

The use of a feather quilt, childhood asthma and allergic rhinitis: a prospective cohort study

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Summary

Background Feather bedding has long been considered as a potential source of allergen exposure and thus a potential risk factor for allergic diseases. However, recent cross-sectional studies have reported a higher risk of allergic diseases among users of synthetic bedding compared with feather-bedding users.

Objective To explore associations between early life exposure to feather bedding and the risk of developing asthma allergic rhinitis in childhood.

Methods We assessed the association between early life exposure to feather quilts and the risk of bronchial obstruction during the first 2 years of life and asthma and allergic rhinitis in a prospective 4-year cohort study of 2531 Norwegian children.

Results At the age of 6 months, 24% of the children had a quilt with feathers, decreasing to 20% at the age of 2 years. The adjusted odds ratio for bronchial obstruction 0 to 2 years by exposure to a feather quilt at the age of 6 months was 0.59, 95% confidence interval 0.41 to 0.86, for asthma at the age of 4 years 0.38, 0.23 to 0.64 and for allergic rhinitis at the age of 4 years 0.73, 0.43 to 1.18.

Conclusion The use of a feather quilt in early life does not seem to increase the risk of asthma and allergic rhinitis later in childhood.

Keywords allergic rhinitis, asthma, childhood, epidemiology, feather bedding, feather quilt

Submitted 30 August 2001; revised 22 November 2001; accepted 25 February 2002

Introduction

Feather pillow and bedding have long been considered as potential sources of allergen exposure. Therefore, it has been common to advise persons, especially those with allergies or conditions predisposing to allergies, to avoid the use of feather bedding, even if the evidence for such advice is not strong [1–3]. Recent results of several cross-sectional studies have shown that synthetic bedding is positively associated with several respiratory health outcomes [4–10]. Further, synthetic pillows seem to contain higher concentrations of several types of allergens compared with feather pillows [11–15]. In the light of these controversial findings, the scientific basis for recommending non-feather or synthetic bedding is weak.

In the Oslo Birth Cohort Study we collected prospectively information on the use of feather quilts when the children were aged 6 months, 1 year and 2 years [16]. This made it possible to elaborate prospectively the relations between bedding habits and the risk of bronchial obstruction during the first 2 years of life and asthma and allergic rhinitis by the age of 4 years.

Methods

Study population

The source population included children born in the two main birth clinics in Oslo during a 15-month period during 1992 to 1993. The Oslo Birth Cohort included at the baseline a total of 3754 children. We conducted a follow-up of these children at the age of 6, 12, 18 and 24 months [16,17] and a 4-year follow-up as part of a population-based cross-sectional study directed at all 4-year-old children living in Oslo in 1996 [18–20]. The mean age at the last follow-up was 4.3 years (SD 0.3). The eligibility criteria and data collection procedure for the children's first 2 years of life are described in detail elsewhere [16]. The follow-up rate was 81% ($n = 3048$) at the age of 2 years and 67% ($n = 2594$) at the age of 4 years if restricted to children from whom we received filled-in questionnaires from all follow-ups. After excluding those with missing information on respiratory health outcomes of interest, the study population followed for 4 years comprised 2531 children. The Norwegian Data Inspectorate approved the study.

Health outcomes

The primary outcomes were bronchial obstruction during the first 2 years of life and current asthma and allergic rhinitis at the age of 4 years. Bronchial obstruction during the first 2 years of life was defined as two or more episodes with symptoms and

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signs of obstruction or one episode lasting more than 1 month during the first 2 years of life [16,21]. Several procedures were used to identify and confirm these episodes. At least one of the episodes had to be diagnosed by a physician, and the guidelines were that at least three out of five symptoms or signs (wheezing, chest recession, rhonchi during auscultation, forced expiration and rapid breathing) should be observed. Current asthma and allergic rhinitis (nose- or eye-related allergy, including hay fever) were defined on the basis of answers to the 4-year follow-up questionnaire. Both outcomes had to be diagnosed by a physician, and current disease meant that the child had to have experienced symptoms of the disease during the previous 12 months.

