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THE EFFECT OF SECOND HAND SMOKE EXPOSURE ON SLEEP PATTERN IN LEBANESE CHILDREN. AN INTERVIEW QUESTIONNAIRE BASED STUDY

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ABSTRACT

Background: Exposure to second hand smoke is one of the most commonly encountered health problems in the pediatric age group. Information concerning the correlation between second hand smoke exposure and sleep patterns among children is limited. Knowing that sleep is a very important vital physiologic function in children and its disturbance is linked to severe adverse effects, this study mainly aimed to evaluate the correlation between second hand smoke exposure and sleep disturbances in Lebanese children. **Methods:** We conducted an observational study in 400 kids, divided in two equal groups: non-exposed to smoking, or having smoking parents or relatives. A questionnaire targeting smoking exposure and socio-demographic information, as well as Child's Sleep Habits Questionnaire were filled by medical students in interview based sessions. **Results:** Waterpipe was the most frequent (20.1%) smoking exposure. Half (53.9%) of our respondents never smoked in the presence of the child, and 37% were aware of the smoking effects on the child. A Lebanese kid spends in mean 10.23 hours a day asleep. Smoking in the presence of the child ($P = 0.001$), smoking type ($P < 0.001$), the educational level of the kid's parents (both mother $P = 0.006$, and father $P < 0.001$), as well as child birth term ($P = 0.031$), the presence of other nearby smoking sources ($P = 0.007$), and the prenatal smoking exposure status ($P < 0.001$) significantly affect the sleep patterns of the children. Moreover, the educational level of the mother ($P = 0.004$) and the father ($P = 0.031$), as well as the prenatal smoking exposure ($P = 0.043$) significantly affect the kids' total sleeping hours. **Conclusion:** The Educational level and prenatal smoking exposure were significantly associated with disturbance in the sleep duration of the Lebanese children and this study contributes in raising the family awareness about the potential harm of second hand smoke and its impact on possible sleep disorders in children.

KEYWORDS: Second hand smoke exposure (SHS), sleep pattern.

INTRODUCTION

Exposure to second hand smoke is considered as one of the most commonly encountered health problems, especially in the pediatric age group. A study concerning diseases caused by tobacco exposure showed that 40% of children were exposed to second hand smoke, which was responsible of 38% of death in this age group.[1] Second hand smoke has been linked to more frequent and severe asthma attacks, respiratory infections, ear infections, and sudden infant death syndrome (SIDS).[2] Despite being linked to this number of diseases, there has been limited information concerning the correlation between second hand smoke exposure and sleep patterns among children.[3] However, second hand smoke exposure has been associated with an increased risk of having a sleep disorder diagnosis or sleep disorder symptoms (snoring, gasping while being asleep) in adults.[4] Knowing that sleep is one of the most important vital physiologic functions in children and its disturbance is linked to severe adverse effects such as lack of focus in class, daytime moodiness, significant behavioral and learning problems[5] emphasizes the importance to study the correlation between second hand smoke exposure and sleep patterns among children.

Literature Review: Smoking epidemiology and cost: A prevalence of 57.1% of children second hand smoke exposure was noted in Germany.[6] In the USA, 40% of school aged children and one third of adolescents were subject to second hand smoke exposure.[7] After the implementation of a new tobacco ban law in Macao, there wasn't any decline in the prevalence of smoking in parents. Thus, the parents were found to be more likely to smoke at home rather than outdoors after this law, increasing the second hand exposure to smoke for their children.[8] In 2015, the economic burden of second hand

