Systematic review of suicidal behaviour and related issues of wellbeing in the veterinary profession

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Abstract

A systematic review of suicidal behaviour and related issues of wellbeing in the veterinary profession

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Population-based studies of suicide prevalence have identified certain occupational groups to be at particularly high risk of suicide. There is recent evidence that rate of suicide may also be significantly elevated in the veterinary profession. However, relatively little is known about the contributory factors that may explain this phenomenon.

The present study is the first systematic review of the research literature on the prevalence of, and factors associated with, suicidal behaviour in the veterinary profession. An extensive search strategy was performed in order to identify studies that presented data on these issues. Studies were categorised into two main groups: those that presented epidemiological data from observational studies of suicide prevalence and those that were survey-based studies of suicidal behaviour and associated issues of wellbeing in the veterinary profession.

In total, 89 papers were included in the final review. Nineteen studies of suicide prevalence were identified and 11 of these provided data on the relative risk of suicide in the veterinary profession. All but one of these studies found suicide to be significantly elevated in the veterinary profession. Interpretation of studies of highest quality found that the proportion of suicide in the veterinary profession was at least four times that of the general population. Data from 70 survey-based papers identified the prevalence of various aspects of suicidal behaviour in veterinary populations and the psychiatric, occupational and psychological risk factors that may help explain the reasons for the elevated rate of suicide in the veterinary profession.

Knowledge of suicidal behaviour and wellbeing in the veterinary profession is still very much in its early stages. The limitations of research studies reviewed have been identified and suggestions made about the direction of future research. Suggestions for methods of preventing suicide in this high-risk group are also made, based on the current research reviewed, and existing strategies in other groups at high risk of suicide.

Introduction

1.1 Suicide risk related to occupation

Internationally around 1,000,000 people die from suicide each year, making it a leading cause of death in both developing countries and the western world[1]. Suicide has important emotional, social and economic consequences. The family and friends of those bereaved by suicide undoubtedly experience significant emotional distress following the death and issues of stigmatization are particularly likely to affect the grief difficulties, depression and suicidal ideas that often follow a death from suicide[2]. The social consequences of suicide include copycat behaviour, which has been documented following celebrity suicides reported in the media[3]. Suicidal behaviour is often imitated by those who share similar characteristics with the celebrity and where specific aspects such as the method of the suicide are reported these are also copied[4]. The direct and indirect economic costs of suicide are substantial and studies evaluating the economic burden of suicide internationally report the cost per suicide to be as much as £1,400,000 in Ireland[5] and £1,200,000 in New Zealand[6].

Rates and methods of suicide are associated with many demographic, geographic, and cultural factors[7]. In the western world, suicide is far more common in males than females and the ratio of female: male suicides is around 4: 1[8]. This is likely to be due to a combination of several factors although the use of more lethal methods and a reluctance to seek help for difficulties are likely to be important contributory factors in male suicide[8]. A report by the World Health Organisation demonstrated that suicide rates increase steadily with age from around 1.2 suicides per 100,000 in the age group 5-14 years to around 55.7 per 100,000 in the age group over 75 years[9]. Patterns of suicide also vary between countries and cultures. Rates of suicide are highest in

Eastern European regions and lowest in Latin America. Whilst some regions of Asia such as Kuwait report age-standardized rates of suicide as low as 1.2 per 100,000, rates are considerably greater in Sri Lanka (43.4 per 100,000)[10]. These differences are likely to be affected by a combination of cultural, religious, and geographic factors in addition to ease of access to means of suicide. Suicide is also more prevalent in some occupational groups than others[11,12,13]. Occupations at particular risk include those in the healthcare professions as well as farmers. Again, access to easy means of suicide is likely to explain a substantial amount of variance in occupational suicide rates, although this is a developing area of research and much remains unknown about the interaction of important contributory factors in occupational suicide.

A major method used to investigate suicide in different occupations involves epidemiological analysis of national mortality databases. Early studies using national or regional mortality databases have identified elevated rates of suicide in famers[14,15], physicians and dentists[11]. The development of larger, more accurate and more accessible national mortality databases, enables researchers to draw conclusions from occupational suicide data with more confidence than was previously possible. For example, in a Norwegian study conducted over a 40 year period and including over 15,000 suicide cases, the three occupations at greatest risk from suicide were physicians, dentists and nurses [16]. Similarly, in a recent analysis of suicide by occupation in England and Wales, those in the healthcare professions had generally high proportional mortality ratios and specific occupations at greatest risk of suicide were male dentists and farmers and female veterinarians[17].

