four cigarettes daily at home and around children, respectively.

Over 70% of the mothers reported that the fathers smoked one to 14 cigarettes at home, whereas 67.0% reported that the fathers did not smoke around their children in the past week. Only 18% of the mothers reported their children had at least 1 hour of second-hand smoke exposure at home, and 94.4% said that there was no smoker other than the father who smoked near the child. The 2007a group mothers reported that fathers smoked significantly fewer cigarettes around the children, there were fewer smokers around the children, and children had less second-hand smoke exposure at home, but more mothers reported that the fathers consumed more cigarettes at home than the 2005 group. The differences in mother-reported father's cigarette consumption at home and around children remained significant after adjusting for mother's education level, age, and employment status using MANOVA ($F=54.0$, $P<0.001$).

Mothers' actions in protecting the children from second-hand smoke exposure and helping fathers quit

Among mothers who reported their children had second-hand smoke exposure at home (186 in 2005 group, 318 in 2007a group), significantly more 2007a group mothers practised seven out of the nine specific actions in protecting their children from second-hand smoke exposure, and the differences in proportions of mothers taking the seven specific actions were substantial (Table 2).

About one third of the mothers did not advise their husbands to quit smoking in both 2005 and 2007a groups. Significantly more 2007a group mothers asked the fathers to quit more frequently than the 2005 group mothers did; they 'placed a no-smoking sign at home' (1.6% vs 8.6%) and 'discussed the need to quit with the fathers' (0.8% vs 9.3%), but fewer mothers 'gave the fathers the smoking cessation booklet' (17.7% vs 6.3%).

Mothers provided only limited support in helping the fathers quit smoking; small proportion (<20%) reported this practice in each of the 10 supporting actions in both groups. Compared to the 2005 group, significantly more 2007a group mothers 'complimented the fathers when they did not smoke' (7.3% vs 17.4%) and 'told the fathers to stick with quitting' (0% vs 6.6%), but fewer mothers helped the fathers to 'think of' (19.5% vs 10.3%) and 'use' (13.0% vs 9.0%) substitutes for cigarettes.

Parents' perceived impact of the smoke-free legislation

Over 95% of the fathers were aware of, and about 40% of them had changed in their cigarette consumption after the smoke-free legislation in both the 2007a and 2007b groups (Table 3). After the legislation in the 2007a group, 4% of the fathers had increased their smoking and 14% had no smoking at home, whereas 4% of the fathers had increased smoking and 33% did not smoke around their children. Similar patterns were observed in the 2007b group except that only 1.3% and 2.0% of the fathers had increased their smoking at home and around their children, respectively. Moreover, although a large proportion of fathers remained unchanged, more fathers reported that they had increased their perceived motivation, recognition of its importance, and confidence in quitting smoking. They had less perceived difficulty in quitting, owing to the implementation of the legislation.

In both 2007a and 2007b groups, most of the mothers were aware of the new legislation; more mothers reported that their husbands had reduced their cigarette consumption at home; more mothers had increased their actions in protecting their children from second-hand smoke exposure, and were more active in helping their husband to quit after the legislation. There was no significant difference in the 2007a and 2007b groups.

