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The Situation of Smoke Exposure at Home and Respiratory Problems in Early Childhood, Nakhon Si Thammarat Province†

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Abstract

This retrospective study aimed to investigate the situation of smoke exposure at home, smoking behaviors among family members, and respiratory problems among young children in Nakhon Si Thammarat Province. Data were collected from primary caregivers over a 6-month period. The sample size was determined using the Krejcie and Morgan sampling method, at a 95 % reliability level, resulting in a sample size of 414 participants. Data collection involved administering a questionnaire to gather information on the personal details of the children and their caregivers, as well as employing a smoke exposure assessment form and a respiratory problem assessment form. The validity of these instruments was confirmed, with a content validity index (CVI) of 1.0 and a Cronbach's alpha reliability coefficient of 0.8 for the smoke exposure assessment form, and a CVI of 1.0 and a KR-20 reliability coefficient of 0.72 for the respiratory problem assessment form.

Descriptive statistics, including percentages, means, and standard deviations (SD), were utilized to analyze the collected data. The results revealed that 51 % of the participants were male, while 49 were female, with an average age of 3.71±0.60 years. The majority of primary caregivers were female (66.2 %), with an average age of 40.28±12.03 years. Regarding smoke exposure at home during early childhood, the study found that fathers (38.9 %) and grandfathers (33.1 %) were the primary caregivers who smoked. The level of smoke exposure was determined to be moderate (52.2 %). Furthermore, it was observed that 68.8 % of children in these households experienced respiratory diseases. The most reported symptoms were nasal congestion, sneezing, and a runny nose (59.7 %), followed by coughing and phlegm production (45.7 %). Additionally, 40.6 % of affected children required hospital or clinic admission. The most prevalent respiratory conditions identified were the common cold (47.6 %), bronchitis (28 %), and allergic rhinitis (19.1 %).

Comparison with similar studies conducted in developing countries revealed consistent trends and patterns. Consequently, the development of preventive strategies for respiratory problems in children is crucial, with a particular emphasis on reducing exposure to stimuli such as smoke. Family members should be educated about the importance of refraining from smoking at home to mitigate the severity and occurrence of respiratory problems during early childhood.

Keywords: Personal factors, Smoke exposure, Early childhood, Respiratory problems

Introduction

In 2019, smoking worldwide encompassed various forms of tobacco consumption, including tobacco cigarettes, hand-rolled cigarettes, cigars, cigarillos, pipes, and shisha. The global consumption amounted to approximately 7.4 trillion cigarettes, equivalent to around 2.03 billion cigarettes per day (GBD 2019 Tobacco Collaborators, 2021). Notably, the prevalence of smoking tended to be higher in developing

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countries compared to low-income countries (GBD 2019 Tobacco Collaborators, 2021). Based on the SEATCA survey, Indonesia had the highest smoking rate, reaching 39.9 % annually, followed by the Philippines at 23.8 % annually (World Health Organization, 2022). This trend can be attributed to ineffective law enforcement and lax tax/duty collection. Thailand ranked fourth in Asia for the number of smokers, with an average of 837 cigarettes per person per year or roughly 2 cigarettes per person per day (World Health Organization, 2022). Specifically, in Southern Thailand, Nakhon Si Thammarat Province ranked as the second-highest province for smoking prevalence 27.63 %, following Krabi Province (Tobacco Control Research and Knowledge Management Center, 2018). Previous studies have shown that the majority of smokers live with family members (Chinpong, 2021). While there has been a decline of 0.23 % in tobacco smoking among the Thai population aged 15 and over from 2011 to 2025, it is projected that the number of smokers in 2025 will reduce to only 10.5 million (National Statistical Office, 2018). However, according to the 2017 survey on smoking behavior conducted by the National Statistical Office of Thailand, there were approximately 4,962,045 households with smokers, resulting in an estimated annual exposure of 10,333,653 individuals to secondhand smoke at home (Khongsakon, 2020). Furthermore, data from the survey on the prevalence of smoke exposure at home at least once a month between 2001 and 2017 revealed that Nakhon Si Thammarat Province ranked second in Southern Thailand in terms of smoke exposure at home (National Statistical Office, 2018).