smoke was estimated to be, in the USA, around 183 million dollars at a cotinine limit of detection of 0.05 ng/mL, and 267 million $ at 0.015 ng/mL.[9] Factors associated with secondhand smoking: low socioeconomic status, low educational level. Parental smoking status where children whose mothers or both parents were smokers had a 13 times higher likelihood of being exposed to second hand smoke.[10] Nursery or day care attendance. Number of smokers who live in the household. The extent of home smoking ban.[6] On the other hand, children whose parents had negative attitudes for second hand smoke had lower exposure likelihood.[10] Secondhand smoking had multiple adverse outcomes in children's health: Low birth weight, Sudden infant death syndrome[9], Otitis media[9,11], more frequent and severe asthma attacks.[11] Acute respiratory illness including bronchitis, pneumonia, wheezes and coughs[9,11,12], and middle ear problems.[9,11,12] As for the death outcome, some researchers assessed the associations between childhood and adult second hand smoke exposure and death from all causes, death from stroke, chronic obstructive pulmonary disease, and ischemic heart disease in a sample of 70 900. It seems that second hand smoke during childhood wasn't associated with all-cause mortality. But when children lived with a smoker for a long duration of 16 to 18 years, a higher mortality from CODP was noted.[13] Regarding the prevention of secondhand smoke exposure: a study in Baltimore assessed the feasibility of air pollution reduction of pregnant women or children who lived with a smoker, by using second hand smoke education as well as installing two air purifiers. Results were encouraging for non-smoking adults and pregnant women, but not for children who had their salivary cotinine unchanged. To note also; that there wasn't any significant change in air nicotine concentration as well.[14] Another complex intervention was designed and tested in England to reduce children's second hand smoke exposure at home. It consisted of a combination of nicotine replacement therapy, behavioral support, and personalized feedback on home air quality.[15] This technique was more costly but also more effective in terms of reducing smoke exposure in children.[16] Finally, a recent Cochrane review found out that among the 78 studies that met the inclusion criteria, only 26 had a beneficial effect to reduce the children's second hand smoke exposure. Among these, 24 had statistically significant results, and only 13 used objective measures to evaluate children's second hand smoke exposure. However, the reviewers weren't able to show what enhanced these programs' effectiveness. Some studies used motivational interviewing or in-person counseling, or telephone counseling, or a combination of these. Other studies used multi-component education-based interventions, or school-based strategy, or a smoking cessation intervention, or a brief intervention, or educational interventions (including picture books). Some studies employed more than one intervention.[17] **Sleep;** Normal sleep patterns in children: The notion of "optimal sleep" is complex and still poorly understood.[18] Optimal sleep definitions are variable in the literature as well. While it is often defined as the amount that public health authorities recommend, it was defined too as the daily amount of sleep that allows a person to be fully awake and able to have a normal performance during the day.[19] Other authors defined it as the amount of sleep required to feel refreshed in the morning.[20] A cohort that followed up children from birth till the age of 16 showed that the total sleep duration decreased from 14.2 hours in mean at the age of 6 months, to 8.1 hours in average at 16 years. It was also noted that the total sleep duration decreased across the years because of the increasing later bedtime across decades faced by an unchanged wake time.[21] Moreover, delayed sleep onset and night waking can damage sleep consolidation and shorten sleep.[22] In fact, there is no "magical formula" for sleep duration[23] because the individual needs vary from a person to another, and a good sleep includes quality, timing, and duration.[24] Some researchers even claim that there is no current solid scientific evidence to have sleep recommendations in children; nevertheless numbers are issued despite the need for further studies in this field.[25] However, in terms of quantity, a systematic review and meta-analysis, including 34 studies that involved 69 542 infants from 18 different countries and cultures, found that the mean reference values and ranges for sleep duration were of: 12.7 hours per day (9.0–13.3) in infants aged less than 2 years old**,** 11.9 hours per day (9.9–13.8) in toddlers and preschoolers aged 2 to 5 years old**,** and 9.2 hours per day (7.6–10.8) in children aged between 6 and 12 years old. The best fit equation (R2 = 0.89) to estimate children's sleep hours, in ages between 0 and 12 years, was the following: 10.49–5.56× [(age/10) ^ 0.5 − 0.71]. As for sleep latency, it was found to be a mean of 19 min in infants aged between 0 and 2 years, and on average 17 min in children who were 3 to 12 years old.[22] In fact, a higher activity during the day was associated with shorter sleep latency. On the contrary, the longer is sleep latency, the shorter is the total sleep duration, and more health implications are noted.[26]

Finally, the number of daytime naps is also a component of a good sleeping pattern. In fact, most children were found to stop daytime napping between ages 3 and 5 years. In mean, 1.7 naps were noted daily in 0 to 2 year-olds.[22]

Health effects of sleep: A systematic review including ten studies on infant sleep and cognition found that sleep was positively associated with the following: Memory, language and executive function. In the same review, 20 other studies pointed the positive roles that overall cognitive development in typically developing infants and young children. Sleep plays a role in the children's physical growth. It also noted that the current literature actually focuses more on weight gain and obesity instead of healthy growth. In fact, the existing evidence in the domains of cognitive and physical domains was mainly based on association studies, on parental reports, and on cross-sectional designs. On the other hand, these studies

omitted to use more objective sleep measures like polysomnography.[27]