One factor that is commonly hypothesised to contribute to an elevated risk of suicide in certain occupational groups is access to means of suicide and the knowledge of how to use these methods[18]. In a study comparing methods of suicide in medical practitioners to methods of suicide in the general population, self-poisoning was significantly more likely to be used by medical practitioners[19]. More specifically, half of the anaesthetists who died by suicide had used anaesthetic agents in their suicidal acts. Similarly, firearms are significantly more frequently used as a method of suicide by farmers than members of the general population and importantly, both the overall rate of suicide and the rate of suicide using firearms fell after national legislation on the ownership of firearms was introduced in 1989[20]. Whilst these data suggests that access to means of suicide is likely to be one contributory factor, the extent to which it explains the increased rate in certain occupational groups is unknown and there are several other factors that are likely to contribute in addition.

Given that around 90% of suicide cases are associated with mental disorder[21] and 55-65% of those who have attempted to take their life report having been diagnosed with a DSM-IV mental disorder prior to the act[22], mental illness is likely to be more prevalent in occupations at risk of suicide than those with a lower risk. The psychological autopsy approach is a common method used to investigate the circumstances, including psychiatric history, associated with suicide[23]. It involves investigating coroners' records, medical notes and witness statements, as well as interviewing family members of the deceased where appropriate. In a psychological autopsy study of suicide in doctors, 86.2% of those who died from suicide had been suffering from psychiatric disorder at the time of death and in the majority of cases this was a depressive disorder[24]. Similar findings were observed in a psychological autopsy study of suicide in

farmers, where 82% were suffering from a mental disorder at the time of death, which was most commonly depressive illness[25]. However, the nature of the causal links between mental illness and suicide in these groups require more in depth study. It may be that levels of mental illness are no higher than in the general population, but that when suffering from mental health difficulties, veterinarians are more likely to think of suicide and have an easy access to means.

In a prospective study of suicide in female nurses, suicide was found to be significantly associated with severe work-related stress[26] suggesting that certain aspects of nurses' working life contributed to their risk of suicide. In addition, interviews with family members of physicians who had died by suicide showed that 71.4% of individuals had experienced occupational problems in the year leading up to their death[24]. In particular, facing complaints, long working hours, a large volume of work and the responsibility of their job were commonly identified occupational difficulties. These findings are not restricted to high-risk healthcare professions. A study of farmers showed that 52% of those working when they died of suicide had experienced occupational problems in the year before their death [27]. Financial difficulties are seen as a major source of stress for farmers[27] and professional isolation has also been found to be a predictive factor of suicide in Scottish farmers[28], suggesting that occupational risk factors may vary between professions at risk of suicide.

Finally, self-selection is often identified when discussing the causes of suicide in certain occupational groups[12,17,29]. That is, individuals who have pre-existing risk-factors for suicide may be more attracted to certain professions than others. Characteristics such as perfectionism and controlled emotional expression have

been associated with depression, and consequently suicide, and have been identified as characteristics of those who join the medical and other healthcare professions[11]. Again, the extent to which these factors contribute to completed suicide is unknown.

1.2 Suicide prevention in high-risk occupational groups

Reducing the rate of suicide in high-risk occupational groups is a priority in the national suicide prevention strategy for England[30] and a thorough understanding of the suicide risk factors in these occupational groups is essential for the development of effective suicide prevention strategies. As a result of research studies which identify the particular risk factors facing certain professions, several measures have been put in place to help reduce the number of these members from taking their lives.

In a study of suicide by farmers in Sri-Lanka, easy access to lethal pesticides was identified as a significant contributory factor[31] and pesticides in rural farming communities are frequently kept in the household and are seldom locked away in storage containers. In 2004, a pilot programme that involved supplying farming communities with secure storage boxes for their pesticides was initiated by a Sri Lankan national non-governmental organisation (Sumithrayo). Following the success of this programme, these boxes were issued on a larger scale and the use by the communities at risk of suicide evaluated[32]. Before issuing the boxes, 72.5% of households reported that adults in the household had easy access to pesticides. Thirty weeks after the strategy had been implemented, 82.3% of households reported using the box all of the time and 100% reported the box to be useful[32]. Similar findings emerged from another

pilot study of lockable storage devices[33]. These studies demonstrate preliminary evidence of the scheme's success at reducing easy exposure to pesticides and indicate that a larger trial in which the intervention's success at reducing the suicide rate in Sri Lankan farmers is warranted.

In the UK, several measures have been taken to prevent suicide in the farming community. There is increasing recognition that professional and social isolation, stigma of mental health problems and suicide, reluctance to seek help for problems and financial pressures are key factors that contribute to elevated levels of stress and mental ill health in farmers. This led the Department of Health (DoH) and the National Farmers Union (NFU) to establish the Rural Stress Information Network[34]. Similar systems exist in Wales[35], the USA[36] and Canada[37].

In order to support doctors the British Medical Association (BMA) provides a confidential counselling service for doctors in distress and a similar network that is staffed by doctors themselves provides confidential support and counselling[38]. In a report on 'Doctors for Doctors' by the Health Policy & Economic Research Unit, research evidence to suggest that stigmatisation of ill health, elevated levels of stress, drug and alcohol abuse, mental illness and a tendency to self-treat problems is summarised and used to justify the continued support of national peer and non-peer support networks[39].

