Prevalence of occupational exposures and protective practices in Australian female veterinarians

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Objective To identify the prevalence of exposure to potentially harmful occupational hazards in Australian female veterinarians and to report factors associated with prevalence of occupational hazards in this profession.

Design National cross-sectional survey of a cohort population.

Procedure A self-administered questionnaire was mailed to 5748 veterinarians (males and females) graduating from Australian veterinary schools from 1960 to 2000. This paper reports the prevalence of occupational exposures in 1197 female veterinarians in their current job including radiation, anaesthetic gases, pesticides and long working hours. Comparisons were undertaken between respondents by practice type and decades of graduation. Multivariate logistic regression was undertaken to predict the risk for exposure to occupational hazards in female veterinarians by age, type of practice, graduation year and number of hours worked.

Results The response rate for females was 59%. We found that age under 30 years, small and mixed animal practice, graduation year after 1990, and working more than 45 hours per week were all associated with greater exposure to putative risk factors. Mixed animal practitioners worked more than 45 hours per week (53%) and reported the highest exposure to anaesthetic gases (94%) and pesticides (54%). Twenty two percent of those who were exposed to anaesthetic gases did not have waste anaesthetic gas scavenging systems. Small animal practitioners reported they took more X-rays (90%). While taking X-rays, 56% of respondents reported physically restraining animals, and only one in five of respondents used film holders and lead screens.

Conclusions The high prevalence of potentially harmful exposures among female veterinarians and lack of use of protective equipment at work needs to be considered in developing and planning the safety of veterinary work.

Key words: occupational health, survey, female veterinarians.

HRAV Health Risk of Australian Veterinarians
WAG Waste anaesthetic gas

Veterinarians have occupational exposure to several known reproductive hazards including physical hazards such as radiation and physical trauma; chemicals such as anaesthetic gases, laboratory solvents, insecticides or pesticides; biological hazards including zoonotic diseases; and psychological stress. All of these exposures may result in a wide variety of health concerns, such as adverse pregnancy outcomes and infertility in both men and women.1,14 There has been very little research on occupational exposures in veterinary practice, particularly in female veterinarians. The few published studies from the USA expressed concern regarding the potential for adverse health effects from occupational exposures in clinical practice, especially for female veterinarians of childbearing age. In Australia, there has been only one published survey of veterinary practices. It was carried out in 199315 and dealt with major occupational diseases and injuries in 160 male and female Western Australian veterinarians.

During 2002 we conducted the Health Risk of Australian Veterinarians project (HRAV) as a questionnaire based survey of all graduates from Australian veterinary schools since 1960. This study was the first complete national survey of health aspects of veterinary practice in Australia. The aims of the study were to determine whether veterinarians are at increased risk of cancer, injury, zoonoses or adverse reproductive outcomes and to identify risk factors for these conditions in veterinarians.

In this paper we report the prevalence of relevant occupational factors in female veterinarians who participated in the HRAV study. In particular, we focus on several potentially hazardous exposures affecting females, including radiation, anaesthetic gases, pesticides and long working hours. Comparisons were undertaken between respondents by practice type and decades of graduation. The purpose is to assist women in this profession to be aware of and avoid these hazards in their clinical environment and determine what steps should be taken to eliminate or reduce them. This study also will establish baseline data which are an essential prerequisite for further studies on the profession.

Materials and methods

Research design

The HRAV study is a retrospective cohort study of graduates from Australian veterinary schools for the years 1960 to 2000. The list of all veterinary science graduates (7928 males and females) was obtained with the assistance of alumni organisations. Current addresses were obtained from publicly available databases at the State Veterinary Registration Boards, the Australian Veterinary Association, the New Zealand Veterinary Registration Board, and the Royal College of Veterinary Surgeons (UK). Of those graduated
Results

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mean age of 35.9 years in 2002 (SE = ±0.2). Ages of the female

Demographic characteristics

There were 1197 female respondents to the HRAV survey with a

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Results

Demographic characteristics

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Occupational exposures and the use of protective practices

Approximately 82% of subjects spent at least 1 hour undertaking surgery per week (Table 2). Of those, 68% spent five or more hours per week in the operating suite and recovery-room area. We can assume that veterinarians undertaking surgery were exposed to anaesthetic gases; approximately one quarter of them did not use waste anaesthetic gas (WAG) scavenging to decrease ambient exposure.

We found that 43% of the veterinarians surveyed were exposed to pesticides on a daily or weekly basis. An exposure to X-rays (at least one film/week) was reported by approximately 79% of the 1197 female veterinarians surveyed. More than one half of them (56%) reported they restrained animals daily or weekly during radiographic procedures. Of those practitioners who were exposed to X-rays, approximately one half of them (52%) took radiographs of animals five or more times per week. In response to radiation protection questions, 88% reported that they always used a lead apron or a film holder. Most of the cohort worked full time with 36% of females working 45 hours and more per week.