Sleep disorders types & definition: Pediatric sleep disorders are different from adult ones in terms of clinical presentation, diagnosis, and management. These disorders include: Insomnia, restless legs syndrome, periodic limb movements of sleep, narcolepsy, sleep-related breathing disorders and Parasomnias[28], nightmares, enuresis, childhood hypersomnia[29], factors and complications of bad sleeping patterns. Some factors could explain insufficient sleep in adolescents: Exposure to artificial light at night, lack of physical activity, caffeine consumption, poor sleep hygiene, and family dynamics.[24] Inadequate quality or quantity of sleep can negatively affect children's daytime function in terms of: Behavior, cognitive development, academic performance, accidental injury (higher risk), emotional problems, neuropsychological functioning (becomes poorer in adolescence), blood pressure (higher).[22] Treatment: Implementing a bedtime routine seems a very beneficial and cost-effective way to reduce sleep disturbances and enhance healthy sleep, wellbeing, and development of the children.[30] A large study including more than ten thousand children from different ethnicities (Australia, New Zealand, Canada, China, Hong Kong, India, Japan, Korea, Malaysia, Philippines, Singapore, Thailand, United Kingdom, and United States) proved that, when the child had a regular and consistent bedtime routine at night, it was associated with better sleep outcomes: Earlier bedtimes, less night waking, shorter latency of sleep onset[31], higher sleep duration[31,32], reduced sleep problems as perceived by parents, and less daytime behavior problems.[31,33] Furthermore, other benefits of implementing a bedtime routine were language development, literacy, child emotional and behavioral regulation, parent–child attachment, and family functioning as well.[30] Moreover, pharmacological treatments are available to treat sleep disorders in children. These include several molecules with proven efficacy in enhancing children's sleep: Zolpidem, Eszopiclone, Diphenhydramine, Melatonin: showing the less secondary effects and the best outcomes so far as mentioned in a very recent systematic review that included 22 placebo-controlled randomized trials with a total of 1758 children involved.[34] Secondhand smoking and sleep disturbances: Although associated with increased obesity and poorer cognitive scores, secondhand smoking wasn't linked to prediabetes, to sleep-disordered breathing in a cross-sectional study consisting of 222 patients[35], or to the prevalence of sleep disorders in the United States of America (4). However, in another study that assessed 219 patients who were enrolled in a clinical trial, regular exposure to secondhand smoke was incriminated in" overall sleep disturbance ($p = 0.0002$), parasomnias ($p = 0.002$), longer sleep onset delay ($p = 0.004$), sleep disordered breathing ($p = 0.02$), daytime sleepiness ($p = 0.22$) (3). Another larger study, including 1592 patients highlighted the presence of a dose-response relationship between the frequency of secondhand smoking exposure with both increased restless sleep and decreased sleep duration. For sleep duration, when the frequency of secondhand exposure increased by one category, nighttime sleep duration decreased by 4 minutes during the week, and by 6 minutes during the weekend. Moreover, students reporting a low, medium, or high frequency of exposure to secondhand smoke also reported more frequent restless sleep by 1.53, 1.76, and 2.51 times, respectively.[36] Furthermore, a systematic literature review including 47 462 patients from 18 studies concluded that all the associations found between secondhand smoke and sleep-disordered breathing were evidence level 3b and pointed the need of higher-quality future studies.[37] However, a recent study in 2018 pointed the increased risk for worse sleep quality in asthmatic patients who had smoking caregivers, as well as the need to discuss environmental smoke exposure between family caregivers and the physicians regularly.[38] Finally, a large Japanese study including 84 988 adolescents revealed that secondhand smoke exposure was significantly ($p < 0.001$) associated with sleep disturbance in terms of difficulty to initiate sleep, difficulty to maintain it, early morning awakening and subjectively perceived insufficient sleep and short sleep duration.[39]

OBJECTIVES

Our study mainly aims to primarily evaluate the correlation between second hand smoke exposures and sleep disturbances in Lebanese children. Our secondary objectives were to evaluate the contribution of the socioeconomic status on second hand smoke exposure and sleep disorders in children. To assess the difference of the manifestation of sleep disorders of exposed children differs according to their age and gender, and to assess if there is a relationship between exposures to smoking during antenatal period and sleep pattern in children and to determine the prevalence of sleep disorders in Lebanese children.

SUBJECTS AND METHODS

Subjects

The study population consisted of children aged 4 to 12 years' old who had either smoking or nonsmoking parents. Our sample consisted of 400 children, divided in two equal groups: one consisting of children non-exposed to smoking and the other having smoking parents or relatives. They were recruited from the regions of Mount Lebanon and Beirut. The study included all the children aged from 4 to 12 years old, clinically and physically healthy; and without sex predilection. Children with chronic illness (chronic respiratory diseases, asthma...), handicaps and mental problems were excluded from the study.

Methods

It is an observational that used a questionnaire divided into 2 parts (sociodemographic and smoking exposure information, as well as Children's Sleep Habits

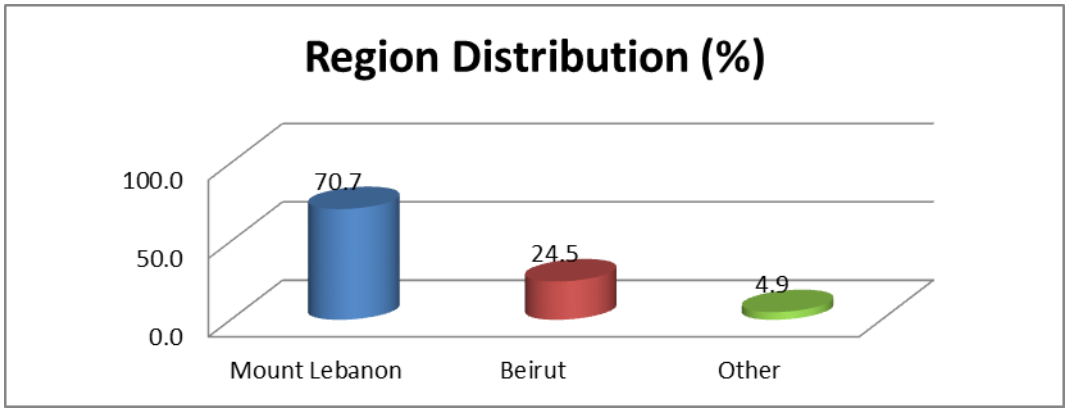
Questionnaire). These 2 parts were translated into validated Arabic versions, and was filled by medical students with interview based sessions. To be more objective we asked the surveyed parents to answer the most honestly possible without mentioning that our objective is to see the effect of smoke on the child health. As for variables, the datasheet we filled had several interest variables: Socio-demographic data (age, gender, educational level of the parents and their working status, region of residence, birth term, and the presence of chronic diseases), sleeping patterns which were evaluated by the Children's Sleep Habits Questionnaire (for sleeping patterns)[40], and the sleeping duration (in hours) in weekdays and weekends, including naps. Smoking exposure was rated by the parents. They informed us on the smoking in the presence of the child frequency, smoking area (indoor, outdoor), smoking type (cigarettes, water-pipe) and quantity, as well as the presence of a smoke source nearby the house (environmental exposure).

