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Atopic Symptoms Among California Veterinarians

Päivikki Susitaival, MD, PhD,[1,3] John H. Kirk, DVM,[2] and Marc B. Schenker, MD, MPH[1]*

Background *The prevalence of allergic symptoms among veterinarians has not been studied adequately.*
Methods *A questionnaire was sent to 2,000 California veterinarians; the return rate was 73% (N = 1416).*
Results *A history of either asthma, allergic rhinitis (AR), or atopic dermatitis (AD) was reported by 66% of respondents. AR was reported by 62%, asthma by 16%, and AD by 11%. Forty percent of the veterinarians reported animal related respiratory and/or skin symptoms. The most commonly reported causes of symptoms were cats and dogs. In multivariate logistic analysis, the significant risk factors for having adult asthma were the history of AR with the history of AD (OR 13.9), AR alone (OR 6.3), and asthma in childhood (OR 6.4).*
Conclusions *The prevalence of asthma and other atopic symptoms was high in the studied population. Most veterinarians with respiratory or skin symptoms reported the symptoms as being related to specific animal contact.* Am. J. Ind. Med. 44:166–171, 2003.
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KEY WORDS: epidemiology; atopy; respiratory allergy; asthma; allergic rhinitis; dermatitis; occupational diseases; animal allergy; questionnaire study

INTRODUCTION

Veterinarians are constantly in contact with animals. Animal proteins have been reported causing immediate (IgE-mediated) allergies in laboratory animal workers and farmers. Allergy to animal proteins can cause respiratory, eye, and skin symptoms [Cockcroft et al., 1981; Agrup and Sjöstedt, 1985; Weissenbach et al., 1988; Aoyama et al., 1992; Susitaival et al., 1995; Susitaival and Hannuksela, 1997].

Veterinarians have been found to have a higher mortality rate for asthma compared to the US general population [Blair and Hayes, 1980]. In a study by Lutsky et al. [1985], the prevalence of asthma in veterinarians was almost three times (16%) the prevalence in controls (6%). According to case-reports, veterinarians have complained of hand dermatitis or urticaria associated with animal fluid and skin contact [Prahl and Roed-Petersen, 1979; Hjorth and Roed-Petersen, 1980; Rudzki et al., 1982; Degreff et al., 1984; Falk et al., 1985; Kalveram et al., 1986; Roger et al., 1995]. Fourteen percent of California veterinarians and 16% of Kansas veterinarians have reported recurrent or persistent hand/forearm dermatitis during the past 12 months [Susitaival et al., 2001; Tauscher and Belsito, 2002].

The objective of this study was to get information on the prevalence of atopic symptoms, especially animal related respiratory and skin symptoms (asthma, rhinitis, dermatitis), and to evaluate possible risk factors for adult asthma among California veterinarians.

SUBJECTS AND METHODS

Two thousand (2,000) questionnaires were mailed out to a stratified sample of the active members of the California Veterinary Medical Association [Susitaival et al., 2001]. Of the 1,965 eligible participants, 1,416 (72%) completed and returned the questionnaires (Table I). Of these, the 1,353

[1]Department of Epidemiology and Preventive Medicine, University of California, Davis, California
[2]School of Veterinary Medicine, University of California, Davis, California
[3]Finnish Institute of Occupational Health, Kuopio, Finland, North Karelia Central Hospital, Joensuu, Finland
*Correspondence to: Marc B. Schenker, Department of Epidemiology and Preventive Medicine, University of California, Davis, One Shields Avenue, TB168, Davis, CA 95616-8638. E-mail: mbschenker@ucdavis.edu

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TABLE I. Study Population of the California Veterinary Medical Association, 1996

CaVMA members (1996)	3,033
Sample selected	2,000
Died	12
Wrong address	23
Eligible	1,965
Refused	30
Response	1,416 (72%)
Professionally active	1,353

professionally active veterinarians (866 men, 487 women), contributed the data to the present study (Table II).

