



Exploration of environmental risk factors for asthma in 5-year-old Dutch twins



Toos van Beijsterveldt & Dorret Boomsma

BACKGROUND & AIM

Over the past three decades, the prevalence of childhood asthma has increased substantially. It has been hypothesized that environmental risk factors, such as parental smoking, and air pollution are responsible for this increase. However, a consistent finding from twin studies is that the environment shared by family members does not contribute to the variation in susceptibility to asthma. The minor role of environmental factors seems remarkable and can probably be explained by gene-environment interactions.

Aim of the study is to explore various environmental factors that may serve as potential environmental modifier of genetic and environmental influences on asthma.

METHODS

- The study included about 11,000 twin pairs from an ongoing longitudinal study of the Netherlands Twin Registry (NTR), who were born between 1986 and 2000.
- Information on possible environmental risk factors were obtained at ages 1, 2 and 5.
- At age 5, information on asthma was obtained by parental report. Parents were asked whether a physician had ever diagnosed asthma.
- To test the role of environmental factors as possible modifier of genetic and environmental influences on asthma we compared the ratio of MZ/DZ pairwise concordance across each level of the environmental factors.
- Pairwise concordance was calculated as $C/(C+D)$, where C is the total number of concordant affected pairs and D is the total number of discordant pairs.

CONCLUSION

- Analyses revealed gestational age as possible environmental modifier of genetic and environmental influences on asthma. Shared environmental factors may play a role in the variability in susceptibility to asthma in children with a gestational age of less than 32 weeks and not in children with a longer gestational age.

RESULTS

Table I: Frequency and odds-ratio (OR) for asthma according to baseline characteristics and possible environmental risk factors

	% asthma	OR	95% CI
SEX			
males	10,3	1	
females	7,2	0,67	(0,59 - 0,77)
ZYGOSITY			
MZ	8,9%	1	
DZ	8,7%	0,97	(0,84-1,11)
BIRTH COHORT			
1986-1989	5,2%	1	
1990-1992	7,5%	1,48	(1,15-1,92)
1993-1995	10,2%	2,08	(1,64-2,65)
1996-1998	10,4%	2,13	(1,68-2,70)
1999-2000	9,2%	1,86	(1,41-2,47)
EDUCATIONAL LEVEL			
low	8,3%	1	
medium	8,9%	1,08	(0,92-1,28)
high	9,2%	1,12	(0,92-1,36)
GESTATIONAL AGE			
\geq 37 weeks	7,1%	1	
\geq 32 and 37 weeks	10,9%	1,61	(1,40-1,85)
< 32 weeks	15,7%	2,45	(1,88-3,20)
SMOKING PREGNANCY			
no	8,6%	1	
yes	9,6%	1,15	(0,99-1,34)
CURRENT SMOKING			
no	8,5%	1	
yes	9,1%	1,08	(0,94-1,24)
ELDERLY SIBS			
no	8,8%	1	
yes	8,6%	0,971	(0,85-1,11)
BREAST FEEDING			
no	8,7%	1	
0,5-3 months	8,6%	0,98	(0,83-1,15)
>3 months	8,9%	1,1	(0,84-1,23)
CHILD CARE OUTSIDE HOME			
no	7,5%	1	
little	8,6%	1,16	(0,98-1,37)
medium	11,2%	1,55	(1,21-1,99)
high	9,4%	1,27	(0,95-1,79)

Table II: Pairwise concordance for asthma according to zygosity and environmental risk factors

	PC* MZ pairs	PC* DZ pairs	MZ/DZ ratio (95% CI)
BIRTH COHORT			
1986-1989	46,3	14,4	3,21 (1,81-5,69)
1990-1992	53,9	14,7	3,68 (2,48-5,45)
1993-1995	64,2	19,9	3,23 (2,47-4,22)
1996-1998	55,8	19	2,94 (2,25-3,85)
1999-2000	60,8	19,4	3,13 (2,07-4,75)
EDUCATIONAL LEVEL MOTHER			
low	56,8	17,8	3,19 (2,39-4,26)
middle	59,3	17,1	3,46 (2,68-4,47)
high	55	19,8	2,77 (1,97-3,91)
GESTATIONAL AGE			
\geq 37 weeks	53,7	15,6	3,44 (2,73-4,33)
\geq 32 and 37 weeks	60,7	18,2	3,34 (2,63-4,22)
< 32 weeks	66,7	37,9	1,76 (1,19-2,61)
SMOKING DURING PREGNANCY			
no	54,1	17,5	3,09 (2,58-3,70)
yes	69,1	19,8	3,49 (2,62-4,63)
CURRENT SMOKING			
no	56,3	18,1	3,11 (2,53-3,81)
yes	60	17,4	3,44 (2,70-4,39)
ELDERLY SIBS			
no	55,5	18,6	2,98 (2,41-3,67)
yes	58,9	17,9	3,29 (2,62-4,13)
BREAST FEEDING			
no	55,4	17	3,27 (2,61-4,08)
0,5-3 months	67,4	17,3	3,90 (2,86-5,33)
>3 months	50,8	23,5	2,16 (1,48-3,16)
CHILD CARE OUTSIDE HOME			
no	55,6	17,4	3,19 (2,25-4,53)
low	59,1	17,7	3,34 (2,71-4,10)
medium	55,8	19,4	2,87 (1,80-4,58)
high	51,7	19,5	2,65 (1,49-4,71)

* note: PC refers to pairwise concordance

Acknowledgments: This work was supported by a grant of the Netherlands organization for Scientific Research (P.I. Boomsma: Grant 904-57-094; Grant 575-25-006).