Statistical Analysis

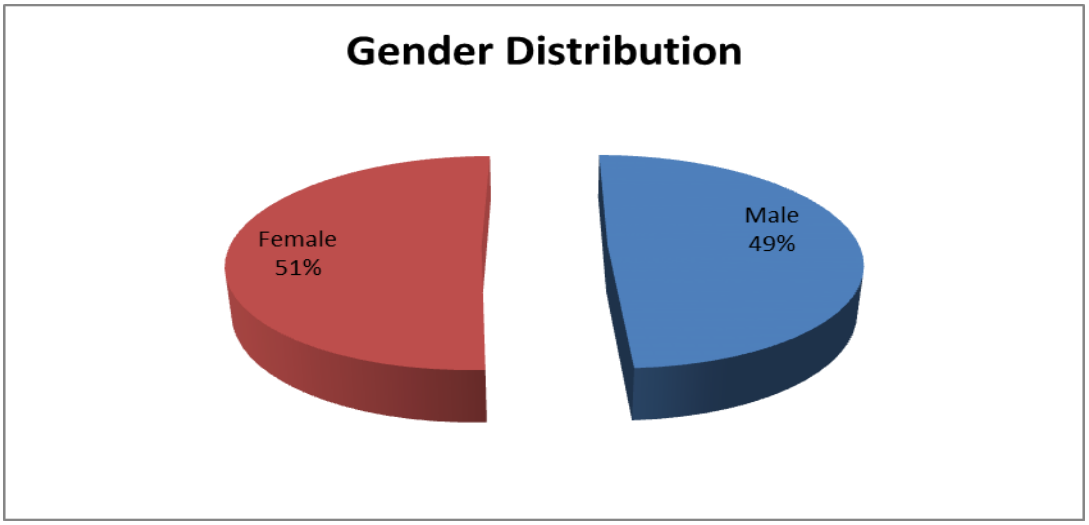
We used Excel for data entry and for the tables and graphs used as study results. We used SPSS version 21 for data analysis and statistical tests performance. A descriptive analysis was first done to assess sociodemographic factors, sleeping patterns and habits, as well as passive smoking exposure. Afterwards, since the dependent variables weren't normally distributed, we couldn't perform the Independent Samples Student T Test or the Anova test. That's why we used their non-parametric equivalents, respectively: Mann Whitney U test, and Kruskal-Wallis Test by Ranks. The significance level of these tests was admitted as p-value < 0.05. For the prevalence calculation, we used the formula: Prevalence = (Number of cases in a given period * 100 000) / Total population during the same period.[41] The prevalence calculated is a specific prevalence.

RESULTS

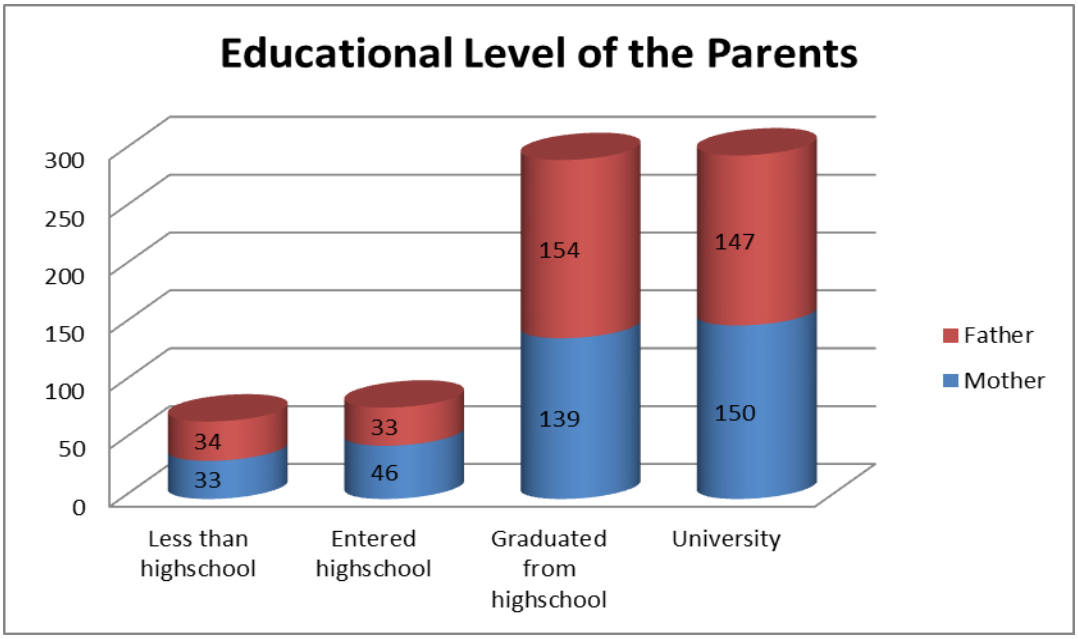
The prevalence calculation wasn't feasible in our study design because the kids were chosen based on their exposure status to smoking. Thus, any prevalence (even a specific one) wouldn't be representative of the population we targeted. Descriptive statistics and socio-demographic characteristics are shown in the following:



