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Work-related accidents and occupational diseases in veterinarians and their staff

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Abstract Objectives: We assessed the occupational hazards in veterinary practice by analysing accident insurance data in order to stimulate strategies to prevent occupational accidents and diseases in veterinarians and their staff. **Methods:** Approximately 10,000 veterinary practices comprising about 27,500 veterinarians and their staff are covered by the Institution of Statutory Accident Insurance of the Health and Welfare Service (BGW). Each year about 2,000 accident and occupational disease claims are filed by these veterinarians and their staff. The claims for the 5-year period from 1998 to 2002 are analysed in this paper. **Results:** For 2002, the incidence rate for accidents in the workplace was 105.4 per 1,000 full-time workers, a rate 2.9-times higher than for general practitioners of human medicine. When only severe accidents resulting in a loss of work time of more than 3 days were analysed, the relative risk increased to 9.2. Approximately 66% of the reported accidents are due to scratches, bites, or kicks from animals. Claims of occupational disease are filed 2.7-times more often by veterinarians and their staff than by general practitioners and their staff. The occupational diseases filed most

often concern the skin (39%), followed by allergic respiratory diseases (30.5%), and infectious diseases (19.1%). **Conclusions:** Prevention strategies for veterinarians should focus on accidents caused by animals. The prevention of occupational diseases should focus on skin diseases, respiratory disease, and infections.

Keywords Veterinary practice · Accident · Occupational disease · Skin disease · Respiratory disease

Introduction

Veterinarians and their staff are exposed to a variety of work-related health risks. A recent Australian literature review (Jeyaretnam and Jones 2000) came to the conclusion that “veterinarians often sustain animal-related injuries, some of which have led to hospitalisation. The most costly injuries to veterinarians include strains and back injuries. Other occupational risks to which veterinarians are subjected include motor vehicle accidents, penetration wounds especially to eyes, and needle-stick and scalpel injuries. Diseases resulting from infection with a zoonotic agent are infrequent, however, they have the potential to be quite serious. Disease as a result of exposure to chemicals is difficult to quantify, however there are potential risks from long-term and short-term exposure to a number of chemicals”. This literature review is based mainly on American and Australian studies, some of which used insurance data (Thipgen and Dorn 1973; Smith and Stilts 1996). In Europe a comprehensive study of the work-related health risks to veterinarians and their staff is not available. Therefore, we analysed the database of the statutory accident insurance of the health and welfare service (BGW), which provides mandatory accident insurance for veterinary practices in Germany, in order to identify the most important health risks to veterinarians and their staff. This endeavour was undertaken to motivate an

Dedicated to Prof. Jürgen Berger, Department of Biostatistics, University Hospital Eppendorf, emeritus in 2004

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increase in strategies used to prevent work-related health risks.

Methods

In Germany 21,931 veterinarians are registered (Tierärztliche Hochschule Hannover 2003, unpublished data). Most work as practitioners in veterinary practices (65%). Others work at universities (6%), in industry (6%) or in state health departments, administrations and institutes (17%). Approximately 10,000 veterinary offices, comprising approximately 27,500 veterinarians and their staff (Table 1), are covered by the BGW. The number of veterinarians covered is estimated to be approximately 7,450 (52% of all practitioners or 34% of all registered veterinarians) and the number of staff is about 19,800. Each year some 2,000 accident and occupational disease claims are filed by these veterinarians and their staff. The claims for the 5-year period from 1998 to 2002 are analysed in this paper: (1) the claim rate and the injuries caused by accidents are analysed using all claims in 2002, (2) a random sample of accidents subject to mandatory reporting is analysed using claims from 1998 to 2002 and (3) all occupational diseases claimed from 1998 to 2002 are analysed.

The analysed database comprises standard information for all claims routinely assessed, including occupation of the claimant, specification of the accident and the resulting injury, or the occupational disease and its verified causal agent. A distinction is also made between accidents that occurred in the workplace or during working hours and accidents that took place while the claimant was commuting to and from work.

A further distinction is made between accidents that resulted in a loss of work-time lasting more than 3 days and those for which the work-time loss was 3 days or fewer (HVBG 1996, p. 79). Since the latter are not subject to mandatory reporting, such accidents may be underestimated. From the accidents that are subject to mandatory reporting, a random 10% sample is drawn.