Family members during early childhood are in a critical developmental stage that encompasses various aspects of life, and they are particularly vulnerable to environmental factors that can impact their health (National Collaborating Centre for Determinants of Health, 2019). One significant risk factor for their respiratory health is exposure to substances present in cigarettes and secondhand smoke when family members engage in smoking behaviors (Department of Disease Control Particulate Matter, 2019). A comprehensive review of relevant research highlights several factors associated with respiratory problems in early childhood. Notably, environmental exposure to polluted air has been identified as a risk factor for both upper and lower respiratory tract issues in children, leading to reduced lung efficiency (Vanker et al., 2017). Exposure to cigarette smoke at home, especially from close family members, further exacerbates respiratory problems (Samudio & Landires, 2021). Substances present in cigarettes, including the smoke itself, can induce respiratory irritation and cause constriction by stimulating the smooth muscles of the respiratory system. Children with smoking parents face up to a 4 % higher risk of bronchitis or pneumonia and up to a 39 % higher risk of asthma compared to those without such exposure (Thai Health Promotion Foundation, 2019). Children who are exposed to smoke also have an increased likelihood of developing respiratory problems (Elshazly et al., 2020). Families with at least one smoker have a 1.8 times higher risk of asthma in their children, primarily due to the smaller, narrower, and shorter airways in young individuals (Taweepattana, 2019; Niyomwit & Khammarit, 2019). Additionally, their respiratory muscles have lower resistance and elasticity, while their immune systems are not fully developed. Considering that young children have significantly lower body weights compared to adults, they are exposed to toxic substances at a rate 20 times higher (Khongsakon, 2020; Sakulhongsopon, 2020). Consequently, respiratory issues in children are generally more severe than in adults (Niyomwit & Khammarit, 2019). It is not surprising that children under the age of 5 experience respiratory illnesses more frequently than older children and adults (Srising & Srijanthongsiri, 2021).

Respiratory problems in children can stem from disorders affecting various organs within the respiratory system, including the nasal cavity, throat, epiglottis, trachea, bronchioles, alveoli, and lungs. When respiratory issues arise, the body responds by triggering a cough and sneezing reflex to expel foreign substances and restore normal respiratory conditions. However, this reflex can lead to nasal irritation, congestion, a runny nose, coughing, sneezing, a sore throat, breathing difficulties, and an increased risk of infection (Srising & Srijanthongsiri, 2021). It is crucial for caregivers to carefully observe and monitor these health problems in children, providing close attention and implementing effective management strategies both indoors and outdoors to mitigate airway risks and prevent the development of more severe health issues. Since children have developing immune systems, they are more susceptible to infections and illnesses and require special care and attention to safeguard their respiratory health.

Based on an extensive review of associated research literature, it has been observed that early childhood primarily spends a significant portion of their lives within their family environment (Vanker et al., 2017; Smit & Pillarsetti, 2018; Samudio & Landires, 2021). Children who live with smoking family members are at risk of direct exposure to secondhand smoke, which can have long-term detrimental effects on their health. Previous studies have explored the associations between cigarette smoke and respiratory issues in children under the age of 5. However, there remains a research gap regarding the comprehensive examination of smoke exposure, smoking behaviors within family members, and the occurrence of respiratory symptoms in children aged 3 to 5 years. As a nurse practitioner, the researcher recognized the importance of addressing this knowledge gap and conducted a study investigating the situation of smoke exposure at home and its impact on respiratory problems in early childhood within Nakhon Si Thammarat Province. The goal of this research is to contribute to the existing knowledge base and provide insights that can be utilized to develop strategies aimed at reducing, discouraging, and ultimately eliminating cigarette smoking. Additionally, the researcher intends to develop a program and guidelines that can foster cooperation among family members to prevent smoking within the home environment.

Objectives

1) To investigate the extent of smoke exposure at home during early childhood, including the smoking behaviors of family members and the behavior of smoke exposure within Nakhon Si Thammarat Province.