Ninety percent of veterinarians were in full time veterinary work, and most were in private small animal practice. Seventy percent of respondents had never smoked cigarettes and only 7.5% of them smoked currently and less than a half of those regularly (Table II).

Atopy and skin questions were mostly derived from the Tuohilampi questionnaire [Susitaival et al., 1996] while the skin atopy (history of atopic dermatitis (AD)) question was adopted from the UK-working party criteria validated by Williams et al. [1996] (see Appendix A). The definition of dermatitis aimed at detecting cases of possible contact dermatitis, including contact urticaria and protein contact dermatitis. The conditions were specified for possible work-related exacerbating factors. The questionnaire also addressed general demographics, smoking, and work history.

Data were processed with SAS System for Windows 6.12 software, using cross-tables and chi-square tests. Risk factors were estimated as prevalence odds ratios (OR) calculated with multivariate logistic analysis by SAS Genmod.

TABLE II. Characteristics of Study Subjects; California Veterinarians

	Men (866)	Women (487)	All (1,353)
Full time in veterinary work (%)	92	86	90
Mean age years (range)	50 (26–85)	38 (26–77)	
Mean years in profession (range)	23 (0–59)	10 (0–44)	
Smoking (%)			
Never	66	80	71
Ex-smoker	25	15	22
Current smoker	9	5	7
Practice type (%)			
Small animal (N = 996)	69	82	74
Large/food animal (N = 209)	19	9	15
Mixed (N = 88)	7	6	7
No animal practice (N = 53)	4	3	4

TABLE III. Self-Reported Atopic and Other Respiratory Symptoms Among 1,353 California Veterinarians,%

	Men	Women	All	*p*
History of atopic symptoms				
Allergic rhinitis (AR)[a]	58	70	62	0.001
Asthma[a]	14	19	16	0.005
AR or asthma (ARD)	59	71	63	0.001
Atopic dermatitis (AD)[a]	9.6	14	11	0.019
AR, asthma, or AD (all atopy)	62	74	66	0.001
Work related asthma symptoms[a]	15	28	20	0.001
Work related rhinitis/conjunctivitis[a]	34	45	38	0.001

[a]See Appendix A.

RESULTS

Altogether 66% of the study population reported a history of respiratory atopy (ARD) or AD (Table III). Women reported significantly more atopic symptoms than men. The interrelationships between the reporting of the different atopic symptoms (asthma, allergic rhinitis (AR), and AD) are presented in Figure 1. Most of those reporting AD also reported AR. AD within the past 12 months (1-year prevalence) was reported by 5%.

Work related rhinitis and/or conjunctivitis was reported by 61% of those reporting AD (Table III). Of those, 77% implicated animals for symptoms (29% of all respondents, Table V). The prevalence of work related asthma symptoms varied by atopy from 3% among those with no history of atopic symptoms to 16% among those reporting ARD and 28% among those reporting AD, and the symptoms were attacks of shortness of breath (6.7%), chest tightness (7.5%), and wheezing (9.5%).

The prevalence of adult asthma was higher in women than men (Table IV). About half (62% of women and 39% of men, $p = 0.03$) of those who reported asthma in childhood or school age reported also having adult asthma. The year of diagnosis was provided by 93% of all those reporting adult asthma. One fourth of asthma cases had been diagnosed under the age of 10 and 90% before the age of 40. Almost one in five veterinarians (18%) had been skin tested for allergy, and most of them (89%) had been diagnosed with an allergy. Forty-seven percent of those reporting adult asthma were on regular asthma or allergy medication. Bronchodilators were the most common medications (26%) followed by antihistamines (16%), inhaled corticosteroids (15%), and nasal corticosteroids (11%). Only slightly over one third of those with adult asthma reported using respiratory protection regularly for harmful exposures. In more than half of the cases, a specific animal contact was reported as a worsening factor for adult asthma symptoms (Table V). In only 18% of adult asthma cases was the cause reported as unknown. Of all