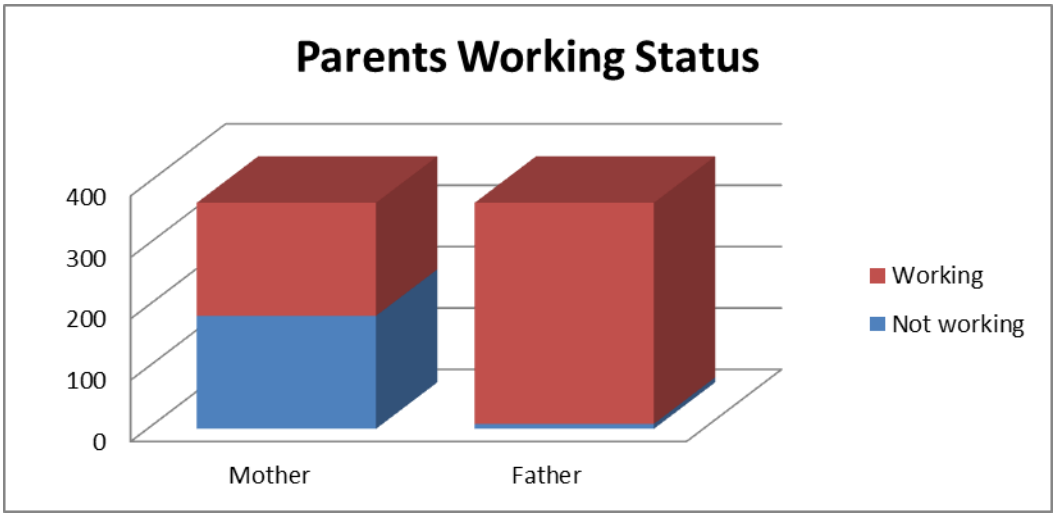
Graph 1: Majority of the sample (70%) were from Mount Lebanon.



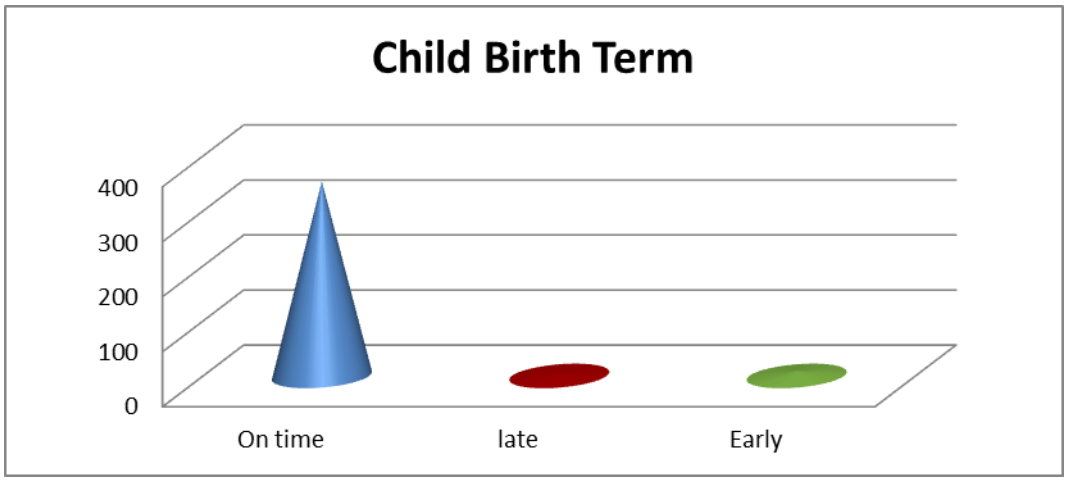
Graph 2: Half of patients were female (52%).