2) To examine the situation of respiratory problems in early childhood with in Nakhon Si Thammarat Province.

Methodology

This retrospective study aimed to investigate smoke exposure, smoking behavior among family members, and respiratory problems in early childhood with in Nakhon Si Thammarat province. Data were collected from fathers, mothers, and primary caregivers of children aged 3 - 5 years living in households with smokers. The study was conducted from May to July 2022. The sample size was determined using the Krejcie and Morgan (1970), ensuring a 95 % reliability level. Based on the formula, the initial sample size was estimated at 380, considering the total population of 35,567 children aged 3 - 5 years with smokers in their families in Nakhon Si Thammarat province. To account for potential data loss or incompleteness, the researchers increased the sample size by 10 % to a total of 414 participants.

Step 1: Nakhon Si Thammarat province was divided into districts based on geographic features. Two districts, Chulabhorn and Ron Phibun, were selected using simple random sampling.

Step 2: A list of Tambon health-promoting hospitals within the 2 selected districts was created. Five Tambon health-promoting hospitals were randomly selected from a total of 16, including Kuanmud, Kuan Nong Kwa, Thung Pho, Na Moh Boon, Sam Tambon, Ban Cha Uad, Hin Tok, Sao Thong, Kuan Koei, Kuan Pang, Kuan Chum, and Ron Phibun.

Step 3: The lists of children in the 5 selected Tambon health-promoting hospitals were created. Early childhood participants were recruited using simple random sampling, ensuring that they met the criteria of having smokers in their families, until the desired number of children was reached.

To be eligible for inclusion in the sample group, participants must meet the following criteria: The child must be between 3 - 5 years of age and have a family member who smokes. Additionally, the child should not have any congenital diseases that require continuous drug treatment, such as heart disease, blood disease, cancer, immunodeficiency disease, or asthma. The main caregiver must be capable of communicating in Thai, have no listening problems, and possess good vision. It is also important that there are no serious illnesses that would impede the participant's ability to respond to the research questions. Furthermore, voluntary consent to participate in the research is required, and the participant should have lived with the child for a minimum of 6 consecutive months.

The research instruments used in this study were as follows:

Part 1: Personal data of children in early childhood, which consisted of 9 items including sex, age, weight, height, nutritional status, labor history, post-labor complications, birth weight, and breastfeeding history in the first 6 months. The questionnaire was developed as a checklist with open-ended questions.

Part 2: Personal data of main caregivers, which included 11 items such as sex, age, religion, marital status, present occupation, educational level, monthly household income, smoking history, the relationship between the caregiver and child, number of smokers in the family, and the role of smokers in the family. The questionnaire was developed as a checklist with open-ended questions.

Part 3: Assessment of early childhood exposure to tobacco smoke, which was adapted from the instrument developed by Suwanwaiphattana et al. (2013). This section comprised 6 questions, and the means were interpreted by categorizing the smoke exposure score into 3 levels: 1) 6 - 12 points = Low smoke exposure, 2) 13 - 18 points = Moderate smoke exposure, and 3) 19 - 24 points = High smoke exposure. The instrument underwent content validity and reliability testing by 5 experts, resulting in a content validity index (CVI) of 1.0 and a Cronbach's alpha reliability coefficient of 0.8.

Part 4: The questionnaire for assessing respiratory health problems in early childhood was modified from the instrument developed by Duangsawat (2016), which was based on the American Thoracic Society (ATS-1987) questionnaire. This section consisted of 9 checklist questions and also underwent content validity and reliability testing by 5 experts. The test results revealed a CVI of 1.0 and a KR-20 reliability coefficient of 0.72.

Statistical analysis

In this study, descriptive statistics such as frequency, percentage, mean, and standard deviation were utilized to analyze the personal data of children in early childhood and main caregivers. These statistical measures provided valuable insights into the characteristics and demographics of the participants. Furthermore, descriptive statistics, specifically frequency and percentage, were employed to analyze the data concerning smoke exposure in early childhood and the history of respiratory illnesses. These statistical analyses helped in understanding the prevalence and patterns of smoke exposure as well as the occurrence of respiratory problems among the participants.