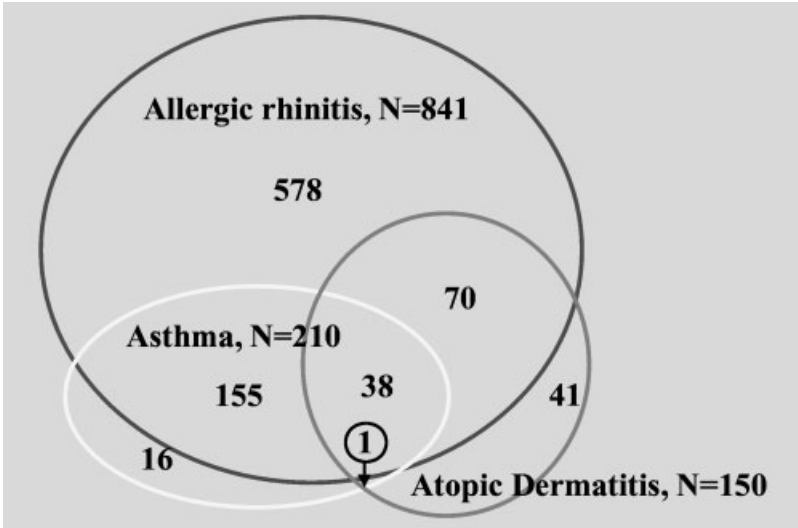

FIGURE 1. The distribution of reported atopic symptoms in 1,353 California veterinarians.

work-related respiratory symptoms, almost 3/4 were related to specific animals (Table V). Women related their respiratory symptoms to animal exposures more often (79%) than men (69%). The cat was the most commonly implicated animal, followed by the dog, horse, cattle, and rabbit (Table V).

Altogether 40% of the veterinarians reported animal related skin or respiratory symptoms (AD, AR, conjunctivitis, or asthma) (Table VI). Half of them reported only respiratory symptoms (52%), 22% only skin symptoms, and 26% both respiratory and skin symptoms. Almost two-thirds of those with animal related skin symptoms reported symptoms appearing in minutes after the contact with, in most cases, just one animal species.

Constitutional factors were the most significant independent risk factors for having adult asthma (Table VII). AD alone without AR (N = 42), did not seem to be a risk factor for adult asthma. On the other hand, the combination of AD and AR was a greater risk factor than asthma in childhood. Age, smoking, and years in veterinary practice did not appear as independent risk factors for adult asthma if added to the model.

TABLE IV. History of Asthma in 1,353 California Veterinarians,%

	Men	Women	All
Ever asthma	14	19	16
Childhood	2.9	3.3	3.0
School age	4.9	6.8	5.5
Adult	9.4	16	12
Adult only	6.9	11	8.4

DISCUSSION

High prevalence of atopy has been connected to Western life-style and non-farm background [von Mutius, 1998; Leynaert et al., 2001]. The prevalence of atopic symptoms, especially respiratory symptoms (66%), was high among the surveyed sample of California veterinarians. The prevalence of current smoking among men and women was far lower (9 and 5%) than the state prevalence of current smoking in 1998 (22 and 17%, CDC MMWR Weekly, 1999]. AR was reported by 62% of veterinarians which is significantly higher than in Southern European population studies (15–18%) and also higher than the figures reported from the US East coast (46%) [Papageorgiou et al., 1997; Siracusa et al., 1997; Greisner et al., 1998]. Most of those with asthma also reported AR, similar to other studies [Oswald et al., 1994; Greisner et al., 1998].

TABLE V. Animals Reported as Causes or Aggravators of Work-Related Rhinitis/Conjunctivitis (r/c) and Adult Asthma,%

	Work-related r/c (N = 511)	Asthma[a] (N = 159)	Either[b] (N = 549)
Some animal	77	55	73
Cat	60	40	58
Dog	31	23	31
Horse	11	18	13
Cattle	4.9	4.4	5.1
Other	26	25	26

[a]Asthma when older than 18 years old.
[b]Either work-related rhinitis or adult asthma.