1.3 Suicide in veterinary surgeons

Veterinary surgeons share many occupational factors with the professional groups for which there is an established high rate of suicide. In terms of

education, they undergo a similar pattern of training to medical practitioners; entry onto the course is highly competitive, the undergraduate course typically takes five to six years to complete, and involves theoretical as well as clinical skills training. Like medical practitioners, veterinary surgeons also typically work shift patterns and are frequently on call, factors which have been reported to contribute to stress in the medical profession[40]. Many veterinary surgeons work in rural areas, with minimal contact with other members of their profession and this kind of isolation is known to be a contributory factor to suicide[41]. In common with all professions at risk of suicide, veterinary surgeons have relatively easy access to methods of suicide. Importantly, veterinary surgeons have not only the access to means of suicide but the knowledge of how to use them to terminate life since euthanizing animals is a routine part of most clinicians' workload.

Within the veterinary profession there is a growing awareness of the stressful nature of the veterinary medicine training course and of the veterinarian's job. The effect that occupational stress might have on both mental ill health and potentially suicidal behaviour has become a major concern for the veterinary profession and its representative bodies. The Veterinary Record is the official journal of the British Veterinary Association (BVA) and publishes a rapidly increasing number of letters and news items related to the wellbeing of veterinarians in Great Britain. These range from personal accounts of members of the profession who have personally experienced suicidal behaviour[42], to hypothetical models for stress[43] and suggestions for methods to prevent suicidal behaviour[44]. Recognition of the veterinarian's vulnerability to mental ill health exists in several countries, with the Journal of the American Veterinary Medical Association (JAVMA), the Australian Veterinary Journal, the Canadian

Veterinary Journal and Tijdschrift voor Diergeneeskunde (a Dutch Veterinary Journal) frequently publishing articles by members who are concerned about the mental wellbeing of their profession. In many cases, these are individuals who have been personally affected by suicide. In Britain, the Veterinary Support Working Party (VSWP) group was founded by leaders of veterinary organisations with the aim of raising awareness of the importance of wellbeing in the veterinary profession. By working with those who are conducting research into the problem, they also aim to help implement suicide prevention strategies.

Research in the USA as early as the 1960s documented an elevated rate of suicide in veterinary surgeons[45]. However, due to the relatively small size of the profession, the actual number of veterinary surgeons dying from suicide per year is much lower than other professions. For this reason the power of statistical analysis has been limited and the implications in terms of potential number of lives to be saved have meant that greater attention has been paid to other professions such as doctors and nurses. In 2005, the first specific epidemiological study of suicide rates and methods of suicide in veterinary surgeons in England and Wales was conducted[46]. Analysing 744 deaths of veterinary surgeons in England and Wales between 1979 and 2000 (including 74 suicides) this study demonstrated that the rate of suicide in veterinary surgeons was around 4 times that of the national average and was significantly greater than that of medical practitioners and dentists. Studies from Europe[47], the USA[48], and Australia[49] have also demonstrated the rate of suicide in veterinary surgeons to be significantly elevated.

Given that suicide in other high-risk occupations is associated with ease of access to means of suicide, one might expect acts of suicide by veterinary surgeons to involve occupation-related methods. Few studies have investigated the methods of suicide used by veterinary surgeons. However, in an epidemiological study of suicide methods by occupation in England and Wales between 1982-1996, it was found that 79% of male and 100% of female veterinary suicide cases involved poisoning[18]. Little is known about the methods used by veterinary surgeons who *attempt* suicide.

Based on evidence that suicide is usually associated with mental illness, one might also expect rates of psychiatric disorder to be elevated in the veterinary profession. Research to investigate the mediating effects that mental illness might have on suicide rates in veterinary surgeons is lacking, although questionnaire-based studies of depression in veterinarians and veterinary medicine students suggest that 3.2% of French veterinarians[50] and 4.1% of New Zealand veterinarians[51] are currently experiencing clinical levels of depression. Unfortunately statistical comparisons with figures from the general population were not made in these studies. Even higher rates of depression existed in a study of veterinary students in the USA in which 32% of students were found to be experiencing clinical levels of depression[52]. This rate is significantly greater than that of both human medical students [53] and the general student population[52], suggesting that depression may be related either to some particular aspects of veterinary medicine training or to the personality types of those attracted to training as a veterinary surgeon. Anxiety disorders were reported by 11.3% of American veterinary medical students[54]. Also, the majority of practising American veterinary surgeons demonstrated the beginnings of burnout syndrome[55], which was significantly associated with work-related

stress[56]. It is not known however, exactly how mental illness might contribute to suicide in the veterinary profession.