Prior to data collection, this study obtained approval from the Ethics Committee on Human Research at Walailak University on April 7, 2022 (No. WU-EC-22-116-01), as required by the standard process. The researchers also obtained informed consent from all participants involved in the study.

Results and discussion

Four hundred fourteen participants in early childhood were recruited for the study, with 51 % being male and 49 % female. The average age of the participants was 3.71±0.60 years. The youngest and oldest participant was 3.5 and 5 years old, respectively. In terms of nutritional status, the majority of children (80.2 %) met the standard criteria. Additionally, most children were born full-term (81.9 %), had a birth weight greater than 2,500 g (94.4 %), and were breastfed for at least 6 months (69.8 %), as indicated in **Table 1**.

Table 1 Number and percentage of personal data of children in early childhood (n = 414).

Personal Data of Children	**n**	**%**
Sex		
Male	211	51.0
Female	203	49.0
Age (years) (Min = 3.5 years, Max = 5 years, Mean = 3.71, SD = 0.60)		
3 years	151	36.5
4 years	231	55.8

Personal Data of Children	**n**	**%**
5 years	32	7.7
Nutritional status		
Underweight	25	6.0
Normal	332	80.2
≥ Overweight	57	13.8
Labor History		
Preterm labor	46	11.1
Full-term labor	339	81.9
Post term labor	29	7.0
Birth weight		
≤ 2,500 g	23	5.6
> 2,500 g	391	94.4
Post-labor breastfeeding		
< 6 months	125	30.2
≥ 6 months	289	69.8

According to the personal data of the caregivers, the majority of them were female (66.2 %) and aged between 19 and 40 years (68.6 %). The average age of the caregivers was 40.28±12.03 years, with the minimum age being 19 and the maximum age being 72 years. Almost all of the caregivers identified as Buddhist (99.3 %) and were married (79.7 %). In terms of occupation, 24.4 % were engaged in agriculture. Additionally, 49.8 % of the caregivers had graduated from high school or an equivalent level of education. The majority of caregivers (34.1 %) had a monthly income ranging from 10,001 to 20,000 baht. Most caregivers (73.4 %) had a parental relationship with the children and lived with 1 smoker at home (76.6 %). Among the smokers in the household, the majority were fathers (38.9 %), as shown in **Table 2**.

Table 2 Number and percentage of caregivers' personal data (n = 414).

Personal data of caregivers	**n**	**%**
Sex		
Male	140	33.8
Female	274	66.2
Age of caregivers (years) (Min = 19, Max = 72, Mean = 40.28, SD. = 12.03)		
19 - 40 years	284	68.6
> 41 years	130	31.4
Religion		
Buddhist	411	99.3
Other	3	0.7
Marital status		
Single	1	0.2
Widowed/Divorced/Separated	83	20.1
Married	330	79.7

Personal data of caregivers	**n**	**%**
Occupation		
Unemployed	66	15.9
Hireling	52	12.6
Merchant	77	18.6
Agriculturist	101	24.4
Business person	49	11.8
Government officer/Company employee	69	16.7
Educational level		
Below high school	92	22.2
High school or equivalent	206	49.8
Diploma/Bachelor's degree	111	26.8
Higher than a bachelor's degree	5	1.2
Monthly income		
< 5,000 baht/month	79	19.1
5,000 - 10,000 baht/month	63	15.2
10,001 - 20,000 baht/month	141	34.1
20,001 - 30,000 baht/month	97	23.4
> 30,000 baht/month	34	8.2
Smoking history		
No	300	72.5
Yes	114	27.5
Relationship between main caregiver and child		
Parents	304	73.4
Grandparents	96	23.2
Relatives (uncle/aunt)	14	3.4
Number of smokers		
1	317	76.6
2	94	22.7
3	3	0.7
Role of Smokers in Families of Early Childhood		
Father	161	38.9
Grandfather	137	33.1
Relatives (uncle/aunt)	25	6.0
Father and relatives (grandfather/uncle/aunt)	91	22.0