Self-reported occupational exposures and protective practices by practice type

Anaesthetic gas exposure was more prevalent in small (92%) and mixed (94%) animal practice compared with large animal practice (42%). Among those doing surgery, 70% of women in small and mixed animal practice spent 5 or more hours per week in operating room, but 22% of women in small animal practice and
34% of women in mixed animal practice did not have WAG scavengers (Table 3).

Exposure to pesticides was more common in mixed animal practices (54%) and small animal practices (47%) compared with large animal practices (17%). X-ray exposure was more prevalent in small and mixed animal practices (90%) compared with large animal practices (37%). Among those taking X-rays, 64% of women in large animal practice took 5 or more films per week, 72% of women in mixed animal practice restrained animals during X-ray and 25% inadequately restrained animals (Table 3).

In response to radiation protection, mixed animal practice had lower use of lead screen (9%) and film holder (15%) while taking X-ray compared with small or large animal practice. Working 45 hours and more per week was more prevalent in mixed animal practice compared with small or large animal practice.
Self-reported occupational exposures and protective practices by graduation year

Recent graduates had more potential exposure to anaesthetic gases in comparison with earlier graduates. However, use of WAG scavenging systems was more common in recent graduates (Table 4). Reported exposure to X-rays was higher in more recent graduates with 89% of graduates in the years 1991 to 2000 taking at least one X-ray film per week. Taking 5 or more films per week, doing 5 or more hours surgery per week, restraining animals and using pesticides were also more prevalent in graduates from the years 1991 to 2000 (Table 4). Overall, however, the use of WAG scavengers and use of radiation protection were also higher in recent graduates compared with earlier graduates. The percentage of women working full time or more than 45 hours per week increased over time with year of graduation, as 82% of veterinarians who graduated after 1991 were working fulltime compared with 51% of women who graduated from 1961 to 1970.

Multivariate logistic regression of occupational exposures in female veterinarians

In a multivariate logistic regression analysis, taking 5 or more X-ray films per week was most commonly reported by small and mixed animal practitioners, by women under 30 years of age, by more recent graduates and by women working at least 45 hours per week (Table 5). A similar pattern was seen for women restraining animals during X-ray and doing surgery for 5 or more hours per week or using pesticide for at least once a week. Small animal practitioners had more than 10 times the risk of reporting doing surgery for 5 or more hours per week compared with those in large animal practice. Mixed animal practitioners had more than 4 times the risk of reporting using pesticide for at least once a week compared with large animal practice.

Discussion

This study is the first national survey of exposure to health risks among female veterinarians in Australia. With increasing proportions of veterinarian graduates being female, this survey highlights some important health issues for the veterinary profession. We compared the results of this survey with the results of a survey by Wiggins et al, covering 457 female veterinarians in the USA,1 and a survey of 160 Western Australian veterinarians by Jeyaretnam in 1993.15 The method used to estimate exposure in both studies were self-administered questionnaires.

Occupational exposures

Anaesthetic gases—Halothane, nitrous oxide, enflurane and methoxyflurane are commonly used anaesthetic gases in veterinary practice. Unintended exposure occurs principally through leakage of anaesthetic gases from equipment and from around animal face masks.11 A number of studies have suggested that operating...
room personnel may experience adverse health effects related to their work environment. The major adverse health effects identified include hepatic disease, renal disease, immunosuppression, bone marrow depression, enzyme induction, abortion, infertility, birth defects, cancer, fatigue, headache, nausea, pruritus, constant mental stress and a wide range of nervous system disturbances.

The results of exposure data from this survey showed that 82% of Australian female veterinarians were exposed to anaesthetic gases, which was similar to figures from the American surveys (83% and 81%) and the Western Australian study (88% in both sexes). In our survey, about two-thirds of respondents spent 5 or more hours per week in an operating suite or recovery room area and one-quarter did not use WAG scavenging to decrease ambient exposure to anaesthetic gases. This was fewer than the one-third of American veterinarians who did not use WAG scavenging in 1989. The prevalence of anaesthetic gas exposure increased from 71% among those graduating in the 1960s to 73% in 1980s graduates and 90% in 1990s graduates. The number of clinics that used a WAG scavenging system increased from 41% in 1960s graduates to 76% in 1990s graduates. This was consistent with the results from other studies that reflect improvement in practice over time.

Mixed and small animal practitioners reported the highest rates of exposure to anaesthetic gas. This result was consistent with other studies. Effective WAG scavenging, adequate room ventilation, and attention to proper use and maintenance of equipment can reduce anaesthetic exposures significantly at moderate cost and appears to be important in protecting the reproductive health of women who work with anaesthetic gases.

