Published in final edited form as:

Ann Allergy Asthma Immunol. 2016 November ; 117(5): 562–563.e1. doi:10.1016/j.anai.2016.08.023.

Prevalence of allergic disease in Old Order Mennonites in New York

Camille Martina, PhD^{*}, R. John Looney, MD[†], Carolina Marcus, MD[†], Maria Allen, BS[†], and Richard Stahlhut, MD[‡]

^{*}Department of Public Health Science and Environmental Medicine University of Rochester School of Medicine and Dentistry Rochester, New York

[†]Allergy Immunology Rheumatology Division Department of Medicine University of Rochester School of Medicine and Dentistry Rochester, New York

[‡]Division of Biological Sciences University of Missouri Columbia, Missouri

Allergic and autoimmune diseases are far less frequent in developing countries compared with economically developed countries, where prevalence has increased significantly during the past 50 years.¹ The rapidity of change strongly argues against a genetic explanation and suggests environmental and lifestyle behaviors as the more likely origin. In 1989, Strachan² observed that having more siblings was associated with a decrease in the prevalence of hay fever, speculating that this difference may be related to hygiene. Further studies found that growing up on farms and consuming unpasteurized milk protected children from asthma, hay fever, and allergies.³ In addition, greater microbial diversity in house dust was positively associated with living on farms and negatively associated with asthma.⁴ Furthermore, the mode and site of birth were associated with atopic disease, with vaginal delivery at home having the greatest protection.⁵ Within the past decade, a large number of epidemiologic studies have linked farm living to a lower prevalence of allergic and autoimmune disease.⁶

On the basis of these studies, we recruited a community of what should be a low-risk population: the Old Order Mennonites (OOMs) living in Upstate New York. The OOMs (1) predominantly live on farms, (2) have large families, (3) give birth mainly at home, and (4) avoid the use of antibiotics. Our OOM study participants are Swiss German descendants of Mennonites who arrived in America in 1683 to escape religious persecution in Europe. Unlike the Amish, OOM lifestyle behaviors are more varied and generalizable; for example, some OOMs use motorized farm and shop equipment and have electricity, central heating, telephones, and kitchen and household appliances. However, the OOMs use fewer commercial products and processed foods than typical Americans, thus reducing exposures to chemical contaminants. For example, a pilot study in 2009 found that, compared with the US population, the OOMs had significantly lower exposures to bisphenol A and phthalates,⁷ which are common household chemicals found in plastics and other products. Di(2-ethylhexyl)phthalate, which is commonly used in soft plastics, has been implicated in

Drs Martina and Looney contributed equally to this work.

Supplementary Data

Supplementary data related to this article can be found at <http://dx.doi.org/10.1016/j.anai.2016.08.023>.

asthma and allergy in both experimental and population studies.⁸ Therefore, our goal in this preliminary study was to confirm a low prevalence of allergic diseases in OOMs compared with those of the US population of the same age range and race (white) by using the Centers for Disease Control and Prevention National Health and Nutrition Examination Survey (NHANES) data. If low prevalence in OOMs is confirmed, our future studies will look for contributing behaviors and chemical exposures.

Questionnaires were mailed to 315 OOM families in Upstate New York that asked about allergic diseases, lifestyle behaviors, product use, and home environments. To enable comparisons between the OOM and the general US population, allergic disease questions were adapted primarily from NHANES 2011–2012 data, although some questions were only asked in the special allergy section of NHANES 2005–2006. Allergy questions were asked at the individual level, focusing on those aged 4 to 40 years, for which the allergy questions most likely reflect true allergy, rather than nonallergic symptoms attributable to viral infection in early life and potentially chronic obstructive pulmonary disease in later life. Exposure questions are reported at the family level. For our statistics, we used R version 3.1.0 plus the survey and the forest plot packages. NHANES statistics used weights and other survey variables to account for NHANES complex sampling design. To compare prevalence between OOM and NHANES samples, we used a method described by Lumley and Scott⁹ that enabled us to combine the 2 sets of data while still accounting for NHANES' multilevel sampling and clustering, as well as the OOMs' clustering of individuals within families. This study was approved the institutional research subjects review board.