Table 1 Holders of insurance and claims of accidents and occupational diseases by veterinarians and their staff in 2002, separated by the primary type of animal treated in the practice

Holders of insurance	Practice treating mainly				Total	
	Small animals		Large animals		(n)	(%)
	(n)	(%)	(n)	(%)		
Practices	4,377	44.9	5,371	55.1	9,748	100.0
Veterinarians and staff	12,984	47.3	14,472	52.7	27,456	100.0
Full-time workers	7,943.9	46.9	9,177.7	53.1	17,121.6	100.0
Claims						
Accidents in workplace	767	84.2	1,038	90.5	1,805	87.7
Commuting accidents	98	10.8	71	6.2	169	8.2
Occupational diseases	46	5.0	38	3.3	84	4.1
All claims	911	100.0	1,147	100.0	2,058	100.0

The accidents in this sample are documented in more detail in the standardised database of the statutory accident insurance. The additional information covered includes the agent causing the accident and the place of the accident. For the 5-year period from 1998 to 2002 this more detailed documentation of workplace accidents is available for 459 claims.

A claim rate per 1,000 full-time workers is calculated by taking the number of all claims as numerator and the number of full-time workers as denominator. For every person covered by the insurance, the annual hours worked are reported to the insurance company. The sum of all working hours is divided by 1,570 h in order to obtain the number of full-time workers (HVBG 1996, p. 75). In our data, the number of persons covered was 1.6-times higher than the number of full-time workers artificially calculated.

When applying for insurance coverage all veterinarians are asked to indicate whether they treat mainly small or large animals in their practice. Therefore, when the accidents were analysed, a distinction was made between the two different kinds of practices.

Relative risks for accidents, severe accidents (subject to mandatory reporting), and occupational diseases were calculated using general practitioners and their staff as comparison group. The analysis was performed with the statistical software package SPSS, version 12.

Results

A total of 2,058 claims was filed in 2002 by veterinarians or their staff (Table 1). Most of those claims concerned accidents in the workplace (87.7%). In relation to the number of veterinarians and their employees, fewer claims were filed from practices that treated primarily small animals. This was especially true for occupational accidents that caused a work-time loss of more than 3 days, where, relative to the number of full-time workers, 19.2% fewer accidents occurred (Table 2). When the number of claims were analysed separately for each year from 1998 to 2002, no trend over time could be detected (no table).

Compared with that for general practitioners and their staff, the occupational accident risk was 2.9-times higher for veterinarians and their staff (Table 2). When the comparison was restricted to severe accidents that resulted in a work-time loss of more than 3 days, the relative risk for veterinarians and their staff increased (RR 9.2; 95% CI 8.12–10.42). Furthermore, the frequency of a claim for occupational disease was 2.7-times higher for veterinarians (RR 2.7 95% CI 2.01–2.53). For accidents while the claimant was commuting, the difference is rather small but still statistically significant (RR 1.3; 95% CI 1.10–1.53).

The kind of injury and the location of the injury on the body did not depend on the gender or age of the claimant or on the type of practice; that is, whether

Table 2 Claim rates (per 1,000 full-time workers) and relative risks (RR) of accidents and occupational diseases in 2002, separated by the primary type of animal treated in the practice

Claims	Veterinarians and staff			General medicine ^a	Relative risk ^b	
	Small animals	Large animals	All animals		RR	95% CI
Accidents in the workplace						
Not subject to reporting ^c	64.1	73.9	68.8	31.9	2.2	2.06–2.35
Subject to reporting ^c	32.5	40.2	36.6	4.0	9.2	8.12–10.42
All	96.6	113.1	105.4	35.9	2.9	2.74–3.07
Commuting accidents	12.3	7.7	9.9	7.7	1.3	1.10–1.53
Occupational diseases	5.8	4.1	4.9	1.8	2.7	2.01–3.52
All claims	114.7	125.0	120.2	50.2	2.4	2.28–2.53

^aPractitioners in human medicine and their staff

^bClaim rate of all veterinarians compared to that of practitioners in human medicine