There is also a lack of research that investigates the effect of occupational difficulties on suicide in the veterinary profession specifically. However, several studies suggest that certain aspects of veterinary working life may present veterinarians with difficulties that may in turn result in an increased risk of suicide. Whilst some factors may be shared with other high-risk occupations (e.g. long working hours and professional isolation), certain aspects may be unique to veterinary surgeons (e.g. animal euthanasia).

In an Australian study it was found that practising small animal veterinarians work an average of 45 hours per week, have around 14 consultations per day and euthanize around 5 animals a day[57]. All of these factors were found to be significantly positively associated with self-reported job stress. In a study of German veterinary surgeons, 43% reported working more than 48 hours per week and those that did were significantly more stressed than those who did not[58]. Emerging evidence that professional isolation may be a contributory factor shared with the farming community comes from epidemiological studies that report that the majority of veterinarians who die from suicide are living or working in rural areas[49]. Further support for the suggestion that euthanasia may be one factor that influences the wellbeing of veterinarians comes from a study that showed that having to euthanize an animal they were trying to save led to sleeping difficulties in 14% of veterinarians, feelings of depression in 51% and failure in 61%[59].

However, in spite of these advances in knowledge, we are far from having a complete understanding of why suicide rates are high in the veterinary profession. Further investigation of suicidal behaviour is definitely needed.

1.4 Methods of investigating suicidal behaviour

1.4.1 Observational studies of the prevalence of suicide

Epidemiological approaches to suicide research typically involve studying national mortality databases to determine levels of suicide and the demographic, economic, geographic and social factors associated with completed suicide in a given population. The existence, access to, and quality of national mortality databases vary greatly by country which affects how much data can be collected and the types of analyses permitted. Furthermore, regardless of the database from which suicide data are taken, analysis of occupational mortality is often limited by the size of the occupational group under study. This is particularly true for veterinary surgeons, as they belong to a comparatively small profession.

Where national mortality databases are available and contain information about the occupational status of the deceased, researchers are able to compare the risk of suicide in different occupations, making statistical comparisons with both the general population as a whole, and other occupational groups of particular interest, using a variety of statistical techniques. The types of statistical analysis conducted carry their own strengths and weaknesses, and should be understood before suicide data are interpreted.

1.4.1.1 Rates of suicide and relative risk (RR)

A crude indicator of the incidence of suicide in a particular occupation ideally involves identifying the number of suicide cases (numerator data) in a given time period, as a fraction of the total number of members of that profession in the same period of time (denominator data). This ratio is known as the absolute (crude) rate and is typically in the form of number of cases of suicide per 100,000 members of the profession. The absolute rate of suicide provides a standard statistic that can be compared with other occupations and can be adjusted for age or other demographic variables of relevance as necessary.

Where numerator and denominator data of a comparison population are also available, the Relative Risk (RR) of suicide (compared to other forms of mortality) can be calculated (see Figure 1). The absolute rate of suicide in the study population is divided by the absolute rate in the comparison population. This is the optimal form of comparison as the data are not affected by differences between occupations in other causes of death.

Figure 1: Calculation of Relative Risk (RR)

$$RR = \frac{\text{Number of suicides in the study population/100,000 members}}{\text{Number of suicides in the comparison population/100,000 members}}$$

The explanatory power of the RR depends partly on the structure of the two populations studied. Differences between the populations in terms of potentially confounding variables such as age and gender, may in themselves explain the relative risk that the study population is exposed to. Where there is

reason to believe that the two populations may differ in terms of confounding demographic variables such as these, age- and gender-adjustments can be made to enhance the extent to which relative risk of the study population can be attributed to occupational factors. The precision of the RR is expressed in terms of 95% confidence intervals around the point estimate.

1.4.1.2 Proportional suicide and proportional mortality ratio (PMR)

When the study population denominator data (the number of members of the profession) are not available, cases of suicide must instead be compared to all deaths in the study population. This fraction is known as proportional mortality (PM) and is often expressed as a percentage (see Figure 2).

Figure 2: Calculation of Proportional Mortality (PM)

$$PM = \frac{\text{Number of deaths due to suicide}}{\text{Total number of deaths}} \times 100$$

The relative risk of suicide can be estimated by comparing the PM of the study population with the PM of a comparison population. This statistic is known as the proportional mortality ratio (PMR). The comparison population tells us what proportion of deaths we should expect to be due to suicide by multiplying the total number of deaths in the study population by the proportion of deaths in the comparison population (Figure 3).