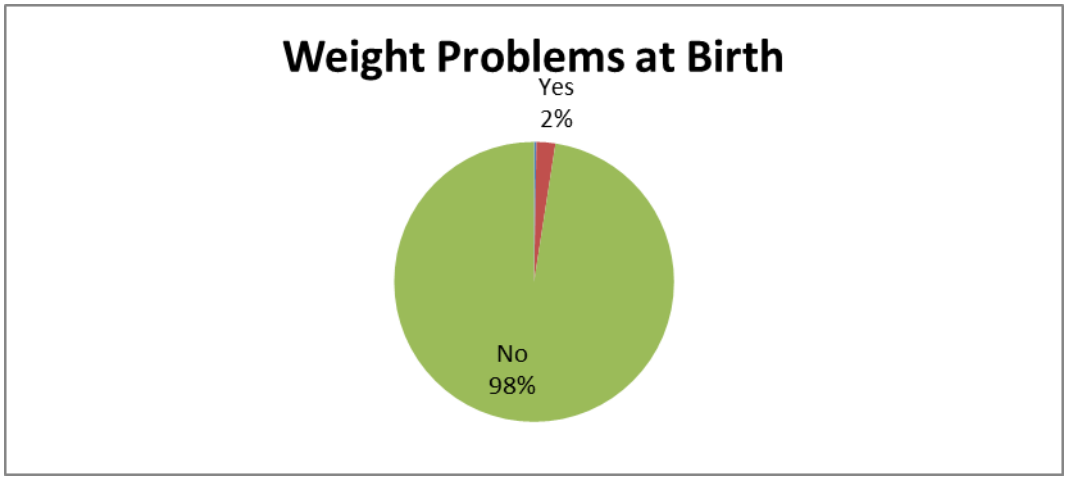
Graph 3: Only few parents had less than high school education, and that mothers and fathers' education is almost similar.



Graph 4: A slight minority of the kids' fathers weren't working whereas almost half of the mothers weren't working as shown by the graph 4 below.



Graph 5: The wide majority of the children were born on time.



Graph 6: 98% of the kids didn't have any weight problems at birth.

Sleeping patterns: (Table 1) shows that the children sleep around 8.76 hours in mean during weekdays and around 9.7 hours during weekends. The children wake up in mean around 6:39 am and sleep around 8:44 pm. Children's nap duration is about 40.69 minutes in mean. So a child spends in mean 10.23 hours a day asleep.

Table 1: Sleep Habits.

	Mean	Median	Mode	Std. Deviation	Min	Max
Sleeping time during weekdays	8.76	9.00	9	0.809	7	12
Sleeping time during weekends	9.70	10.00	10	0.947	7	12
Total number of the kid's sleeping hours per day	10.23	10.00	10	1.055	5	15
Duration (in minutes) of the kid's nap	40.69	40.00	60	34.008	0	180
Weekdays specific usual time when the kid wakes up	6.39	6.00	6	0.802	2	10
Weekends specific usual time when the kid wakes up	8.44	8.00	8	1.060	1	12

Table 2 shows that the majority of the children always sleep by their own in their own bed; often go to bed at the same time, sleep within 20 minutes afterwards, and have a fix sleep duration daily. The children sometimes resist going to bed on time, take a nap during the day, wake up by themselves in the morning, or wake up very early in the morning (before or on time). They rarely move a lot during sleep or wake up once during the night. The children seem to never sleep in the parents or brothers' bed, or sleep using some special movement, or need something special or their mother's presence to sleep, or wake up more than once during the night. They're never afraid to sleep in the dark in their majority, never move to another person's bed at night, nor do they press on their teeth while sleeping, or snore loudly, or wake up at night sweating or screaming, or look tired during the day or fall asleep while doing activities.

Table 2: Sleep Patterns.

	Never	Rarely	Sometimes	Often	Always
Children goes to bed at night at the same time	4	10	98	140	116
Children sleeps within 20 minutes after going to bed	9	28	101	162	**68**
Children sleeps by his own in his own bed	12	5	32	83	236
Children sleeps in the parents or brother's bed	232	63	60	4	9
Children sleeps using some special movements	329	12	21	3	3
Children needs something special to sleep (toy, blanket, teddy bear,...)	304	10	34	12	8
Children needs his mother's presence in the room to sleep	152	73	118	11	14
Children resists going to bed on time	79	74	174	33	8
Children is afraid of sleeping in the dark	264	49	34	10	11
Children has a fix sleeping duration daily	2	10	98	172	86
Children moves a lot during sleep	53	107	112	56	40

Children moves to another person's bed at night (mother, brother,...)	230	70	57	4	7
Children presses on his teeth while sleeping (the dentist might have informed you about it)	261	37	54	11	5
Children snores loudly	166	52	108	36	6
Children wakes up at night sweating screaming and in an unbearable state	312	36	17	2	1
Children takes a nap during the day	95	45	168	42	18
Children wakes up once during the night	67	163	114	13	11
Children wakes up more than once during the night	264	72	28	2	2
Children wakes up by himself	6	34	142	132	54
Children wakes up very early in the morning (before or on time)	54	80	187	28	19
Children looks tired during the day	208	49	104	3	4
Children falls asleep while doing activities	262	70	29	5	2

Smoking exposure: (Table 3) shows that almost half the patients (49.5%) weren't in contact with smokers. Waterpipe was the most frequent (20.1%) smoking exposure. 79.6% of our respondents didn't have any nearby smoking sources. Half (53.9%) of our respondents never smoked in the presence of the child, and 37% were aware of the smoking effects on the child.

Table 1: Smoking Exposure.