^cAccidents leading to a work-time loss of more than 3 days are subject to being reported

primarily small or large animals were treated (no table). Most occupational accidents resulted in cuts, bites, or scratches (59.7%), while most commuting accidents resulted in an acceleration trauma of the neck (40.8%; Table 3). In 2002, one fatal commuting accident occurred. In the 5 years analysed, the total number of fatal accidents amounted to ten. Two occurred while the insured were commuting from home to the workplace; six accidents were also traffic accidents, but they occurred while the insured were driving from one farm to another. Two fatal accidents happened in the workplace (a homicide and a dog bite, no table). Traffic accidents while people were commuting caused severe injuries with

Table 3 Injuries caused by accidents in 2002, separated by occupational and commuting accidents

Injuries	Occupational accidents		Commuting accidents		Total	
	(n)	(%)	(n)	(%)	(n)	(%)
Minor injury, full recovery	280	15.5	57	33.7	337	17.1
Severe injury, incomplete recovery	42	2.3	3	21.8	45	2.3
Distortion	129	7.1	12	7.1	141	7.1
Acceleration trauma of the spinal column	39	2.2	69	40.8	108	5.5
Luxation or rupture	96	5.4	3	1.8	99	5.0
Cut, bite, or scratch injury ^a	1,077	59.7	10	5.9	1,087	55.1
Fracture	84	4.7	7	4.1	91	4.6
Burn	14	0.8	1	0.6	15	0.8
Fatal injury	–	–	1	0.6	1	0.05
Not classified	54	3.0	6	3.6	60	3.0
All	1,805	100.0	169	100.0	1,974	100.0

^aMost cut, bite, and scratch injuries were inflicted on the hands and arms ($n = 946$; 87.8%)

prolonged or incomplete recovery (21.8%) more often than occupational accidents (2.3%; Table 3). Bone fractures occurred just as often in occupational accidents (4.7%) as in commuting accidents (4.1%). In occupational accidents, hands (48.3%) and arms (17.3%) were affected most often, while in commuting accidents neck injuries (45.0%) and injuries to the head, or polytrauma (19.5%), were most common (Table 4).

Ten per cent random sample for occupational accidents

For a more detailed analysis of accidents, data are available for 459 occupational accidents, representing a random sample of 10.6% of all occupational accidents that had been subject to being reported between 1998 and 2002. These data revealed animals to be the most frequent cause of occupational accidents (66.0%; Table 5). The proportion of traffic accidents increased from 3.9% to 9.6% when commuting accidents were also considered (no table). There was no difference between veterinarians and veterinarians' aides regarding the cause of the accidents (no table). However, there is a difference regarding the place of the accident between practices treating mostly small animals and those treating large animals (Table 5).

There is also a difference with regard to the animals that caused the accidents. In practices that treated small animals, most animal-related accidents were caused by cats and dogs, while in practices that treated large animals, horses and cows prevailed (Table 5). Animal-related injuries in veterinarians were most often caused by horses and cows (51%), while in staff they were most often caused by cats (54%; no table).

Bites and scratches were the most frequent injuries caused by animals (48.0%; no table), followed by minor injuries such as bruises (18.2%). Bone fractures occurred in 8.6% of the accidents (no table). Bone fractures were approximately ten-times more frequent when large animals, such as cows and horses, were involved (16.1% compared to 1.3%). In one instance, a veterinarian's aide was killed by a dog during treatment in the practice.

Table 4 Location of injury, separated by occupational and commuting accidents in 2002

Location of injury	Occupational accidents		Commuting accidents		Total	
	(n)	(%)	(n)	(%)	(n)	(%)
Head, polytrauma	230	12.7	33	19.5	263	13.3
Neck	58	3.2	76	45.0	134	6.8
Trunk	77	4.3	7	4.1	84	4.3
Arm	313	17.3	15	8.9	328	16.6
Hand	871	48.3	6	3.6	877	44.4
Leg	145	8.0	20	11.9	165	8.4
Foot	86	4.8	9	5.3	95	4.8
Unknown	25	1.4	3	1.8	28	1.4
All	1,805	100.0	169	100.0	1,974	100.0

Table 5 Causes and places of occupational accidents in a 10% random sample of occupational accidents filed between 1998 and 2002, separated by the primary type of animal treated in the practice