Figure 3: Calculation of Proportional Mortality Ratio (PMR)

$$PMR = \frac{\text{Observed number of suicides}}{\text{Expected number of suicides}} \times 100$$

where,

'Expected number of suicides' = Suicide PM (comparison pop) x Total deaths (study pop)

A PMR of 100 indicates the PM for suicide is the same in the study population as it is in the comparison population. On the other hand, a PMR of 200 indicates that the PM of the study population is twice the size of the PM of the comparison population. Conversely, a PMR of 50 indicates that the PM in the comparison population is twice the PM in the study population. Again, the precision of the PMR is usually expressed in terms of 95% confidence intervals around the point estimate. Statistical tests of the significance of the PMR are sometimes calculated and reported as a p-value. However if these are not reported, confidence intervals that do not include 100 are used as a rough indication that the proportion of deaths due to suicide is significantly different from the proportion in the comparison population. A limitation of the PMR is that it assumes the proportion of deaths due to non-suicide causes is the same in both the study and comparison population. Differences between the two populations in terms of the frequency of other causes of mortality threaten the validity of the PMR[18].

1.4.1.3 Standardising relative risk

When data on the distribution of suicide by age or gender are available in the study population, a standardised indication of relative risk can be calculated.

Standardisation is either performed directly or indirectly. Direct standardisation involves dividing the age- or gender- specific rate (or PM) by the overall rate (or PM) in the comparison population. This method can be used to standardise both RR- and PMR-based figures. Indirect standardisation involves firstly multiplying age- or gender-specific rates of suicide in the comparison population, by the number of individuals that belong to that age or gender group in the study population in order to obtain a measure of standardised expected rates. This expected rate then becomes the denominator, the numerator being the observed number of suicides in the same age or gender subgroup of the study population. The resulting statistic is known as the standardised mortality ratio (SMR). It is only ever used to compare rates (rather than PM) between age or gender subgroups of the study and comparison population. Since demographic structure is likely to differ between occupational groups, SMRs should not be compared between occupations[60].

1.4.2 Observational studies of the methods of suicide

Mortality databases also allow methods of suicide to be analysed. Typically, the death certificates from which they are based identify the cause of death, which is usually assigned by a coroner. Where databases provide this information the frequency of different methods of suicide can be compared between occupations. This is particularly useful as an indicator of whether occupational mortality from suicide is related to access to means of suicide, as has been demonstrated in studies of methods of suicide in farmers and doctors[19,20].

1.4.3 Questionnaire methods

A common assumption in suicide research is that completed suicide represents the tip of the iceberg of a much larger phenomenon of widespread poor mental health[61]. For every case of suicide, many more individuals attempt suicide, think seriously about suicide, or experience occupational or mental difficulties that also put them at risk of suicide. Gaining information from groups exhibiting these phenomena is an important aspect of research, particularly when access to national mortality data is not possible for whatever reasons. Questionnaire-based surveys have been useful in identifying the factors associated with suicidal behaviour in several occupational groups.

In a recent cross-sectional survey of female hospital physicians in Sweden and Italy, around 14% of respondents reported having thoughts of suicide[62]. The survey also asked respondents about several potentially difficult work-related issues and found that degrading experiences/issues of harassment were significant predictors of suicidal ideation (OR=3.03, 1.48-6.23). In a survey of British farmers, levels of psychological distress, as measured by the General Health Questionnaire (GHQ) and the Hospital Anxiety and Depression Scale (HADS) were around 35%[63]. Work-related factors that farmers reported to be particularly stressful were new legislation, amount of paperwork and media criticism. Similarly, in a survey of the mental health of farmers in the north of England, it was found that 30.2% experienced severe levels of anxiety and 12.4% experienced severe levels of depression[64].

The emergence of evidence for a significantly elevated rate of suicide in the veterinary profession is relatively recent, and therefore few questionnaire based

studies have investigated the nature and causes of suicide in the veterinary profession. However, there has been concern for many years that risk factors for suicide such as occupational stress and mental illness are prevalent within the profession. Questionnaire-based studies have been an important research tool for investigating these factors. For example, a study of the prevalence and causes of stress in Finnish veterinarians found that 73% reported being 'rather' or 'very' stressed[65]. Work was considered the primary cause of stress by 65% of respondents and common aspects of working life that were particularly difficult included a heavy workload and being on call. The questionnaire method has also been used to provide evidence of elevated levels of anxiety and depression in veterinary surgeons and students[51,52].

1.4.4 Interview studies

Whilst questionnaire studies allow a more in-depth analysis of the contributory factors associated with suicide than studies based on mortality databases, they are restricted by the fact that they are often based on forced-choice items and may not provide the participant with the opportunity to describe their experiences of suicidal behaviour fully. For this reason, interviews with individuals who are exposed to risk factors for suicide can be particularly useful. They enable participants to describe their experiences of suicidal behaviour in their own words, which is especially important when studying suicidal behaviour in other cultures or in groups where little is known about suicidal behaviour. In relation to occupations at risk of suicide, interviews have been used to describe pesticide storage practices in an Indian farming community[31], the experiences of pharmacists who have drug or alcohol addictions[66], and to

compare the prevalence of stress and attitudes towards using drugs as a means of coping with stress between doctors, dentists and veterinarians[67].