Table 1. Parent-reported second-hand smoke exposure of the children*

Second-hand smoke exposure of children	No. (%) of persons			P value (Chi-square test)
	2005 group	2006 group	2007a group	
Father-reported	n=186	n=114	n=608	
Smoking behaviour at home				0.008
Never smoke at home	-	16 (14.0)	158 (26.7)	
Smoked at specific area/period	-	81 (71.1)	377 (63.8)	
Smoked everywhere	-	17 (14.9)	56 (9.5)	
Smoking behaviours around children				<0.001
Never smoked around children	-	35 (30.7)	352 (59.7)	
Sometimes	-	69 (60.5)	202 (34.2)	
Usually	-	5 (4.4)	11 (1.9)	
Always	-	5 (4.4)	25 (4.3)	
No. of cigarettes smoked daily at home (among those smoked at home)				
<1	-	-	37 (8.7)	
1-4	-	-	258 (60.6)	
5-14	-	-	104 (24.4)	
15-24	-	-	16 (3.8)	
>24	-	-	5 (1.2)	
Don't know	-	-	6 (1.4)	
No. of cigarettes smoked within 10 feet of the child in the past week (among those who smoked near children)				
<1	-	-	91 (39.2)	
1-4	-	-	105 (45.3)	
5-14	-	-	22 (9.5)	
15-24	-	-	3 (1.3)	
>24	-	-	11 (4.7)	
Mother-reported	n=186	n=114	n=742	
Father's daily cigarette consumption at home in the past week				<0.001
<1	30 (16.1)	-	38 (7.3)	
1-4	119 (64.0)	-	269 (51.6)	
5-14	34 (18.3)	-	111 (21.3)	
15-24	2 (1.1)	-	24 (4.6)	
>24	0 (0)	-	3 (0.6)	
Don't know	1 (0.5)	-	76 (14.6)	
Father's cigarette consumption within 10 feet of the child in the past week				<0.001
None	18 (9.7)	-	493 (67.0)	
<1	67 (36.0)	-	53 (7.2)	
1-4	78 (41.9)	-	116 (15.8)	
5-14	20 (10.8)	-	36 (4.9)	
15-24	2 (1.1)	-	6 (0.8)	
>24	0 (0)	-	2 (0.3)	
Don't know	1 (0.5)	-	30 (4.1)	
No. of smokers (excluding father) who smoked within 10 feet of the child in the past week				<0.001
0	48 (25.8)	-	689 (94.4)	
1	124 (66.7)	-	38 (5.2)	
2	12 (6.5)	-	3 (0.4)	
3	2 (1.1)	-	0 (0)	
Child's exposure at home (hours per day)				<0.001
No exposure	9 (4.8)	-	425 (58.1)	
Occasional	77 (41.4)	-	175 (23.9)	
1	53 (28.5)	-	71 (9.7)	
2-4	44 (23.7)	-	47 (6.4)	
5-7	2 (1.1)	-	11 (1.5)	
8-10	1 (0.5)	-	3 (0.4)	
Mother-reported child's symptoms of second-hand smoke exposure				
No symptoms	175 (94.1)	-	208 (66.0)	<0.001
Eye discomfort	2 (1.1)	-	18 (5.7)	0.009
Sore throat	1 (0.5)	-	7 (2.2)	0.27
Coughing	4 (2.2)	-	51 (16.2)	<0.001
Shortness of breath	0 (0)	-	10 (3.2)	<0.001
Running nose and sneezing	4 (2.2)	-	34 (10.8)	<0.001
Loss of appetite	0 (0)	-	5 (1.6)	0.16
Increase in heart rate	0 (0)	-	2 (0.6)	0.53
Father's smoking behaviour at home				
Never	-	-	39 (6.9)	
Smoked in specific areas	-	-	461 (81.9)	
Smoked everywhere	-	-	63 (11.2)	
Father's smoking behaviour around children				
Never	-	-	465 (62.7)	
Sometimes	-	-	219 (29.5)	
Usually	-	-	11 (1.5)	
Always	-	-	47 (6.3)	

* Missing data are excluded from analysis

Table 2. Mother's actions to protect children from second-hand smoke exposure and helping fathers quit*