TABLE VI. Animals Reported as Causes of Respiratory or Skin Symptoms in 1,353 California Veterinarians

			Type of symptoms[c]	
Symptoms from. . .	N[a]	%[b]	Respiratory	Skin
Any animal	538	40	78	48
Cat	353	26	92	20
Horse	93	7	80	32
Rabbit	30	2	87	63
Dog	263	19	66	53
Cattle	89	7	40	79
Rat	18	1	1/18[d]	18/18[d]

[a]Number reporting either respiratory or skin symptoms on contact with the animal.
[b]% of all veterinarians (N = 1,353).
[c]% of N.
[d]Number.

The prevalence of current adult asthma was 11.6%, which is higher than reported either in European countries or in the US National Survey in 1994 (5.4%) [Sly, 1999], but is similar to the figures reported among the US laboratory animal-exposed workers [Fuortes et al., 1996]. Reporting of asthma was similar to a questionnaire survey of young people (20–22 years) in Los Angeles and San Diego in 1993. In that study, 12% reported having had asthma and 8% as having current asthma [Hu et al., 1997] although the response rate was only 61%. Women reported significantly more adult asthma and rhinitis symptoms than men did. This is consistent with some studies [Gerstman et al., 1989; Senthilselvan, 1998; Torén and Hermansson, 1999], but contradicts other population reports [Nicolai et al., 1997; Siracusa et al., 1997; Campello et al., 1998]. Female veterinarians with asthma in childhood reported adult asthma more often than men. The present results and also findings in some other studies suggest that continuation of childhood asthma and adult-onset asthma is more common among women than men [von Mutius, 1996; Senthilselvan, 1998; Torén and Hermansson, 1999].

TABLE VII. Prevalence Odds Ratios (OR) for Adult Asthma

	OR	(95% CI[a])
Gender		
Male (N = 866)	1.0	
Female (N = 487)	1.4	(0.92–2.20)
History of allergic rhinitis (AR)		
No AR (N = 512)	1.0	
AR alone[b] (N = 733)	6.3	(3.33–12.0)
AR + AD[c] (N = 108)	13.9	(6.58–29.5)
Asthma in childhood[d]		
No (N = 1,258)	1.0	
Yes (N = 95)	6.4	(3.98–10.3)
Practice		
No animals (N = 61)	1.0	
Small animals (N = 988)	3.6	(0.84–15.6)
Mixed (N = 85)	2.1	(0.39–11.2)
Large animals (N = 208)	2.8	(0.60–13.0)
Age (years, continuous)	1.0	(0.98–1.02)

The model included the listed variables (deviance of the model 796, Degrees of Freedom 1,319).
[a]95% confidence interval (CI).
[b]History of AR without the history of AD (see Appendix A).
[c]History of AD (see Appendix A).
[d]Asthma 'before school age' or 'in school age.'

Reporting of work-related respiratory symptoms was as frequent as in a study of German livestock farmers (40%), and reporting of work-related wheeze (9.5%) was similar to data from a study of laboratory animal-exposed workers (10.8%) [Fuortes et al., 1996; Radon et al., 1999].

In the present survey, one third of the veterinarians reported respiratory symptoms and one-fifth skin symptoms when handling animals. Of those with skin symptoms more than a half also had respiratory symptoms, this being in accordance with the studies among laboratory animal workers [Aoyama et al., 1992]. Higher symptom reporting has been associated with higher animal exposure [Aoyama et al., 1992; Hollander et al., 1997; Kruize et al., 1997; Rakowiak et al., 1997]. Veterinarians are heavily exposed to animal dander most of their working time. It is likely that they have also been dealing with animals before their career [Das et al., 1992].

The animals implicated most as causing respiratory symptoms were cats and dogs. It seems, according to these results, that animals differ in their capacity of eliciting skin or respiratory symptoms. Cats and horses appear to cause primarily respiratory symptoms while dogs and cattle often caused also skin symptoms. Of the laboratory animals, rabbits and guinea pigs were blamed for both respiratory and skin symptoms while rats and mice were often connected with skin symptoms only.