Pesticides—Pesticide exposure in veterinary practice occurs primarily through cutaneous exposure to pet grooming products such as flea dips and insect-repellent wipes. Secondary routes of exposure include inhalation of products such as insect fumigants sprayed in animal confinement areas.

We found that 43% of the veterinarians surveyed were exposed to pesticides on at least a weekly basis, which was similar to that found in the US (52%). Recent graduates and mixed animal veterinarians were more likely to use pesticides. It is suggested that taking precautions such as appropriate glove use by veterinary personnel is essential to minimize the risk of adverse reactions.

Ionising radiation—Ionising radiation is used for many purposes in veterinary medicine. These include diagnostic imaging, as well as treatment of selected neoplasms. During diagnostic radiation procedures, incident photons of the primary X-ray beam are scattered by electrons in the body of the patient and therefore represent a safety hazard for individuals who remain in exposure rooms during X-ray procedures. The dosage of radiation received depends on many variables such as number and kinds of radiographs taken in a given time, the protection devices and procedures used, and the machine type and settings. Occupational exposure to ionising radiation has been linked to increased spontaneous abortion in female veterinarians in a...
number of American studies. Human embryos and foetuses are sensitive to radiation, and exposure may result in deleterious effects including sterility, miscarriage, mutagenesis, carcinogenesis, fatal development problems and mental retardation in offspring. It has also been reported to increase the risk of developing aplastic anaemia and leukaemia in the foetus.

Our study revealed that 79% of the 1197 female veterinarians were exposed to X-rays which was similar to the results of American surveys (64–83%). However, we found a slightly lower prevalence than that reported in a recent study of Western Australian veterinarians (male and female), which showed that 94% of the respondents undertook X-rays. The different levels of exposure between the Western Australian study and our national survey might be explained by differences in survey design and population and also because the other study reported results for males and females combined. Our study also revealed that approximately 52% of these practitioners took 5 or more radiographs per week, which was slightly higher than that found in the US.

Eighty eight percent of the veterinarians in our survey used lead aprons, but large proportions of respondents did not use a thyroid protector, lead gloves, a lead screen or a film holder. These proportions were similar to those reported from the USA. Small and mixed animal practitioners had the highest rates of exposure to X-rays and were less likely to use radiation protection equipment. More recent graduates were more likely to use X-rays, to restrain animals during X-rays, to take more films per week and to make less use of film holders.

To reduce occupational exposure to ionising radiation, every veterinarian should minimise the duration of exposure by taking fewer X-rays or doing a fewer surgery per week, maintain an adequate distance from the source of radiation, and use barriers such as lead aprons, lead screens, lead gloves, thyroid shields and film holders. Distance from the primary beam can be increased by the use of chemical and mechanical animal restraints. In addition, radiological techniques such as the use of filters, collimators and faster screen-type films can be used to reduce the duration and amount of exposure. We did not ask about the use of collimators or use of filters in this study.

**Conclusion**

This study addressed the prevalence of exposure to potentially harmful occupational exposures including radiation, anaesthetic gas and pesticides among female veterinarians in Australia. The findings of this study revealed that veterinarians who worked ≥ 45 hours per week, small and mixed animal practitioners, and recent graduates who were younger had higher levels of exposures. Further, they suggest that considerable variation of all these exposures exists within the profession.

There were some limitations for this study as we did not have the resources to measure actual exposure levels and had to rely on self-reported data by participants. This survey did not also determine which anaesthetic agents were used by respondents, and use of anaesthetic agents might be different by the individual practitioners. Another limitation of this study was that we had no information regarding different types of pesticide exposure in
veterinary practice. In addition the response fraction was relatively low (59%), but is similar to that achieved by most mail surveys in Australia today. According to information from non-participating veterinarians (195 veterinarians who acknowledged the receipt of questionnaires but refused to participate), the main reasons for non-response were: working for a postgraduate qualification (for example in research area or in teaching), outside the profession for a long time, working temporarily overseas, too busy or having no time to fill in the questionnaire.

The higher levels of exposures to ionizing radiation, pesticides and anaesthetic gases among our female veterinarians and lack of use of protective equipment at work needs to be considered in improving the safety of veterinary work. Planning the ventilation of the workplace, minimising the amount of exposure, using radiation protection, using personal protectors against substances hazardous to health such as the appropriate use of a protective mask, shoes, and gloves to prevent exposure during procedures, is of vital importance. It is also essential that the veterinarians themselves participate in the planning of preventive measures, and in training and educating the profession about how and when to use protective devices at work.

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