		Frequency	Percentage %
Smokers that are frequently in contact with children	None	182	49.5%
	Mother	18	4.9%
	Father	78	21.2%
	Others	9	2.4%
	1 or more smokers in the family	81	22.1%
Smoking type	None	182	49.5%
	Cigarettes	67	18.2%
	Water-pipe	74	20.1%
	Both	45	12.2%
Number of cigarettes per day	10 or less	52	14.1%
	11 – 20	45	12.2%
	21 – 30	11	3.0%
	31 or more	6	1.6%
	Missing	254	69.0%
Water-pipe minutes smoking per day	None	241	65.5%
	15 mins or less	18	4.9%
	15 - 30 mins	44	12.0%
	30 mins - 1 hour	46	12.5%
	> 1 hour	19	5.2%
Smoking area	None	182	49.5%
	Indoor	19	5.2%
	Outdoor	53	14.4%
	Both	114	40.0%
Presence of other nearby smoking sources	Missing	6	1.6%
	Yes	69	18.8%
	No	293	79.6%
Prenatal smoking exposure	Missing	8	2.2%
	Yes	84	22.8%
	No	276	75.0%
Smoking in the presence of the child	Yes, everyday	106	28.8%
	Rarely	64	17.4%
	Never	198	53.8%
Smoker aware of smoking effects on the child	Missing	181	49.2%
	Yes	136	37.0%
	No	51	13.9%

Factors affecting sleep patterns: Smoking in the presence of the child (p-value = 0.001), smoking type (p-value < 0.001), the educational level of the kid's parents (both mother p-value = 0.006, and father p-value < 0.001), as well as child birth term (p-value = 0.031), the presence of other nearby smoking sources (p-value = 0.007), and the prenatal smoking exposure status (p-value < 0.001) significantly affect the variation of the Child Sleep Habit Questionnaire, and thus the sleep patterns of the kids, as shown in (Table 4).

Table 2: Factors Affecting Sleep Patterns.

Null Hypothesis	Test	Sig.	Decision
The distribution of Child Sleep Habits Questionnaire is the same across categories of Smoking in the presence of the child	Independent-Samples Kruskal-Wallis Test	0.001	Reject the null hypothesis
The distribution of Child Sleep Habits Questionnaire is the same across categories of Gender	Independent-Samples Mann-Whitney U Test	0.413	Retain the null hypothesis
The distribution of Child Sleep Habits Questionnaire is the same across categories of Educational level of the mother	Independent-Samples Kruskal-Wallis Test	0.006	Reject the null hypothesis
The distribution of Child Sleep Habits Questionnaire is the same across categories of Educational level of the father	Independent-Samples Kruskal-Wallis Test	<0.001	Reject the null hypothesis
The distribution of Child Sleep Habits Questionnaire is the same across categories of Child birth term	Independent-Samples Kruskal-Wallis Test	0.031	Reject the null hypothesis
The distribution of Child Sleep Habits Questionnaire is the same across categories of Weight problems at birth	Independent-Samples Kruskal-Wallis Test	0.083	Retain the null hypothesis
The distribution of Child Sleep Habits Questionnaire is the same across categories of Presence of chronic disease.	Independent-Samples Mann-Whitney U Test	0.389	Retain the null hypothesis.
The distribution of Child Sleep Habits Questionnaire is the same across categories of Smoking type	Independent-Samples Kruskal-Wallis Test	<0.001	Reject the null hypothesis
The distribution of Child Sleep Habits Questionnaire is the same across categories of Presence of other nearby smoking sources	Independent-Samples Kruskal-Wallis Test	0.007	Reject the null hypothesis
The distribution of Child Sleep Habits Questionnaire is the same across categories of Prenatal smoking exposure	Independent-Samples Kruskal-Wallis Test	<0.001	Reject the null hypothesis

Factors affecting sleep duration: (Table 5) shows the factors that affect the kids sleep duration. Educational level of the mother (p-value = 0.004) and the father (p-value = 0.031), as well as prenatal smoking exposure (p-value = 0.043) significantly affect the distribution of the kids' total sleeping hours.

Table 3: Factors affecting the total number of the kid's daily sleeping hours.

Null Hypothesis	Test	Sig.	Decision
The distribution of Total number of the kid's sleeping hours per day is the same across categories of Gender	Independent-Samples Mann-Whitney U Test	0.727	Retain the null hypothesis
The distribution of Total number of the kid's sleeping hours per day is the same across categories of Educational level of the mother	Independent-Samples Kruskal-Wallis Test	0.004	Reject the null hypothesis
The distribution of Total number of the kid's sleeping hours per day is the same across categories of Educational level of the father	Independent-Samples Kruskal-Wallis Test	0.031	Reject the null hypothesis
The distribution of Total number of the kid's sleeping hours per day is the same across categories of Child birth term	Independent-Samples Kruskal-Wallis Test	0.552	Retain the null hypothesis
The distribution of Total number of the kid's sleeping hours per day is the same across categories of Weight problems at birth	Independent-Samples Kruskal-Wallis Test	0.14	Retain the null hypothesis
The distribution of Total number of the kid's sleeping hours per day is the same across categories of Presence of chronic disease.	Independent-Samples Mann-Whitney U Test	0.663	Retain the null hypothesis.
The distribution of Total number of the kid's sleeping hours per day is the same across categories of Prenatal smoking exposure	Independent-Samples Kruskal-Wallis Test	0.043	Reject the null hypothesis
The distribution of Total number of the kid's sleeping hours per day is the same across categories of Smoking in the presence of the child	Independent-Samples Kruskal-Wallis Test	0.537	Retain the null hypothesis
The distribution of Total number of the kid's sleeping hours per day is the same across categories of Smoking in the presence of the child (dichotomic)	Independent-Samples Mann-Whitney U Test	0.277	Retain the null hypothesis