In the present data, the three categories of atopic symptoms (asthma, rhinitis, and AD) overlapped largely supporting a common etiologic background. Most veterinarians with asthma reported rhinitis and one-fifth also reported AD. Over two-thirds of subjects reporting AD also reported respiratory symptoms. Reporting both the history of AR and AD was the greatest risk factor for adult asthma in a logistic model. Some studies have found a strong association of AD in infancy with asthma later in life [Settipane et al., 1994; Bergmann et al., 1998; Withers et al., 1998; Torén and Hermansson, 1999]. Those reporting a history of atopic symptoms also reported more often having hand dermatitis. The reporting of hand dermatitis (within 12 months) by those with AD was, as compared to those with no atopy, over twofold among women and fourfold among men [Susitaival et al., 2001].

The prevalence of reported atopic respiratory and skin symptoms among California veterinarians was high. The symptoms were often connected to contact with specific animals. Animal species seem to differ in their capacity of producing skin or respiratory symptoms.

APPENDIX A. Definitions for Cases

1. History of asthma:
   "*Have you ever had asthma*?" The year of diagnosis was also asked.
2. History of adult asthma:
   Asthma and "*in adult life (age: more than 18 years)*."
3. History of asthma in childhood:
   Asthma and "*before school age (less than 6 years) or at school age (6–18 years)*."
4. History of allergic rhinitis (AR):
   "*Have you ever hay fever or other symptoms of nasal allergy*?" *(Bouts of sneezing, itchy or runny nose from e.g., pollens or animals).*
5. History of respiratory atopy (ARD): affirmative answer to either asthma (1) or AR (4).
6. History of atopic dermatitis (AD): affirmative answer to the following:
   "*Have you ever had itchy rash (AD) that has affected skin creases or folds?" (e.g., fronts of elbows, behind the knees, fronts of ankles, wrists, neck).*[a]
7. History of work related rhinitis/conjunctivitis: affirmative answer to the following:
   "*Have you ever had rhinitis or conjunctivitis that you consider related to some tasks in your practice?" (Bouts of sneezing, itchy or runny nose, or redness, stinging, itching, or watering in the eyes).*
8. Work related asthma symptoms:
   "*Have you ever had any of the following symptoms related to some tasks in your practice?" Listed symptoms: attacks of shortness of breath, chest tightness, wheezing.*
9. Hand dermatitis (possible contact dermatitis, including contact urticaria/protein contact dermatitis):
   - Dermatosis during career: "*During your veterinary career, have you had any dermatoses (rash, eczema, hives)*?"

And

   - Dermatitis area either *hands* or *forearms*

And

   - Symptoms include either *hives* *and/or* at least two of the following: *redness, dryness, itch, vesicles*, or *fissures*.

[a] Williams et al. [1996].

REFERENCES

Agrup G, Sjöstedt L. 1985. Contact urticaria in laboratory technicians working with animals. Acta Derm Venereol (Stockh) 65:111–115.

Aoyama K, Ueda A, Manda F, Matsushita T, Ueda T. 1992. Allergy to laboratory animals: An epidemiological study. Br J Ind Med 49:41–47.

Bergmann RL, Edenharter G, Bergmann KE, Forster J, Bauer CP, Wahn V, Zepp F, Wahn U. 1998. Atopic dermatitis in early infancy predicts allergic airway disease at 5 years. Clin Exp Allergy 28(8):965–970.

Blair A, Hayes HM. 1980. Cancer and other causes of death among US veterinarians, 1966–1977. Int J Cancer 25:181–185.

Campello C, Ferrari M, Poli A, Olivieri M, Tardivo S, Verlato G, Martini C, Biasin C, Lampronti G, Cenci B, Lo Cascio V. 1998. Prevalence of asthma and asthma-like symptoms in an adult population sample from Verona. ECRHS Verona. European Community Respiratory Health Survey. Monaldi Arch Chest Dis 53(5):505–509.