Cause of accident	Practices treating mainly				Total	
	Small animals		Large animals		(n)	(%)
	(n)	(%)	(n)	(%)		
Floor, steps, ramps	17	10.6	32	10.7	49	10.7
Gauge, needle, scalpel	5	3.1	21	7.0	26	5.7
Animals	112	69.6	192	64.4	304	66.0
Motor vehicle	3	1.9	15	5.0	18	3.9
Miscellaneous	24	14.9	38	12.8	62	13.7
All	161	100.0	298	100.0	459	100.0
Place of accident						
Stable	30	18.6	132	44.3	162	35.3
Practice	109	67.7	112	37.6	221	48.1
Others	22	13.7	54	18.1	76	16.6
All	161	100.0	298	100.0	459	100.0
Animal-related accidents						
Cow	14	12.5	56	29.2	70	23.0
Horse	11	9.8	68	35.4	79	26.0
Dog	35	31.3	26	13.5	61	20.1
Cat	48	42.9	33	17.2	81	26.6
Other animals	4	3.6	9	4.7	13	4.3
All animals	112	100.0	192	100.0	304	100.0

Occupational diseases

On average, 91 claims of occupational diseases were filed every year. Most claims concerned skin diseases (39.0%), followed by allergic respiratory diseases

(30.5%) and infectious diseases (19.1%) (Table 6). A trend over time was not apparent (no table).

Only one claim of disease suspected to be caused by exposure to chemicals was filed. A veterinarian with symptoms of encephalopathy (dizziness, memory loss, and false olfactory sensations) suspected these symptoms to be caused by exposure to disinfectants and anaesthetic gas. His claim was rejected.

In 35.1% of the claims, work-related factors were established as the cause of the disease (Table 6). The number of cases resulting in a monthly pension payment due to a reduction in the earning capacity of at least 20% (HVVG 1996, p. 61) was considerably lower ($n=8$ or 1.7%).

In two out of four claims concerning alveolitis, the disease was caused by dust from animal feed (Table 7). In both instances the veterinarians affected had to change jobs in order to avoid further exposure. In one case the veterinarian's ability to work was reduced by an estimated 20%, resulting in a pension. The second veterinarian's ability to work was reduced only by an estimated 10%, resulting in a granted job search assistance but no pension.

Due to work-related allergic asthma, 30 veterinarians or their staff had to give up their jobs (21.6% of all claims concerning allergic respiratory diseases; Table 6). A pension was granted to three claimants (2.1%). Most allergies were animal-related (54.2% of all verified cases; Table 7). For three out of the seven toxic respiratory disease claims, the occupational cause was confirmed, the causal agent's being disinfectant ($n=1$) or ammoniacal ($n=2$).

Table 6 Claims of occupational diseases filed between 1998 and 2002, separated by decision type *OD* occupational disease)

Occupational disease	Accepted with pension		Accepted without pension		Work-related, no OD ^c		Rejected		Total	
	(n)	(%) ^a	(n)	(%) ^a	(n)	(%) ^a	(n)	(%) ^a	(n)	(%) ^b
Chemical exposure										
Encephalopathy due to solvents	–		–		–		1	100	1	0.2
Physical exposure										
Tendosynovitis	–		–		–		4	100	4	0.9
Meniscus	–		–		–		1	100	1	0.2
Bursitis	–		–		–		1	100	1	0.2
Disc-related disease, low back	2	6.7	1	3.3	–		27	90.0	30	6.6
Disc-related disease, neck	–		–		–		3	100	3	0.7
Noise-induced hearing loss	–		–		–		2	100	2	0.4
Infections										
Human to human	–		2	20.0	–		8	80.0	10	2.2
Zoonosis	1	1.3	21	27.2	–		55	71.4	77	16.9
Lung diseases										
Extrinsic allergic alveolitis	1	33.3	1	33.3	–		1	33.3	3	0.7
Allergic asthma	3	2.2	27	19.4	18	12.9	91	65.5	139	30.5
Irritative or toxic asthma	1	14.3	1	14.3	1	14.3	4	57.1	7	1.5
Skin disease	1	0.6	9	5.1	70	39.3	98	55.1	178	39.0
All	9	2.0	62	13.6	89	19.5	296	64.9	456	100.0

^aRow per cent

^bColumn per cent

^cFor asthma and skin diseases it is mandatory for the claimant to stop work due to the health problem, otherwise the disease cannot be accepted as an occupational disease. When the disease is acknowledged to be work-related, support can be granted in order to prevent the deterioration of the disease