Bedding

The determinant of interest was the presence of feather bedding in early life. We collected information on the type of quilt in the 6-, 12- and 24-month follow-up questionnaire. The parents or guardians were asked to mark the material used in the child's quilt with the following alternatives: feather, synthetic material or other. Reports of synthetic and other material were in most analyses collapsed to non-feather quilt.

Covariates

We obtained information on covariates and potential confounders from the questionnaires and hospital records. Parental atopy (parental asthma or hay fever) and gender were used as indicators of genetic propensity (i.e. the presence of genetic markers that predict the disease of interest). Maternal age at delivery, birth order, maternal education (number of years), family income per year (Norwegian kroner (NOK)), environmental tobacco smoke (ETS) exposure at birth (yes/no), pets at home at birth (yes/no), length of breastfeeding and an episode of lower respiratory tract infection during first year of life [17] were used as indicators of social and environmental exposures. Birth weight was used as an indicator of fetal growth, and atopic eczema at the age of 6 months as an indicator of early life atopy.

Length of breastfeeding was categorized into 0 to 6 months and more than 6 months. Exposure to environmental tobacco smoke was defined as living with one or more smokers.

Statistical methods

First, we assessed the frequency of use of quilts at 6, 12 and 24 months in total and in different categories of several of the covariates. Secondly, we studied the relationship between type of quilt at 6 months, 0 to 1 years and 0 to 2 years of age, and health outcomes before and at the age of 4 years. We compared the risk of experiencing bronchial obstruction in the first 2 years and the risk of asthma at 4 years of age in different exposure categories during the first 12 and 24 months of life. Thirdly, we elaborated to what extent the association between the use of a feather quilt and the health outcomes could be explained by selection in bedding habits related to socioeconomic factors, environmental exposure, or awareness caused by disease development or predisposition. We used odds ratio as a measure of association and effect. Logistic regression analysis was applied and these relations were elaborated in models including different covariates as well as in analyses in different strata of socioeconomic level, environmental exposure and disease development or predisposition. Due to missing values for

some of the variables, we explored models that included categories for missing values to maintain all cases in the analysis and models excluding cases with missing values for one or more conditions. Both approaches gave similar results and only results of the first approach are presented.

Results

The characteristics and early exposure of the children followed for 4 years and those of the baseline and 2-year cohort were similar (Table 1). At the age of 6 months, 24% of the children had a quilt with feather, while 76% had non-feather (71% synthetic and 5% other). The use of feather quilts was slightly reduced from birth to the age of 2 years. Atopic parents and parents of children with early life atopic eczema were slightly less likely to choose feather quilts for their children compared with those without atopy and children without early life

Table 1. Percentage of children with a feather quilt at the age of 6, 12 and 24 months in total and according to parental atopy, atopic eczema at the age of 6 months, maternal education, family income, pets at home at birth, maternal age and birth order

	<i>n</i>	6 months (%)	12 months (%)	24 months (%)
Total	2531	24.0	20.7	19.9
Parental atopy		*	*	*
No	1656	26.4	23.0	22.9
Yes	875	19.4	16.2	14.2
Atopic eczema at the age of 6 months (missing: 163)				*
No	1993	24.8	21.5	20.9
Yes	375	20.4	17.0	13.2
Maternal education (missing: 19)			*	*
< 12 years	119	21.4	17.5	19.0
12–15 years	914	22.2	15.8	16.6
+ 15 years	1479	25.1	23.7	21.7
Family income per year (NOK) (missing: 35)			*	*
< 200 000	330	26.1	24.0	21.6
200–500 000	1668	22.7	19.1	18.0
> 500 000	498	26.6	23.4	23.4
Pets at home at birth (missing: 23)				
No	1945	23.7	21.1	20.3
Yes	563	24.4	18.7	18.0
Maternal age			*	
< 25 years	241	21.2	15.7	16.0
25–29 years	898	22.4	18.5	19.3
30–34 years	950	24.3	22.5	20.7
35+ years	442	28.1	23.5	21.4
Birth order:				
First	1332	23.7	20.2	19.9
Second	904	23.8	20.0	18.8
Third or later	295	26.0	24.5	23.0

Missing information on quilt: 85 (6 months), 67 (12 months) and 31 (24 months). * Indicates that the association between the variable and the use of quilt is statistically different ($P < 0.05$, χ^2 test).