We received questionnaires from 211 families (67% response rate), representing 1384 individuals. For allergy-specific analysis, we excluded individuals outside the ages of 4 to 40 years and families with no members aged 4 to 40 years, leaving 197 families and 961 individuals. The demographics and lifestyle characteristics for the 211 families of OOMs are given in eTable 1. As expected 80% of OOM families were farmers, 98% consumed some or all unpasteurized farm milk, and 96% had farm animals. Consumer product use was greater than anticipated. For example, 89% of homes used pesticide, and 56% of families reported hair spray. On average, 33% of a family's transport was motorized (median, 23%) as opposed to walking, biking, or horse and buggy.

For those aged 4 to 40 years, the prevalence of asthma, rhinitis, and eczema in the OOMs was very low compared with the NHANES sample (Fig 1). For example, rates of wheezing in the past 12 months and physician-diagnosed asthma were 1.7% and 2.2% in OOMs compared with 13% and 19% in NHANES. Moreover, use of any type of glucocorticoid inhalers was 0.1% in the OOM sample vs 1.2% in the NHANES sample.

In sum, the OOMs, a community living predominantly on farms, having large families, and have low to moderate modern product use, have a very low rate of allergic disease (asthma, rhinitis, eczema) compared with a sample of the US population of similar age, sex, and race. A low prevalence of allergic disease of Swiss Amish children reported by Holbreich et al¹⁰ was based on Gabriel questions and control data from Switzerland. Our study is different in that we used the NHANES questions and US controls and we collected OOM data on a larger number of individuals with a greater range of ages. Furthermore, the OOMs in our

study are less restrictive in their lifestyle behaviors than the Amish, making what we learn more generalizable. Nevertheless, the outcomes of our results and those of Holbreich et al¹⁰ are very similar and confirm that there are populations within the United States with a very low prevalence of allergic disease. These low-risk populations provide an excellent opportunity within the United States to compare immune system development in low-risk vs high-risk populations and offer insights into the immunologic determinants of allergic sensitization.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

Funding Sources: This work was supported by the University of Rochester Environmental Health Sciences Center as an Integrative Health Sciences Facility Core pilot as part of grant 5P30ES001247 from the National Institute of Environmental Health Sciences.

References

1. Bach JF. The effect of infections on susceptibility to autoimmune and allergic diseases. *N Engl J Med*. 2002; 347:911–920. [PubMed: 12239261]
2. Strachan DP. Hay fever, hygiene, and household size. *BMJ*. 1989; 299:1259–1260. [PubMed: 2513902]
3. Riedler J, Braun-Fahrlander C, Eder W, et al. Exposure to farming in early life and development of asthma and allergy: a cross-sectional survey. *Lancet*. 2001; 358:1129–1133. [PubMed: 11597666]
4. Ege MJ, Mayer M, Normand AC, et al. Exposure to environmental microorganisms and childhood asthma. *N Engl J Med*. 2011; 364:701–709. [PubMed: 21345099]
5. van Nimwegen FA, Penders J, Stobberingh EE, et al. Mode and place of delivery, gastrointestinal microbiota, and their influence on asthma and atopy. *J Allergy Clin Immunol*. 2011; 128:948–955. e1-3. [PubMed: 21872915]
6. von Mutius E, Vercelli D. Farm living: effects on childhood asthma and allergy. *Nature Rev Immunol*. 2010; 10:861–868. [PubMed: 21060319]
7. Martina CA, Weiss B, Swan SH. Lifestyle behaviors associated with exposures to endocrine disruptors. *Neurotoxicology*. 2012; 33:1427–1433. [PubMed: 22739065]
8. Jaakkola JJ, Knight TL. The role of exposure to phthalates from polyvinyl chloride products in the development of asthma and allergies: a systematic review and meta-analysis. *Environ Health Perspect*. 2008; 116:845–853. [PubMed: 18629304]
9. Lumley T, Scott A. Two-sample rank tests under complex sampling. *Biometrika*. 2013; 100:831–842.
10. Holbreich M, Genuneit J, Weber J, Braun-Fahrlander C, Waser M, von Mutius E. Amish children living in northern Indiana have a very low prevalence of allergic sensitization. *J Allergy Clin Immunol*. 2012; 129:1671–1673. [PubMed: 22513133]

Figure 1.

Forest plot of prevalence of allergic diseases and celiac disease or gluten-free diet in the Old Order Mennonite (OOM) and National Health and Nutrition Examination Survey (NHANES) samples. Bars represent 95% confidence intervals. Participant ages are 4 to 40 years, except for the celiac disease and gluten-free diet group, which had data available for only those 6 to 40 years old in NHANES. For rhinitis, rash, and eczema, only NHANES 2005–2006 data were used; all others used NHANES 2011–2012.