Table 7 Established causes of 160 verified occupational and work-related diseases between 1998 and 2002

Cause of occupational disease	Number	Percentage
<i>Degeneration of discs in lumbar spine</i>		
Lifting of animals	3	100.0
<i>Infections</i>		
Human to human		
Scarlet fever	1	50.0
Unspecified bacterial infection	1	50.0
All	2	100.0
<i>Zoonosis</i>		
Mycosis	10	45.5
Brucellosis	3	13.6
Lyme disease	2	9.1
Psittacosis	2	9.1
Not classified	5	22.7
All	22	100.0
<i>Lung diseases</i>		
Extrinsic allergic alveolitis		
Animal feed dust	2	100.0
Allergic asthma		
Hair, dandruff, feathers	26	54.2
Latex	8	16.7
Mites in storage areas	3	6.3
Organic dust	2	4.2
Not classified	10	20.9
All	48	100.0
Irritative or toxic asthma		
Disinfectants	1	33.3
Ammonia	2	66.7
All	3	100.0
<i>Skin disease</i>		
Primary irritant contact dermatitis		
Work in wet areas	30	37.5
Disinfectants	12	15.0
Unspecified	12	15.0
All irritants	54	67.5
Allergic contact dermatitis		
Hair, dandruff, feathers	12	15.0
Latex	7	8.8
Pharmaceuticals	6	7.5
Dichromate	1	1.3
All allergens	26	32.5
All forms of skin disease	80	100.0
All verified occupational diseases	160	100.0

Owing to skin diseases, ten claimants were forced to stop working as veterinarians or veterinarian's aides (Table 6). Allergy was the cause of 32.5% of all work-related skin diseases, the most important allergens being animal hair, dandruff, or feathers ($n=12$; 15.0%) and latex ($n=7$; 8.8%; Table 7). A severe allergic skin reaction was caused by amniotic fluid in two veterinarians (no table). In both cases the allergy started with a respiratory reaction to animal hair and, after several years, developed into an allergic respiratory and skin reaction to multiple substances, including amniotic fluid.

Of the 77 claims of animal-borne infectious diseases that were filed, 22 (28.5%) were accepted as occupational diseases. Most diseases concerned animal-borne mycosis ($n=10$; 45.5%). Of ten human-borne infectious diseases, two were accepted as occupational diseases (Table 6).

Discussion

The risk of occupational accidents is higher for veterinarians and their aides than for general practitioners and their aides. This is especially true for severe occupational accidents that are subject to registration, with a relative risk of 9.2 (95% CI 8.1–10.4) for veterinarians. To our knowledge, no comparable risk estimate is available in the literature. The risk of an occupational accident that is subject to registration for veterinary practice (36.6/1,000 full-time workers) is lower than for the construction industry (78.9/1,000 full-time workers) or the metal industry (49.8/1,000 full-time workers) and higher than for the chemical industry (18.7/1,000 full-time workers) or the trade and administration sector (19.8/1,000 full-time workers; HVBG 2003).

The observed annual rate for all work-related accidents of ten per 100 veterinarians and their staff is comparable to that (ten to 23 per 100 veterinarians) reported in other countries (Landercasper et al. 1988; Langley et al. 1995; Poole et al. 1998; Gabel and Gerberich 2002). Most occupational accidents are caused by animals (66%). This observation is confirmed by other studies, in which 43%–59% of all accidents were caused by animals (Thipgen and Dorn 1973; Smith and Stilts 1996; Jeyaretnam and Jones 2000; Poole et al. 1999). During their careers approximately 61%–68% of veterinarians sustain a major animal-related injury (Landercasper et al. 1988; Langley et al. 1995; Hill et al. 1998; Jeyaretnam et al. 2000). In contrast, only 12.5% of swine veterinarians sustained a major swine-related injury (Hafer et al. 1996). This difference might partly be explained by different definitions of major injuries. The accident rate is higher when animals are being manually restrained during radiography and when appropriate protective personal equipment is not always being used (Hill et al. 1998).