Table 2. The absolute and relative risk (adjusted odds ratio (aOR)) (reference category: no symptoms) of bronchial obstruction during the first 2 years of life and asthma and allergic rhinitis at the age of 4 years by bedding habits in early life

	<i>n</i>	Bronchial obstruction 0 to 2 years			Asthma at the age of 4 years			Allergic rhinitis at the age of 4 years		
		Risk	aOR	95%CI	Risk	aOR	95%CI	Risk	aOR	95%CI
Quilt 6 months										
Non-feather	1859	0.097	1		0.073	1		0.046	1	
Feather	587	0.060	0.61	0.40–0.93	0.029	0.43	0.25–0.73	0.036	0.92	0.56–1.52
Quilt 0–12 months										
Always non-feather	1692	0.103	1		0.078	1		0.050	1	
Non-feather to feather	123	0.033	0.48	0.16–1.42	0.024	0.38	0.13–1.25	0.024	0.59	0.18–1.96
Feather to non-feather	199	0.070	0.71	0.38–1.32	0.040	0.55	0.26–1.15	0.030	0.69	0.29–1.65
Always feather	371	0.054	0.52	0.31–0.89	0.024	0.34	0.17–0.69	0.038	1.04	0.57–1.90
Quilt 0–24 months										
Always non-feather	1582	0.104	1		0.078	1		0.051	1	
Both	516	0.076	0.87	0.58–1.32	0.054	0.77	0.49–1.20	0.041	0.98	0.58–1.64
Always feather	261	0.031	0.28	0.13–0.60	0.004	0.06	0.01–0.40	0.019	0.56	0.22–1.42

aORs adjusted for the covariates listed in methods.

eczema. Family income and high maternal education were also significantly associated with the use of feather quilts, while ownership of pets at birth was not. Changes in bedding habits were quite common during the first 2 years, including both changes from feather to non-feather and vice versa (Table 2).

During the first 2 years of life, 8.9% of the children experienced bronchial obstruction and by the age of 4 years, 9.6% had received a physician's diagnosis of asthma and 5.5% allergic rhinitis. Current asthma was reported for 6.5% and current allergic rhinitis for 4.6% of the children.

Feather quilt and respiratory health

The risk of developing bronchial obstruction during the first 2 years of life (odds ratio 0.59, 95% confidence interval 0.41–0.86), as well as having asthma (0.38, 0.23–0.64) and allergic rhinitis at the age of 4 years (0.73, 0.43–1.18) were lower in children with a feather quilt at the age of 6 months compared with those with a non-feather quilt (Table 2). Table 2 also compares the risks of the studied health outcomes according to presence of feather quilt in different time periods. In general the risks were lowest in children with a feather quilt throughout the 2 first years, second lowest with a feather quilt part of the time and highest with a non-feather quilt all the time. Analyses without a category for missing values gave less than 0.1 changes on odds ratio, except in one case for allergic rhinitis at the age of 4 years in which the odds ratio was reduced with 0.2.

Table 3 shows the adjusted odds ratios for the studied relations. The odds ratios between the different categories still showed a reduced risk of developing bronchial obstruction and asthma if the child had been exposed to feather compared with non-feather quilt. We also performed parallel analyses, including only children with a confirming answer to the questions of having feather or synthetic quilt, and excluding those whose bedding was marked in the 'other' category. These analyses gave equal risks between feather and synthetic quilt as between feather and non-feather quilt (figures not given).

