

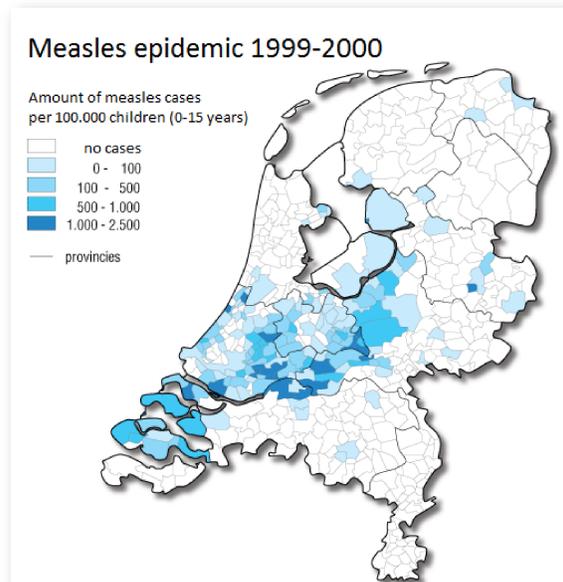
# Who escaped the measles epidemic?

## A case-control study among unvaccinated orthodox Protestants in The Netherlands

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### Background

In the Netherlands measles epidemics periodically occur among unvaccinated orthodox Protestants, a socially and geographically clustered minority group.

- In the 2013/2014 measles epidemic, 17% of the cases was adolescent or adult (>14 years of age).
- Measles at older age is related to an increased risk of complications, resulting in higher hospital rates and deaths.
- Adolescents and adults with measles in 2013/2014 were susceptible to measles in 1999/2000. However, they escaped the 1999/2000 epidemic..

Study aim: identifying **risk factors for persisting measles susceptibility** after a large epidemic.

### Methods

A retrospective case-control study was performed among unvaccinated orthodox Protestant adolescents and young adults born in the time period 1988-1998, using an online questionnaire.

- **Cases:** were identified as 'notified measles cases' during the 2013/2014 epidemic. They were recruited for participation via Regional Public Health Services.
- **Controls** were individuals with self-reported clinical measles in their childhood during or before the 1999/2000 epidemic. Controls were recruited via orthodox Protestant (social) media, orthodox Protestant secondary schools and orthodox Protestant social networks.

For data-analysis, univariate and multivariable logistic regression was used to determine the association between the determinants and 'persisting measles susceptibility' after a large epidemic.

### Results

In total, 204 cases and 563 controls were included (n=767).

Analysis was stratified in two age-groups:

- respondents born in 1996-1998; babies/toddlers in 1999/2000 (n=391), and
- respondents born in 1988-1995; school-aged children in 1999/2000 (n=376).

Table 1: Risk factors for persisting measles susceptibility in babies/toddlers during the 1999/2000 measles epidemic (n=391)

Babies/toddlers (in 1999/2000)	N	Cases (n=134)	Controls (n=257)	Multivariable ORs (95% CIs)
<b>Gender</b>				
Female	297	59.0%	84.8%	reference
Male	94	41.0%	15.2%	3.8 (2.0-7.0)**
<b>Older siblings</b>				
Yes	274	52.2%	79.4%	ref.
No	117	47.8%	20.6%	3.4 (1.9-6.0)**
<b>Residency in low vaccination coverage municipality (&lt;90%)</b>				
Yes	204	49.5%	63.3%	ref.
No	139	50.5%	36.7%	1.9 (1.1-3.3)*
<b>Orthodox Protestant church denomination, level of conservatism</b>				
High	150	22.3%	48.6%	ref.
Moderate	229	77.7%	51.4%	4.2 (2.3-7.7)**

\* p<0.05, \*\* P< 0.01

Table 2: Risk factors for persisting measles susceptibility in school-aged children during the 1999/2000 measles epidemic (n= 376)

School-aged children (in 1999/2000)	N	Cases (n=70)	Controls (n=306)	Univariate ORs (95% CIs)	Multivariable ORs (95% CIs)
<b>Gender</b>					
Female	267	63.2%	73.4%	reference	
Male	106	36.8%	26.6%	1.6 (0.9-2.8)	
<b>Older siblings</b>					
Yes	244	74.3%	62.7%	ref.	
No	132	25.7%	37.3%	0.6 (0.3-1.0)	
<b>Residency in low vaccination coverage municipality (&lt;90%)</b>					
Yes	183	31.0%	56.9%	ref.	ref.
No	158	69.0%	43.1%	2.9 (1.5-5.9)**	2.6 (1.2-5.5)*
<b>Attendance to orthodox Protestant school</b>					
Yes	285	60.9%	84.5%	ref.	ref.
No	70	39.1%	15.5%	3.5 (1.9-6.4)**	2.8 (1.3-6.1)**
<b>Orthodox Protestant church denomination, level of conservatism</b>					
High	99	15.4%	30.0%	ref.	ref.
Moderate	263	84.6%	70.0%	2.4 (1.2-4.8)*	2.5 (0.9-6.8)

\* p<0.05 \*\* P< 0.01

### Conclusion

Unvaccinated orthodox Protestant adolescents or adults still have a significant risk to be susceptible for measles during a new epidemic when they:

- did not live in a low vaccination coverage municipality, and/or
- did not attend an orthodox Protestants school during the previous epidemic.

For those who were too young to attend school in the previous epidemic, additional risk factors are:

- membership of a moderate conservative church, and
- not having older siblings.

Health care professionals should provide targeted information about susceptibility and catch-up vaccinations to this subgroup of orthodox Protestants.



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