The animal causing the accident depends on the type of veterinary practice. Cows and horses are more dominant in large-animal practices and cats and dogs are the prevailing cause of accidents in small-animal practices. The accident rate is slightly higher (1.2-times) in large-animal practices than in small-animal practices. Therefore, our data suggest that the treating of large animals is more hazardous than the treating of small animals. However, owing to the lack of information on the number of the various animals treated, a separate estimated risk for each kind of animal cannot be calculated. When large animals are involved in an occupational accident, the injury tends to be more severe, e.g. the percentage of bone fracture is ten-times higher when cows and horses are involved than when cats and dogs are. In a Minnesota and Wisconsin survey, the type of practice did not affect the number of injuries, although large animals caused more severe injuries (Landercasper et al. 1988). A recent survey found the incidence of injuries to be higher in dairy practices than in other large-animal practices, but no control for the number of

patients treated was included in the analysis (Poole et al. 1999). Compared with the results of a similar survey of small (companion) animal practices, the injury rate was 1.75 times higher for large-animal practices (Poole et al. 1998). Therefore, particular attention to occupational safety should be given when large animals are being treated. The bites and scratches of cats and dogs, however, also have the potential for major injury, due to infection (Hill et al. 1998). The risk while dogs are being treated is, in our data set, demonstrated by the one fatal accident involving a veterinarian's aide within the 5-year period we analysed.

For large-animal veterinarians accidents occur more often in stables than in the practice office. However, owing to the lack of baseline information, our data do not allow the conclusion to be drawn that working at the site of the animal owner is more risky than treating the animals in one's own office. In the literature no data were found which would shed light on this issue.

Advice for the safe handling and treatment of animals comes in multiple areas. A comprehensive description regarding the safe handling of large animals is given by Grandin (1999). All the following advice is important in preventing accidents due to fearful or aggressive animals: calm and quiet handling of animals, the use of squeeze chutes with solid chute sides (in order to protect the handler as well as to prevent the animal from seeing the handler), restraining devices, non-slip flooring, and adequate shoes.

Injuries caused by gauges, needles, and scalpels are of minor importance in our data set (5.7%). They are most likely underestimated because most often they do not lead to a work-time loss of more than 3 days. In the above-mentioned survey of occupational hazards in large-animal practices, 32% of the reported accidents were needle punctures (Poole et al. 1999). In surveys 66%–87% of all respondents reported needle stick injuries (Hill et al. 1998; Hafer et al. 1996; Wilkins and Bowman 1997). Most often, an inadvertent injection of a vaccine seems to occur; e.g., in a survey, 27% of North Carolina veterinarians reported the accidental exposure to rabies vaccine (Langley et al. 1995).

Recapping needles was performed most of the time by many (86%) zoo veterinarians (Hill et al. 1998). If no needle disposal boxes were available, the probability of injuries increased (Gabel and Gerberich 2002). Appropriate use of needle and syringe disposal containers and the use of needle stick prevention devices, such as self-sheathing needles or recapping devices, would reduce the incidence of needle stick injuries.

Traffic accidents account for 3.9% of all occupational accidents. They are a little more frequent (5%) in large-animal veterinary practices, which is most likely due to the fact that those veterinarians spending more time driving from patient to patient. Similar percentages of vehicle accidents (5%–6% of all claims) were observed in Australia (Jeyaretnam and Jones 2000) and the USA (Thipgen and Dorn 1973). It was also demonstrated that, except for older veterinarians, those

reporting greater job satisfaction and a more favourable working climate showed a decreased likelihood of being involved in a traffic accident (Trimpop et al. 2000).