According to the study on smoke exposure at home in early childhood, children experienced different frequencies of smoke exposure. The results showed that 45.4 % of children were directly exposed to smoking, while 47.6 % walked past smoking areas at home. Additionally, 40.6 % of children engaged in activities in smoking areas at home, and 36.5 % were exposed to smoke residue on various surfaces such as tables, chairs, sofas, clothing, curtains, and carpets. Furthermore, 39.4 % of children touched the body parts of smokers, such as hands, arms, and face, on a daily basis, and 41.5 % frequently hugged or kissed smokers on the cheek at home (see **Table 3**).

Table 3 Number and percentage of smoke exposure at the home of children in early childhood (n = 414).

Smoke exposure at home	Frequency of smoke exposure			
	Usually	Often	Sometimes	Once in a while
	n (%)	n (%)	n (%)	n (%)
1) Children were directly exposed to smoking.	102 (24.6)	188 (45.4)	112 (27.1)	12 (2.9)
2) Children walked past smoking areas at home.	89 (21.5)	197 (47.6)	118 (28.5)	10 (2.4)
3) Children engaged in activities in smoking areas at home.	125 (30.2)	168 (40.6)	116 (28.0)	5 (1.2)
4) Children were exposed to smoke residue on various surfaces, including tables, chairs, sofas, clothing, curtains, and carpets.	151 (36.5)	148 (35.7)	103 (24.9)	12 (2.9)
5) Children touched the body parts of smokers, such as hands, arms, and face.	163 (39.4)	128 (30.9)	109 (26.3)	14 (3.4)
6) Children frequently hugged smokers at home or kissed them on the cheek.	139 (33.6)	172 (41.5)	91 (22.0)	12 (2.9)

The study on the history of respiratory-related illnesses among children revealed several findings within a 6-month timeframe (see **Table 4**). Among the participants, 59.7 % reported experiencing nasal congestion, sneezing, and a runny nose. Coughs and phlegm were prevalent among 45.7 % of the children, while 41.3 % reported throat irritation and sore throat. Additionally, 14.5 % of the children had eye irritation and tears, and 12.6 % experienced symptoms of asthma, dyspnea, and panting. Wheezing was reported by 11.8 % of the participants, and chest tightness was experienced by 5.6 % of the children. These findings provide insights into the respiratory problems and symptoms observed among the children during the specified 6-month period.

Table 4 Number and percentage of symptoms of respiratory problems in early childhood (n = 414).

Symptoms	Respiratory problems			
	No		Yes	
	(n)	(%)	(n)	(%)
Symptoms in the past 6 months				
Eye irritation and tears	354	85.5	60	14.5
Nasal congestion, sneezing, and runny nose	167	40.3	247	59.7
Throat irritation and sore throat	243	58.7	171	41.3
Coughs	225	54.3	189	45.7
Phlegm	225	54.3	189	45.7
Asthma, dyspnea, and panting	362	87.4	52	12.6
Wheezes	365	88.2	49	11.8
Tightness in the chest	391	94.4	23	5.6

The study revealed that the smoke exposure among children was moderate, with a prevalence of 52.2 %. Additionally, a considerable proportion of children (68.8 %) experienced illnesses related to respiratory diseases. Furthermore, within the past 6 months, a notable percentage of children (40.6 %) sought medical treatment for respiratory symptoms from government or private healthcare facilities. The most common respiratory condition reported among the children was the common cold, with a prevalence of 47.6 %. These findings are detailed in **Table 5**.

Table 5 Number and percentage of smoke exposure and health problems in early childhood (n = 414).