The associations between feather quilt and the studied health outcomes were further explored in different strata of children according to socioeconomic conditions, environmental exposure

and disease development or predisposition. In general, the associations between asthma and bronchial obstruction and feather quilt remained negative (statistically significant) in the largest strata, while for the smaller strata this was not always the case. To further explore associations between changes in bedding habits and disease development became difficult because of low statistical power when dividing the material further.

Discussion

In our prospective cohort study, we found that the risk of bronchial obstruction during the first 2 years of life and asthma at the age of 4 years were negatively associated with the use of feather quilt during the first years of life. The association did not seem to be confounded by disease development/predisposition, other environmental exposures or socioeconomic conditions.

There has been an extensive debate about the role of bedding materials in the development of respiratory diseases in children. The main reason for this is that a series of cross-sectional and case control studies have consistently indicated that feather bedding has a protective effect on disease development [1–10]. This finding is somewhat in contrast with earlier beliefs that feather bedding increases allergen exposure and disease development [1–3].

Selection bias could be a major source of error, if the choice of bedding material was related to the child's propensity to or early symptoms and sign of disease development. Information bias would be introduced if disease status influenced the information on past exposure. Cross-sectional and case control studies focusing on the relations between current exposure and outcome are most vulnerable to such bias. The major strength of the present prospective cohort study includes reduction of the possibility of selection bias and elimination of information bias as exposure information was collected before disease development. Further, the study was carried out in a country with a cold climate. This makes it necessary to use quilts with a high isolation capacity during most of the year, favouring the view that exposure through quilt use could be an important source of exposure.

Table 3. The absolute and relative risk (adjusted odds ratio, OR) (reference category: no symptoms) of bronchial obstruction during the first 2 years of life and asthma and allergic rhinitis at the age of 4 years by bedding habits in early life in total and in different strata of indicators of selection propensity

Quilt at 6 months	n	Bronchial obstruction 0 to 2 years			Asthma at the age of 4 years			Allergic rhinitis at the age of 4 years		
		Risk	aOR	95%CI	Risk	aOR	95%CI	Risk	aOR	95%CI
Total										
Non-feather	1859	0.097	1		0.073	1		0.046	1	
Feather	587	0.060	0.62	0.40–0.93	0.029	0.43	0.25–0.73	0.036	0.92	0.56–1.52
Parental atopy										
No										
Non-feather	1174	0.083	1		0.056	1		0.035	1	
Feather	422	0.047	0.53	0.31–0.92	0.021	0.34	0.17–0.71	0.026	0.88	0.44–1.76
Yes										
Non-feather	685	0.120	1		0.101	1		0.072	1	
Feather	165	0.091	0.78	0.41–1.49	0.048	0.57	0.26–1.26	0.061	1.13	0.54–2.38
Atopic eczema										
No										
Non-feather	1467	0.089	1		0.053	1		0.027	1	
Feather	484	0.052	0.53	0.36–0.86	0.027	0.50	0.27–0.93	0.029	1.18	0.63–2.21
Yes										
Non-feather	296	0.132	1		0.166	1		0.159	1	
Feather	76	0.105	1.05	0.40–2.72	0.039	0.24	0.07–0.81	0.092	0.69	0.29–1.66
Maternal education										
< 12 years										
Non-feather	88	0.068	1		0.080	1		0.080	1	
Feather	24	0.083	1.92	0.27–13.80	0.125	2.51	0.40–15.53	0.083	2.59	0.34–19.50
12–15 years										
Non-feather	685	0.120	1		0.085	1		0.057	1	
Feather	195	0.067	0.57	0.29–1.15	0.036	0.46	0.20–1.04	0.036	0.71	0.30–1.67
> 15 years										
Non-feather	1076	0.086	1		0.065	1		0.041	1	
Feather	361	0.055	0.57	0.32–0.99	0.019	0.28	0.12–0.64	0.033	0.90	0.45–1.80
Family income										
Low										
Non-feather	229	0.105	1		0.074	1		0.061	1	
Feather	81	0.086	1.00	0.34–2.92	0.037	0.48	0.12–1.87	0.012	0.32	0.04–2.72
Medium										
Non-feather	1253	0.098	1		0.076	1		0.048	1	
Feather	368	0.054	0.55	0.32–0.93	0.030	0.40	0.21–0.78	0.038	0.95	0.52–1.76
High										
Non-feather	354	0.079	1		0.057	1		0.045	1	
Feather	128	0.047	0.57	0.20–1.59	0.016	0.31	0.07–1.37	0.031	0.63	0.16–2.35
Pets										
No										
Non-feather	1491	0.096	1		0.079	1		0.053	1	
Feather	464	0.056	0.60	0.38–0.97	0.024	0.33	0.17–0.62	0.041	0.98	0.57–1.67
Yes										
Non-feather	367	0.101	1		0.049	1		0.030	1	
Feather	123	0.073	0.68	0.28–1.66	0.049	1.12	0.41–3.03	0.016	0.62	0.13–3.10