Claims for occupational diseases are filed approximately 20-times less frequently than those for occupational accidents (Table 2), but they bear the potential to reduce severely the workability of the claimant (nine cases in 5 years; Table 6). Allergic reactions (respiratory symptoms or allergic contact dermatitis) to animal hair, dandruff, and feathers proved to be the most frequent cause (23.8%) of all verified occupational diseases in veterinary practice. Therefore, our data confirm that allergic reaction to animals is a significant occupational health concern for veterinarians (Seward 1999). In a survey, 32% (89/276) of zoo veterinarians reported an allergic reaction to animals (Hill et al. 1998). Published studies of allergy prevalence among animal handlers, also comprising veterinarians, show levels of allergic reactions to animals of 11%–44% in various populations (Seward 1999). This wide range of estimations is partly due to imprecise definitions of disease. A survey of occupational asthma, based on the Finnish Registry of Occupational Diseases, revealed that 60% of all cases were caused by animal epithelia, hairs, and secretions, or flour, grains, and fodder. Apart from bakers and painters, veterinary surgeons had the highest incidence rate (Karjalainen et al. 2000). Those studies emphasise, as our data do, the need for a reduction in exposure to allergens in the workplace. Overall recommendations regarding control of exposure to animal allergens are given by NIOSH (1998). In particular, advice is given to increase ventilation rate and humidity in the animal housing area, to decrease animal density, to keep cages and handling areas clean, and to use absorbent pads for bedding. Skin contact with animal matter such as dander, serum, and urine should be reduced by the use of gloves and laboratory coats. The design of coveralls or laboratory coats should ensure that the forearms and neck are protected from accumulation of allergenic material and that the cuffs provide a seal with the gloves (Seward 1999).

Latex is the second most important allergen in the veterinarian's practice (15 confirmed cases, 10% of all accepted claims). The importance of latex allergies was also confirmed in surveys: 5%–12% of the veterinarians interviewed reported a skin reaction to latex gloves (Langley et al. 1995; Hafer et al. 1996; Hill et al. 1998). However, it could also be shown that the increased use of powder-free latex gloves reduced the incidence of latex allergies in the health professions (Allmers et al. 2002). Therefore, replacing powdered latex gloves with powder-free gloves should diminish the prevalence of latex as an allergen in veterinary practices in future.

Pharmaceutical drugs caused six cases of allergic contact dermatitis in our data set. In a Belgian study on occupational allergic contact dermatitis from drugs in healthcare workers, antibiotics were the most common sensitisers (Gielen and Goossens 2001). The study

sample also included four veterinarians with a contact allergy to drugs.

Allergic dermatitis, often being an IgE-mediated contact urticaria from animal exposure, is considered a significant problem in veterinary practice (Kanerva et al. 1996). Of 160 verified occupational diseases, 26 (16.3%) were caused by allergic dermatitis and 54 (33.8%) were caused by primary irritant contact dermatitis. In a survey of California veterinarians, 22% of women and 10% of men reported dermatitis on a hand or forearm during the past year. Dermatitis with work-related exacerbation factors was reported by 28% (Susitaival et al. 2001). The importance of occupational skin disease among veterinarians is also demonstrated by a Kansas survey in which 24% of the veterinarians reported non-infectious, recurrent, or persistent hand or forearm dermatitis; 28% had contracted at least one infectious skin disease from an animal. Veterinarians who never or rarely used gloves during obstetric procedures were more likely to report work-related dermatitis (odds ratio 1.78, 95% CI 1.78–10.1) than those who used gloves (Tauscher and Belsito 2002). Delivery of cattle or sheep might be associated with pustular dermatitis. In a Dutch survey, 62 (82%) of the 76 respondents experienced one or more episodes of pustular dermatitis while performing deliveries (Visser 1998). In our data set, ten cases of dermal mycosis (6.3% of all accepted claims) were observed in the 5-year period. Therefore, our analysis, as well as the few studies on skin disease in veterinarians, emphasises the need for skin protection in veterinarians' practices to be improved.

Breathing the air in stables might be a health hazard for veterinarians and their staff (Nowak 1998). This is confirmed by our data. Besides the 48 acknowledged cases of allergic asthma, two cases of extrinsic allergic alveolitis due to animal feed dust and three cases of irritant or toxic asthma due to disinfectants ($n=1$) or ammonia ($n=2$) occurred in the 5-year period. Thus far in the literature, little attention has been given to extrinsic allergic alveolitis and irritant or toxic asthma in veterinary practice. Therefore, apart from our data, no prevalence or incidence data are available.