Mother's actions	No. (%) of persons		P value (Chi-square test)
	2005 group (n=186)	2007a group (n=318)	
Take the child away from smoke	11 (5.9)	267 (84.0)	<0.001
Open the window	182 (97.8)	292 (91.8)	0.006
Place a 'No Smoking' sign at home	2 (1.1)	88 (27.7)	<0.001
Advise father to reduce smoking	181 (97.3)	286 (90.0)	0.04
Advise other family members to reduce smoking	11 (5.9)	105 (37.6)	<0.001
Advise father avoid smoking at home	166 (89.2)	263 (83.5)	0.087
Advise other family members avoid smoking at home	3 (1.6)	99 (35.7)	<0.001
Advise father avoid smoking around the child	131 (70.4)	271 (85.8)	<0.001
Advise other family members avoid smoking around the child	3 (1.6)	101 (36.6)	<0.001
Mother advised father quit smoking	n=186	n=737	<0.001
Never	62 (33.3)	274 (37.2)	
1-3 times	113 (60.8)	198 (26.9)	
4-6 times	8 (4.3)	81 (11.0)	
7-9 times	2 (1.1)	22 (3.0)	
>9 times	1 (0.5)	162 (22.0)	
Mother's actions to help father quit	n=124	n=460	
Set a quit date	1 (0.8)	12 (2.6)	0.32
Removed all the smoking-related utensils	6 (4.8)	24 (5.2)	1.00
Placed a 'No Smoking' sign at home	2 (1.6)	39 (8.5)	0.001
Requested others not to smoke near the father	6 (4.8)	16 (3.5)	0.44
Gave father smoking cessation booklet	22 (17.7)	29 (6.3)	0.004
Advised to seek professional help	2 (1.6)	21 (4.6)	0.19
Benefit to the child's health after quitting	53 (42.7)	201 (43.7)	0.10
Smoking can lead to death	34 (27.4)	127 (27.6)	0.36
Quit smoking can save money	36 (29.0)	127 (27.6)	0.91
Discussed with father of needs in quitting	1 (0.8)	43 (9.3)	<0.001
Mother's support in helping father quit	n=123	n=456	
Compliment father when he did not smoke	9 (7.3)	79 (17.4)	0.005
Congratulated him for decided to quit	1 (0.8)	17 (3.7)	0.14
Help father to think of substitutes for cigarettes	24 (19.5)	47 (10.3)	0.008
Celebrate with father on his success in quitting smoking	0 (0)	4 (0.8)	0.58
Comfort father when he was feeling stressed or irritated	9 (7.3)	14 (3.1)	0.18
Tell father to stick with quitting	0 (0)	30 (6.6)	0.001
Express confidence in father's ability to quit/remain quitting	4 (3.3)	13 (2.9)	0.77
Participate in activities with father to keep him from smoking	7 (5.7)	2 (0.4)	<0.001
Express pleasure at father's effort to quit	4 (3.3)	25 (5.5)	0.48
Help father to use substitutes for cigarettes	16 (13.0)	41 (9.0)	0.23

* Missing data are excluded from analysis

Discussion

This study revealed a reduction in parent-reported second-hand smoke exposure in children at home after the implementation of the smoke-free legislation in Hong Kong. The father-reported smoking prevalence rate around children decreased from 69.3% at baseline to 40.3% after the legislation. There was a more striking drop from 90.3% to 33.0% in the corresponding mother-reported father's smoking rate around the children. The father-reported smoking prevalence rate at home decreased from 86.0% in the 2006 group to 73.3% in the 2007a group. However, mothers reported an increase in father's cigarette consumption at home in the 2007a group as compared to the 2005 group. This contradictory observation can be explained by the higher mean daily cigarette consumption among the fathers in the 2007a group, and the possibility of the father smoking in different areas in the home where the child was not around.

The mothers reported a substantial increase in actions they took to protect their children from second-hand smoke exposure. Over 50% of the mothers in both 2007a and 2007b groups reported an increase in their actions after legislation. The non-smoking mothers more often advised that the smoking fathers quit smoking.

Most fathers thought that there had been little/no change in their smoking-related psychosocial factors. About 50% reported a reduction, and only <15% reported an increase in their own second-hand smoke exposure after the legislation. The reduction in second-hand smoke exposure may be due to the complete ban of smoking in indoors including places for entertainment where smoking was mostly seen in public open areas. Mothers reflected more changes in their behaviours regarding smoking that 50% reported an increase in their actions to protect their children from second-hand smoke exposure and about 30% reported an increase in their support to help their husbands to quit after the legislation. These results suggest that the non-smoking mothers were more responsive, in a positive way, to the smoke-free legislation. Nonetheless, some of the smoking fathers did not change their smoking behaviour at all.