1.4.5 Psychological autopsy studies

Researchers in the field of suicide recognise that studying suicide using a range of methodologies is important. Where national mortality data are available for specific occupations and researchers also have the resources to investigate suicide on a more individual level, the psychological autopsy method can be particularly useful[23]. Cases of suicide in the occupational group of interest are typically identified from a national mortality database. This national register is usually able to supply death records for the cases identified, allowing the coroner that presided in the suicide case to be contacted. With the coroner's permission, records associated with the case can be analysed (for example psychiatric records, interview transcripts with key informants to the case and police records) and where appropriate, friends or family of the deceased may be contacted to gather their thoughts on the causes of suicide. Triangulation of data in this way provides a detailed picture of the various circumstances and events that lead up to the death, which is important given that suicidal behaviour is known to be a complex phenomenon involving the interaction of multiple contributory factors [7]. As well as the many methodological issues that must be considered when designing and carrying out studies using the psychological autopsy approach, these studies have important ethical implications due to the sensitivity of the data involved, most noticeably the studies which have contact with third parties such as family and friends[23].

Psychological autopsy studies have been conducted to investigate suicide in several high-risk occupations such as doctors[24], female nurses[68], farmers[27], police[69], and Army personnel[70]. They enable data on a wide range of areas to be collected and are useful for studying suicide in particular occupations as they allow information to be collected on methods of suicide used, history of suicidal behaviour, social support and isolation, occupational difficulties in the period leading up to the death and contact with support services.

1.4.6 Systematic reviews

In any area of healthcare research, an increasing number of studies investigating similar aspects of disease epidemiology, diagnosis, management or treatment can inevitably lead to confusion about the overall conclusions that should be drawn from the body of research and therefore the implications for healthcare policy that the research might have is often unclear. Systematic reviews aim to assimilate research in a given area, describe the research and its findings, and where possible, synthesise the research in order to develop conclusions about the overall findings and therefore make suggestions about the implications of the research for the disease and aspect of interest. Given that the review may have implications for healthcare policy, it is vital that it accurately and reliably describes the research available. Guidelines for systematic reviews describe the methodological steps necessary to achieve these goals.

Historically, systematic reviews have involved reviewing randomised controlled trials (RCTs) for the treatment of a disease[71] based on the assumption that a truly unbiased and accurate systematic review assimilates only information

from those studies that employ a high quality, rigorous experimental design in order to minimise potential bias. More recently it has been recognised that it is not always possible or appropriate to conduct systematic reviews of RCTs, for example where only data from observational studies are available[72]. This is particularly so where the prevalence or the risk factors associated with a disease are being investigated and therefore observational studies are necessary. Systematic reviews have the same value in assimilating and synthesising research findings of observational studies as they do for experimental studies. Recognition of the relevance of the systematic review methodology to non-RCT studies has led several research groups to develop protocols and guidelines for how these reviews should be conducted and reported[72,73,74]. Given the non-experimental nature of the studies included in such reviews, assessing the risk of bias for these studies is a key part of these guidelines[75].

Since there is a growing body of research investigating the prevalence and risk factors for suicide in particular occupational groups, there is a need for systematic reviews of these studies to be conducted in order for reliable conclusions to be drawn from these studies and effective preventive measures to be developed as a result where appropriate. To date, the majority of reviews of occupational suicide have been narrative in nature. Whilst these have been useful in raising awareness that certain occupational groups are potentially at risk from suicide, guidelines for the application of systematic review methodology to non-RCT studies highlight the need for and means of conducting, good quality systematic reviews in this area of research. The results of these should enable the development of suicide prevention measures to be conducted based on the most reliable and accurate research available.

1.5 The present study

Together with colleagues, I have conducted a systematic review of studies of risk of suicide in the veterinary profession and of mental health and stress factors that may contribute to this risk. This study is, as far as the author is aware, the first systematic review of the rates and risk factors of suicide in a particular occupation group. The study populations are veterinary surgeons and students. These populations are deemed appropriate given that a significant number of studies of suicide prevalence and risk factors have been conducted to suggest that veterinary surgeons are at increased risk of suicide. Furthermore, the veterinary profession has demonstrated a keen interest in understanding more about the reason why members of its profession die from suicide each year and a systematic review of the available research literature may inform the direction of future research as well as potentially effective suicide prevention measures. The aims of the review are summarised below.

1.6 Aims of the review

2. To assimilate and describe the nature of all available population-based prevalence studies of suicide in the veterinary profession.
3. To summarise studies of the prevalence of suicide in the veterinary profession internationally.
4. To summarise the methods of suicide used by the veterinary profession.
5. To assimilate and describe the nature of all other research investigating risk factors associated with suicidal behaviour in the veterinary profession, including that from questionnaire- and interview-based studies, psychological autopsy studies and reviews.

6. To summarise the factors which may contribute to suicide in the veterinary profession, including the prevalence of mental illness and occupational difficulties.
7. To make suggestions about the direction of future research into suicidal behaviour in the veterinary profession.
8. To develop suggestions for suicide prevention strategies in the veterinary profession based on available evidence.