aORs adjusted for the covariates listed in methods.

The main finding was a negative association between bronchial obstruction at 0–2 years and asthma at the age of 4 years and feather bedding. It is unlikely that the finding can be explained by postnatal selection. Further, it confirms findings from several cross-sectional studies [4–10]. For allergic rhinitis the associations were weak and difficult to interpret. This could have been caused by the low occurrence of allergic rhinitis, which resulted in low power of the analysis, or that allergic

rhinitis at this age is mainly or more strongly associated with outdoor allergen exposure. Taking into account the changes in bedding habits during the first 2 years of life, the analyses show that children using feather quilts, and particularly those who used feather quilts for the whole period, had a lower risk of developing asthma and bronchial obstruction. The highest risk was seen in children who consistently used non-feather quilts. These findings indicate that the negative association shown by

several cross-sectional studies is not likely to be explained by information bias.

These results are consistent with the hypothesis that the use of synthetic quilts in early life is related to some type of harmful exposure. However, an alternative explanation is that parents preferring feather quilts in some way have children with less risk of disease development [22]. We identified indicators that could be related to this parental preference, including socioeconomic and environmental factors and factors related to disease propensity. In the analyses, we elaborated in two ways how these factors influenced the relations between feather quilts and the studied health outcomes. First, we adjusted for the factors in multiple logistic regression analysis. Secondly, we performed analyses stratified by these factors. In general, the association between the use of feather quilts and the studied health outcomes remained negative, even if there were indications that these factors could be related to parents' choice of bedding material. The findings thus do not support the hypothesis that prenatal selection is a serious threat to the validity. However, controlling for parental atopy, atopic eczema in childhood and socioeconomic factors may not be sufficient to fully eliminate pre-birth selection bias that in principal could have lasted for generations.

Several changes in bedding took place between 6 months and 2 years. The risk of disease development among these children was in general lower than among children constantly being exposed to non-feather quilts and higher than in children constantly exposed to feather quilts. We were not able to decipher to what extent disease development was the cause of changes in bedding practice, but this should not affect the relation between bedding habits and disease development when the information on bedding habits is collected before the disease development. Information from bedding exposure at guardians and the use of pillows was not collected in this study. Few Norwegian children attend daycare outside home before their second year of life because of a 1-year full governmental paid maternity leave and the use of a pillow is rare in early life. These exposures were thus not relevant for most of our analyses. If there were any effect of these exposures, they would most likely weaken the association between early life exposure to feather quilts and the health outcomes.

Conclusion

Minimizing the possibility of information bias and postnatal selection with a prospective study design, we found negative associations between feather quilts and obstructive respiratory conditions. Consideration of several conditions that could have indicated pre-birth selection of the type of bedding did not strengthen the concern of pre-birth selection. To totally exclude the possibilities of pre-birth selection will demand prospectively collected information on exposure and reasons for choice of bedding type long before children are born or a randomized controlled intervention study. The evidence from the previous and the present study does not support a general recommendation against feather bedding.

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