Cockcroft A, McCarthy P, Edwards J, Andersson N. 1981. Allergy in laboratory animal workers. Lancet April 11:827–830.

Das R, Tager IB, Gamsky T, Schenker MB, Royce S, Balmes JR. 1992. Atopy and airways reactivity in animal health technicians. A pilot study. J Occup Med 34:53–60.

Degreff H, Bourgeois M, Naert C, Van de Kerckhove M, Dooms-Goossens A. 1984. Protein contact dermatitis with positive RAST caused by bovine blood and amniotic fluid. Contact Dermat 11(2):129–130.

Falk ES, Hektoen H, Thune PO. 1985. Skin and respiratory tract symptoms in veterinary surgeons. Contact Dermat 12(5):274–278.

Fuortes LJ, Weih L, Jones ML, Burmeister LF, Thorne PS, Pollen S, Merchant JA. 1996. Epidemiologic assessment of laboratory animal allergy among university employees. Am J Ind Med 29(1):67–74.

Gerstman BB, Bosco LA, Tomita DK, Gross TP, Shaw MM. 1989. Prevalence and treatment of asthma in the Michigan Medicaid patient population younger than 45 years, 1980–1986. J Allergy Clin Immunol 83(6):1032–1039.

Greisner WA, III, Settipane RJ, Settipane GA. 1998. Co-existence of asthma and allergic rhinitis: A 23-year follow-up study of college students. Allergy Asthma Proc 19(4):185–188.

Hjorth N, Roed-Petersen J. 1980. Allergic contact dermatitis in veterinary surgeons. Contact Dermat 6:27–29.

Hollander A, Heederik D, Doekes G. 1997. Respiratory allergy to rats: Exposure-response relationships in laboratory animal workers. Am J Respir Crit Care Med 155(2):562–567.

Hu FB, Persky V, Flay BR, Richardson J. 1997. An epidemiologic study of asthma prevalence and related factors among young adults. J Asthma 34(1):67–76.

Kalveram K-J, Kästner H, Forck G. 1986. Nachweis von spezifischen IgE-Antikörpern bei Tierärzten mit Kontakturticaria (Evidence of specific IgE antibodies in veterinarians with contact urticaria). Z Hautkr 61:75–81 (in German).

Kruize H, Post W, Heederik D, Martens B, Hollander A, van der Beek E. 1997. Respiratory allergy in laboratory animal workers: A retrospective cohort study using pre-employment screening data. Occup Environ Med 54(11):830–835.

Leynaert B, Neukirch C, Jarvis D, Chinn S, Burney P, Neukirch F. 2001. Does living on a farm during childhood protect against asthma, allergic rhinitis, and atopy in adulthood? Am J Respir Crit Care Med 164(10 Pt 1):1829–1834.

Lutsky I, Baum GL, Teichtahl H, Mazar A, Aizer F, Bar-Sela S. 1985. Occupational respiratory disease in veterinarians. Ann Allergy 55(2): 153–156.

Nicolai T, Bellach B, Mutius EV, Thefeld W, Hoffmeister H. 1997. Increased prevalence of sensitization against aeroallergens in adults in West compared with East Germany. Clin Exp Allergy 27(8):886–892.

Oswald H, Phelan PD, Lanigan A, Hibbert M, Bowes G, Olinsky A. 1994. Outcome of childhood asthma in mid-adult life. BMJ 309:95–96.

Papageorgiou N, Gaga M, Marossis C, Reppas C, Avarlis P, Kyriakou M, Tsipra S, Zeibecoglou K, Tracopoulos G. 1997. Prevalence of asthma and asthma-like symptoms in Athens, Greece. Respir Med 91(2):83–88.

Prahl P, Roed-Petersen J. 1979. Type I allergy from cows in veterinary surgeons. Contact Dermat 5:33–38.