Chapter 2: Method

2.1 Search strategy

The systematic review process, including the number of studies at each stage, is illustrated in Table 3.4. The search strategy began with an electronic search of existing literature on the emotional wellbeing, mental health and suicidal behaviour of those in the veterinary profession. An extensive search of the databases MEDLINE (1950-May 2008), EMBASE (1980-May 2008), AMED (1982-May 2008), BNI (1985-May 2008), CINAHL (1982-May 2008), PsycINFO (1806-May 2008), SCOPUS, Web of Science (1945-May 2008) and IBSS (1951-May 2008) was conducted in May 2008. Free-text terms 'wellbeing', 'emotion*', 'anxiet*', 'psycholog*', 'mortalit*', 'mental illness', 'mental health', 'stress*', 'depress*', 'self harm', 'suicid*' were combined with the terms 'veterinar*' and 'vets'. In addition, exploded subject headings (see Table 1.1) were combined in a similar way. This process identified publications that did not contain the above free-text terms but which had been identified by managers of the respective electronic databases as belonging to similar categories of research. No language restrictions were applied to the search and neither were there restrictions about the type of research reported in the publication.

2.2 Abstract screening

Using the above search strategy, a total of 20631 references were retrieved and stored in a database using electronic bibliographic software (EndNote). After duplicate references were identified electronically, 13121 references remained. These references, including abstracts where available, were each assigned a

random number between 0 and 1. Once listed in order of this number, they were allocated in blocks to one of four members of the research team (Reviewer 1: SS, Reviewer 2: RM, Reviewer 3: KH, Reviewer 4: LS). Following random allocation, each reviewer made an independent decision based on the following inclusion criteria about whether or not each reference should be screened at the full-text level:

a) Paper includes information on suicide, mental illness, stress and other related issues,

AND

b) Paper reports the above issues in relation to veterinary surgeons or students of veterinary medicine

Table 1.1: Subject heading terms used in electronic search

Database	Subject headings related to suicidal behaviour and wellbeing		Subject headings related to veterinary medicine
MEDLINE	Behaviour and Behaviour Mechanisms	Behavioural disciplines and activities	Veterinary medicine
	Psychological Phenomena and Processes	Mortality	Veterinarians
	Mental disorders		
EMBASE	Psychological and psychiatric procedures, techniques and concepts	Psychological and psychosocial phenomena	Veterinary medicine
	Mental function	Mortality	
	Suicide	Wellbeing	
	Mental disease		
AMED	Psychiatry and Psychology	Mortality	Physicians
	Suicide	Mental health	Education medical
CINAHL	Psychological processes and principles	Psychiatric emergencies	Veterinary medicine
	Behaviour and behaviour mechanisms	Injuries, self-inflicted	
	Behavioural symptoms	Mortality	
	Mental disorders		
PsycINFO			Veterinary medicine
IBSS	Suicide	Emotions	Veterinary medicine
	Mentality	Psychiatry	Veterinarians
	Mortality	Well-being	
	Psychology		

Each abstract was also independently screened by a second reviewer (Reviewer 5: BP) to ensure references were consistently reviewed and that results were not affected by reviewer biases. Cohen's Kappa values were calculated to estimate the level of agreement between reviewer 5 and each of the other reviewers (see Chapter 3.1.1). The process of abstract screening identified more duplicates, which were removed from subsequent review processes. References that both reviewers classified as not meeting inclusion criteria were also excluded from the subsequent review processes. References that both reviewers agreed met the abstract screening inclusion criteria were automatically forwarded for screening at the full-text level. On occasions when reviewers disagreed on whether a reference met the inclusion criteria, another member of the research team (reviewer 6: LH), who was given the same abstract screening instructions and inclusion criteria, reviewed the references and abstracts. The decisions of reviewer 6 were used to determine whether the reference was selected for review at the full-text level or not.

2.3 Full-text screening

A full-text copy of the references was obtained from the University of Oxford library catalogue, the British Library or through contact with the author of the paper. However, the author was unable to locate a few of the references at the full-text level, and a small number were identified as duplicates once a full-text copy was obtained. Each paper written in English was assigned a random number and using an identical method as at the abstract screening level, papers were randomly distributed between reviewers 1-3 for independent full-text screening. Once again, each paper was also reviewed by reviewer 5 in

order to ensure screening consistency and to minimise reviewer bias. Reviewers were required to allocate papers to one of 4 categories based on the inclusion criteria detailed in Table 1.2. Several references were not published in English (62 Dutch, 12 German, 5 Africaans, 4 Russian, 3 Spanish, 1 Polish, 1 French and 1 Japanese). These references were distributed to translators, along with the full-text inclusion criteria (Table 1.2) in order for a consensus decision with reviewer 5 to be reached.