Smoke Exposure and children's health problems in early childhood	**n**	**%**
Smoke exposure at home		
Low	191	46.1
Moderate	216	52.2
High	7	1.7
History of illnesses caused by respiratory diseases in early childhood		
No	129	31.2
Yes	285	68.8
History of treatment at government or private service establishments due to respiratory symptoms		
No	246	59.4
Yes	168	40.6
History of treatment for respiratory diseases in the past 6 months	(n = 168)	
Common cold	80	47.6
Bronchitis	47	28.0
Allergic rhinitis	32	19.1
Pneumonia	9	5.3

This study's results revealed important insights into the smoke exposure situation at home among children in early childhood in Nakhon Si Thammarat province. It was found that primary caregivers who smoke were predominantly fathers (38.9 %), followed by grandfathers (33.1 %). The children themselves were frequently exposed to smoking in various ways: direct exposure (45.4 %), walking past smoking areas at home (47.6 %), engaging in activities in smoking areas (40.6 %), and being exposed to smoke residue on various surfaces (36.5 %). They also had regular contact with smokers, such as touching their hands, arms, and faces on a daily basis (39.4 %), and frequently hugging or kissing them (41.5 %). Regarding smoke exposure levels, it was determined that the children had moderate exposure (52.2 %), followed by those with low exposure to cigarette smoke (46.1 %). Moreover, it was found that among these groups, a significant proportion (68.8 %) experienced respiratory diseases. The most common symptoms reported were nasal congestion, sneezing, and a runny nose (59.7 %), followed by coughs and phlegm (45.7 %). Additionally, 40.6 % of the children required admission to a hospital or clinic for treatment. The most prevalent illness observed was the common cold (47.6 %), followed by bronchitis (28 %) and allergic rhinitis (19.1 %), respectively. These findings shed light on the significant impact of smoke exposure on children's respiratory health in Nakhon Si Thammarat province. It emphasizes the need for effective interventions to reduce children's exposure to smoke at home and mitigate the associated health risks.

When comparing with developing countries, the number and prevalence of respiratory illnesses were found to be similar. The study revealed that in developing countries, the rate of respiratory illnesses that require hospital treatment ranges from 50 to 80 % (McAllister et al., 2019). The study highlighted that child caregivers who smoke have a direct impact on the respiratory health of children, leading to symptoms such as nasal congestion, runny nose, coughs, and sneezes (Wang et al., 2020; Zhuge et al., 2020). This can be

attributed to the composition of children's respiratory systems, which contain a higher proportion of Type-II rapid-twitch muscle fibers compared to Type-I slow-twitch muscle fibers. As a result, their respiratory system has lower elasticity and resistance. Additionally, the immune system of children is not fully developed, making them more vulnerable to foreign substances that affect the cough and sneeze reflexes. This imbalance in the respiratory system can manifest as nasal irritation, nasal congestion, runny nose, coughs, sneezes, sore throat, dyspnea, and infections (Niyomwit & Khammarit, 2019). Furthermore, it increases the risk of chronic coughs, suffocation, and bronchitis. These findings align with the research conducted by Achirasena (2020), which revealed that children living in smoking households have a higher likelihood of developing upper and lower respiratory tract issues compared to those living in non-smoking households. Therefore, continuous exposure to smoke in children can significantly impact their respiratory health (Vanker & Zar, 2017; Francis et al, 2018). Moreover, these results are consistent with a study on respiratory infections in Cameroon, which found a direct correlation between smoke exposure and respiratory problems in children (Tazinya et al., 2018). Thus, it is crucial to incorporate preventive measures into respiratory health planning for children, particularly by minimizing stimuli such as smoke. Family members should be aware of the importance of maintaining a smoke-free environment at home to reduce the severity and occurrence of respiratory issues during early childhood.

Conclusions

The results of this study emphasize the importance of caregivers prioritizing the avoidance of risk factors that can impact children's health, particularly controllable environmental factors. It is crucial for family members to be aware of the importance of maintaining a smoke-free home environment, as this can significantly reduce the likelihood of children being exposed to smoke caused by family members. By doing so, it can help minimize the severity and frequency of respiratory problems in early childhood that are associated with smoke exposure at home. Furthermore, it is essential to disseminate knowledge about the benefits of reducing, refraining from, and quitting cigarette smoking, and to encourage community members to actively participate in smoking cessation programs.

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