Our repeated cross-sectional design is less robust than a longitudinal design, but this is the best method given the limitations. The two pre-legislation samples were pilots for randomised controlled studies, hence the sample size was small and may not be representative of the Hong Kong population. The samples recruited before and after the legislation showed some socioeconomic differences (ie age, education level, and employment status) but these

Table 3. Perceived effect of the new anti-smoking legislation on parents' behaviours*

Parents' behaviour	No. (%) of persons		P value (Chi-square test)
	2007a group	2007b group	
Father's opinion	n=608	n=174	
Aware of the new legislation	587 (96.9)	174 (98.9)	0.19
Change in cigarette consumption	249 (41.3)	66 (37.5)	0.38
Smoking at home			0.04
Decrease	112 (18.6)	41 (27.2)	
No change	382 (63.3)	92 (60.9)	
Increase	25 (4.1)	2 (1.3)	
Did not smoke at home	84 (13.9)	16 (10.6)	
Smoking around their children			0.10
Decrease	105 (17.4)	32 (21.2)	
No change	276 (45.8)	56 (37.1)	
Increase	25 (4.1)	3 (2.0)	
Did not smoke in front of children	197 (32.7)	60 (39.7)	
Motivation to quit smoking			0.047
Decrease	38 (6.3)	5 (2.9)	
No change	407 (67.4)	109 (63.0)	
Increase	159 (26.3)	59 (34.1)	
Importance of quitting smoking			0.07
Decrease	11 (1.8)	1 (0.6)	
No change	440 (72.8)	115 (66.1)	
Increase	153 (25.3)	58 (33.3)	
Confidence in quitting			0.13
Decrease	11 (1.8)	1 (0.6)	
No change	481 (79.8)	130 (75.1)	
Increase	111 (18.4)	42 (24.3)	
Difficulty in quitting			0.002
Decrease	52 (8.6)	31 (18.0)	
No change	519 (85.9)	132 (76.7)	
Increase	33 (5.5)	9 (5.2)	
Significant others encourage them to quit			0.35
Decrease	7 (1.2)	0 (0)	
No change	409 (67.8)	115 (67.3)	
Increase	187 (31.0)	56 (32.7)	
Experience less second-hand smoke exposure			0.63
Decrease	272 (45.0)	86 (49.1)	
No change	246 (40.7)	66 (37.7)	
Increase	86 (14.2)	23 (13.1)	
Mother's opinion	n=742	n=189	
Aware of the new legislation	703 (94.7)	181 (96.3)	0.46
Cigarettes consumption of the fathers at home			0.81
Decrease	167 (22.6)	38 (20.7)	
No change	520 (70.4)	134 (72.8)	
Increase	52 (7.0)	12 (6.5)	
Actions in protecting their children from second-hand smoke exposure			0.93
Decrease	87 (11.7)	20 (10.6)	
No change	282 (38.1)	71 (38.2)	
Increase	372 (50.2)	95 (51.1)	
Support in helping the fathers to quit			0.82
Decrease	20 (2.7)	6 (3.2)	
No change	502 (67.7)	128 (69.2)	
Increase	219 (29.6)	51 (27.6)	

* Missing data are excluded from analysis

differences were controlled for in the analyses of primary outcomes, making systematic bias less likely.

These results demonstrated the effectiveness of comprehensive smoke-free legislation in protecting non-smokers, in particular children, from second-hand smoke exposure. Not only has it shown no displacement of smoking from restricted smoking venues to homes, it has also influenced the fathers' smoking behaviour and improved smoking hygiene at home. Other Asian countries with a high prevalence of smoking should consider adopting such a policy to improve health and save lives.

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