Radon K, Opravil U, Hartung J, Szadkowski D, Nowak D. 1999. Work-related respiratory disorders and farming characteristics among cattle farmers in Northern Germany. Am J Ind Med 36:444–449.

Rakowiak A, Szulc B, Górski P. 1997. Occupational respiratory diseases in laboratory animal workers: Initial results. Int J Occup Med Environ Health 10(1):31–36.

Roger A, Guspi R, Garcia-Patos V, Barriga A, Rubira N, Nogueiras C, Castells A, Cadahia A. 1995. Occupational protein contact dermatitis in a veterinary surgeon. Contact Dermat 32:248.

Rudzki E, Rebandel P, Grzywa Z, Pomorski Z, Jakiminska B, Zawisza E. 1982. Occupational dermatitis in veterinarians. Contact Dermat 8(1):72–73.

Senthilselvan A. 1998. Prevalence of physician diagnosed asthma in Saskatchewan, 1981 to 1990. Chest 114(2):388–392.

Settipane RJ, Hagy GW, Settipane GA. 1994. Long-term risk factors for developing asthma and allergic rhinitis: A 23-year follow-up study of college students. Allergy Proc 15:21–25.

Siracusa A, Marabini A, Sensi L, Bacoccoli R, Ripandelli A, Anulli R, Pettinari L. 1997. Prevalence of asthma and rhinitis in Perugia, Italy. Monaldi Arch Chest Dis 52(5):434–439.

Sly RM. 1999. Changing prevalence of allergic rhinitis and asthma. Ann Allergy Asthma Immunol 82(3):233–248.

Susitaival P, Hannuksela M. 1997. Animals and animal products. In: Amin S, Lahti A, Maibach H, editors. Contact urticaria syndrome. Boca Raton: CRC Press Inc. p 95–105.

Susitaival P, Husman L, Hollmén A, Horsmanheimo M, Husman K, Hannuksela M. 1995. Hand eczema in Finnish farmers—A questionnaire based clinical study. Contact Dermat 32:150–155.

Susitaival P, Kanerva L, Hannuksela M, Jolanki R, Estlander T. 1996. Tuohilampi questionnaire for epidemiological studies of contact dermatitis and atopy. People and Work, Research Reports 10. Helsinki: Finnish Institute of Occupational Health. 26 p.

Susitaival P, Kirk J, Schenker M. 2001. Self-reported hand dermatitis in California veterinarians. Am J Contact Dermat 12(2):103–108.

Tauscher AE, Belsito DV. 2002. Frequency and etiology of hand and forearm dermatoses among veterinarians. Am J Contact Dermat 13(3):116–124.

Torén K, Hermansson BA. 1999. Incidence rate of adult-onset asthma in relation to age, sex, atopy, and smoking: A Swedish population-based study of 15,813 adults. Int J Tuberc Lung Dis 3(3):192–197.

von Mutius E. 1996. Progression of allergy and asthma through childhood to adolescence. Thorax 51(Suppl 1):3–6.

von Mutius E. 1998. The rising trends in asthma and allergic disease. Clin Exp Allergy 28(Suppl 5): 45–49 discussion 50–51.

Weissenbach T, Wüthrich B, Weihe WH. 1988. Laboratory animal allergies. An epidemiological study of allergies among laboratory animal exposed persons. Schweiz med Wschr 118:930–938 (in German).

Williams HC, Burney PGJ, Pembroke AC, Hay RJ. 1996. Validation of the U.K. diagnostic criteria for atopic dermatitis in a population setting. Br J Dermatol 135:12–17.

Withers NJ, Low L, Holgate ST, Clough JB. 1998. The natural history of respiratory symptoms in a cohort of adolescents. Am J Res Crit Care Med 158(2):352–357.

CDC MMWR Weekly. 1999. State-specific prevalence of current cigarette and cigar smoking among adults—United States, 1998. CDC MMWR Weekly 48(45):1034–1039.