Zoonotic diseases are a great health concern in veterinary practice (Weber and Rutala 1999; Jeyaretnam and Jones 2000; Weese et al. 2002a, b), and several case reports have been published recently (Davis 2001; Tarello 2001; Gosbell et al. 1999; Nation et al. 1999). In surveys, the reported percentage of veterinarians with previous zoonotic infections varies from 23% to 43%, depending on the outcome definition (Giesecke and Barton 1993; Schnurrenberger and Martin 1977; Langley et al. 1995; Hill et al. 1998). An Austrian survey analysed the prevalence of antibodies to viral, bacterial, and parasitic zoonotic agents in 137 veterinarians (Nowotny et al. 1997; Deutz et al. 1996a, b, 1997). The highest prevalence rates were found for respiratory syncytial virus (60%), *Toxoplasma gondii* (55%), and *Bartonella henselae* (formerly *Rochalimaea henselae*) (51%). A survey of 351 veterinarians from Ohio revealed

7.1% to be seropositive for *Bartonella henselae* or *B. quintana*. The number of years of experience with cats was a predictor for seropositivity (Noah et al. 1997). Owing to the lack of a control group, the studies quoted above are merely descriptive. They do not allow risk estimates relative to the population or other occupational groups to be given. The prominence of zoonotic diseases is confirmed by our study. Of 160 verified occupational diseases, 22 (13.8%) were zoonotic infections (Table 7). However, only one case (brucellosis) was accompanied by a permanent reduction in earning capacity so that a pension was granted. Most likely, the number of zoonotic infections is underestimated by our data due to the fact that some infections remain unnoticed or misdiagnosed (Nowotny et al. 1997) or are treated by the veterinarians themselves (Landercaasper et al. 1988) without their filing a claim. Nevertheless, our data suggest the importance of improving infection prevention in veterinary practice. The risk of development of a zoonotic disease can be lessened by early recognition of infected animals, proper animal handling, basic bio-security precautions, and personal hygiene (Weese et al. 2002a, b; Deutz et al. 1997).

Veterinary practice is becoming a female-dominated profession (Jeyaretnam and Jones 2000). In our data 34% of all claims concerning veterinarians and 98% of all claims concerning veterinarians aides stem from women. Due to missing baseline information, we are not able to calculate a gender-specific risk estimate for accidents or occupational diseases. There was no gender difference in number or type of injury sustained in the Minnesota and Wisconsin survey (Landercaasper et al. 1988). In a nested case-control study the relative risk for work-related injuries for men was 0.5 (95% CI 0.3–0.8; Gabel and Gerberich 2002). With the number of women engaged in veterinary practice, the question of potential negative effects on human reproduction becomes more important. A wide variety of agents with known or suspected teratogenic or foetotoxic properties in humans or animals may be found in veterinary workplaces (Steele and Wilkins 1996). The risk of adverse pregnancy outcome or spontaneous abortion has been analysed in several studies (Vaughn et al. 1984; Johnson et al. 1987; Schenker et al. 1990; Steele and Wilkins 1996; Lindbohm and Taskinen 2000), but, thus far, the results have been inconclusive. An accidental self-injection of a prostaglandin compound resulted in a spontaneous abortion, heightening awareness that veterinary practice can represent a human reproductive health hazard (Wilkins and Bowman 1997). No case of an adverse pregnancy outcome was reported in our data set. However, even though the foetus is covered by the accident insurance act, the nature of our data does not allow an elucidation of this issue.

Only veterinary practices are covered by the BGW. Therefore, the data presented here do not cover veterinarians working at universities, in industry or in public health departments. While insurance for all employed veterinarians in practices ($n=3,784$, Tierärz-

tlische Hochschule Hannover 2003, unpublished data) is mandatory, only 35% of the 10,475 self-employed veterinarians are covered by the BGW. Therefore, the absolute number of accidents that occur in veterinarian practice is even higher than the one reported here. Accidents that do not cause a work-time loss of more than 3 days are not subject to being reported. Those accidents are therefore likely to be under-reported. However, accidents that warrant medical treatment are likely to be reported, because traumatologists and health insurances are interested in being reimbursed through the accident insurance. Only diseases that are listed as occupational diseases are likely to be verified by the accident insurance company. Therefore, the analysis of claims of occupational diseases does not yield a precise picture of all putatively work-related disease. However, even with the shortcomings of the data presented here, it seems fairly safe to state that our analysis confirmed the elevated risk of accidents and occupational diseases for veterinary practices compared to other healthcare providers and other workers in the service sector. Attempts to prevent injuries should focus on animal-induced injuries, and attempts to prevent diseases should focus on skin and respiratory diseases, especially animal-related allergies. A collaboration of all experts in the field seems to be warranted in order to improve occupational safety and health in veterinarians and their staff.

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