DISCUSSION

We conducted an observational study to assess the effects of smoking on the sleeping patterns and duration of children in Lebanon. The majority of our sample (70%) was from Mount Lebanon. This was expected since the recruitment was done in Mount Lebanon and Beirut. Only few parents had less than high school education, and that mothers and fathers' education is almost similar. This is explained by the Lebanese culture that encourages educational achievement for both

genders, especially in the last decades. Our results also show that a slight minority of the kids' fathers weren't working whereas almost half of the mothers weren't working despite their equal educational achievement. This could be either due to the oriental culture where the child's education is mainly the women's responsibility, and where women's work is a new trend. The children slept around 8.76 hours in mean during weekdays and around 9.7 hours during weekends. A kid's nap duration is about 40.69 minutes in mean. So the Lebanese kid spends in mean 10.23 hours a day asleep. In fact, because the individual needs vary from a person to another, and a good sleep includes quality, timing, and duration[24], there is no "magical formula" for sleep duration.[23,25] However, in terms of quantity, the mean reference values and ranges for sleep duration were close to our results: a) 11.9 hours per day (9.9–13.8) in toddlers and preschoolers aged 2 to 5 years old, b) 9.2 hours per day (7.6–10.8) in children aged between 6 and 12 years old.[26] Another study also noted that the total sleep duration decreased across the years because of the increasing later bedtime across decades faced by an unchanged wake time.[21] Our results suggest that parents' educational level significantly affected their children's sleep duration. This joins other finding where socioeconomic status of the parents significantly impaired their children's sleep duration.[42] This could also be attributed to higher knowledge of sleep benefits.[43] Prenatal smoking exposure significantly affects the children's total sleeping hours. This joins others studies' findings who were able to demonstrate significant sleep duration in those exposed to prenatal smoke.[44,45] Smoking in the presence of the child was found to affect his sleeping patterns significantly. It was proven that having a smoking caregiver elevates the risk of sleep disorders.[38] The presence of other nearby smoking sources also significantly affects the variation of the Child Sleep Habit Questionnaire, and thus the sleep patterns of the kids. This joins the findings of a systematic review that concluded that environmental pollution was incriminated in worse sleep-disordered breathing.[46] The educational level of the kid's parents significantly affected the kids' sleep patterns. This could be due to the fact that being less educated increased the risk of smoking in parents[10], and smoking itself was correlated with the sleep disturbances in children[3,36–39] Moreover, the prenatal smoke exposure was also significantly affecting the variation of the Children's Sleep Habits Questionnaire. This finding matches several studies that were able to demonstrate a similar significant association.[44,47,48]

Study Strength

This study included a large sample size consisting of 400 kids from Beirut and Mount Lebanon areas, divided in two groups: that of nonsmoking parents, and another of smoking parents. In a population like ours, where the smokers are a big majority, finding kids with nonsmoking caregivers was a big challenge, and a real strength for the current study that succeeded to recruit them. Moreover, we were able to determine sleep duration, sleeping patterns, and correlated factors in the kids aged between 4 and 12 years old, and realized our primary objective, as well as most of the secondary ones.

Study Limitations

Although this study had much strength, some limitations are to be however mentioned. We were unable to determine the prevalence of sleep disorders in 4 to 12 years old children due to the study design. In fact, the recruitment done on purpose divided in two groups (exposed v/s non-exposed to smoking) in order to be able to assess the correlation between sleep disorders and smoking exposure. However, this was a secondary objective of the study so further future studies could target this objective in order to get a representative prevalence for the Lebanese population. Moreover, a social desirability bias could have distorted the reality, although we tried not to tell the surveyed parents about the study objectives. Parents who were in majority aware that smoking affects their kids' health negatively could have been more prone to report lower exposure rates of smoking in their children, and lower sleep disturbances to give a better image of their kids. Also, let's not forget that the recruitment was also done by medical students who had to introduce themselves to the parents, and this could have also affected their answers. However, an objective evaluation of smoking exposure through nicotine levels testing, or of sleep disturbances weren't possible due to lack of budget.

Study Perspectives

This study contributes in raising family awareness about the potential harm of second hand smoke and its impact on possible sleep disorders in children. We also hope that we were able to provide enough evidence to send recommendations to the Ministry Of Health for sleep disorder screening and their early detection in such children, though there still is a need for larger studies to target screening timing, feasibility, and economical benefit.

CONCLUSION

Educational level and prenatal smoking exposure were significantly associated with sleep duration of the Lebanese children. This study contributes in raising family awareness about the potential harm of second hand smoke and its impact on possible sleep disorders in children. Also highlight the factors that should be targeted in order to limit the damage of second hand smoke and damaged sleep in these children.

Recommendations

The feasibility and benefit of screening effect on Lebanese children for second hand smoke should also be assessed. Future studies could target the evaluation of the sleep disorders prevalence in the Lebanese kids, as well as interventions to limit exposure to smoking in kids and early detection of sleep disturbances in those at high risk.

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