Table 1.2: Full-text inclusion criteria

Code	Category	Details
1	Include for data extraction	a. Paper is related to the following issues: stress, mental health, psychological well-being or suicidal behaviour
		AND
		b. Paper reports primary empirical data related to the above in veterinary surgeons or veterinary medicine students
2	Studies of relevance but without primary empirical data	a. Paper is related to the following issues: stress, mental health, psychological well-being or suicidal behaviour
		AND
		b. Paper discusses possible causes, methods of prevention or models of the above in veterinary surgeons or veterinary medicine students but does not present any primary empirical data.
3	Studies used to inform background to the review	a. Paper is related to the following issues: stress, mental health, psychological well-being or suicidal behaviour
		AND
		b. Paper provides useful information about the above in relation to veterinary surgeons or veterinary medicine students.
4	Exclude as irrelevant to the review	a. Paper is related to stress, mental health, psychological well-being or suicidal behaviour in veterinary surgeons or veterinary medicine students but does not fulfil criteria 1b, 2b or 3b.
		OR
		b. Paper is not related to the following issues in veterinary surgeons or veterinary medical students: stress, mental health, psychological well-being or suicidal behaviour.

Cohen's Kappa values were once again calculated to estimate the agreement between Reviewer 5 and Reviewers 1-3 in terms of the categories to which studies were allocated (see chapter 3.1.2 for results). When reviewers

disagreed on which category a paper should be assigned to a discussion between the respective reviewers took place and a consensus decision was reached.

2.4 Additional search methods

In order to ensure that all studies of relevance to the present review were considered for inclusion, the reference list of reports of studies presenting data for extraction (category 1) were searched and any additional references of potential relevance identified. Additional references were identified by other means such as personal contact with other researchers in the field and alerts received from a weekly updated database of research studies about injury prevention[76]. Where full-text copies of the papers could be obtained they were randomly assigned to reviewers 1-3 who independently screened them according to the inclusion criteria described in Table 1.2. To ensure reviewer reliability, reviewer 5 also screened each of these reports. The studies that met the inclusion criteria were added to the list of those retrieved in the electronic search strategy.

The final list of all reports in categories 1 or 2 was distributed internationally to four colleagues who have a professional interest in veterinary emotional wellbeing and/or occupational factors associated with suicidal behaviour (Appendix 3). These experts were asked to review the list and identify any research papers they were aware of that were not retrieved by our search strategy. Only two papers were identified as presenting data potentially

relevant to the review and when these papers were reviewed independently by members of the research team, neither met the inclusion criteria.

2.5 Data extraction

Studies from category 1 were included in the data extraction process. Data extraction was performed separately for studies that reported rates of suicide in the veterinary profession (Appendix 1) and those that reported the questionnaire or interview based surveys of suicide and related issues of wellbeing in the veterinary profession (Appendix 2). For both methods of research, a MS Word document was developed and data extraction was performed either electronically or by hand. Development of the form was informed by the Cochrane Handbook for Systematic Reviews[77]. Both forms were piloted at least once by reviewers 1-3 to evaluate the efficacy and usability of the forms. Comments and feedback were used to further develop the forms, to ensure that reviewers understood how to use them, and to test levels agreement on data extraction between reviewers. Common to both data extraction forms was an introduction section about the paper itself e.g. title, year of publication, funding sources and how the paper met inclusion criteria.

2.5.1 Data extraction: Observational studies of the prevalence of suicide

The form designed for extraction of data on suicide prevalence contained an additional six sections: a) the type of data analysis conducted (including information about the mortality database used to acquire the data), b) the demographic characteristics of the population(s) studied, c) the actual data presented on rates of suicide in the veterinary profession, d) data presented on

methods of suicide in the veterinary profession, e) any other data reported in the paper and f) the authors' explanations for their results. The data presented in reports of this kind were extracted by reviewer 5 as well as by one of reviewers 1-3, who was randomly selected in order to reduce reviewer error and bias. One of these studies was reported in French and in this case two native French speakers independently assisted BP in the extraction of data from this study.

2.5.2 Data extraction form: Survey studies of suicide and related issues of wellbeing

The data extraction form adapted for survey studies contained the following sections: a) the type of survey that was conducted (including the issues for which data were presented), b) a description of the recruitment methods, c) demographic information about the sample included in the survey, d) data on the issues of stress or mental health (including prevalence of the problem, data on the causes/contributory factors and data on treatment/support and comparisons with other populations), e) data on suicidal behaviour, f) any other data presented that were related to the wellbeing of the veterinary profession e.g. occupational issues, g) evaluative information such as limitations of the study and areas the authors identified for future research.

Data extraction was performed by reviewer 5 and the results distributed to one of reviewers 1-3 who was randomly selected. The second reviewer also examined the respective publication and made comments on data that was erroneous or omitted. Five studies were presented in a foreign language (two

French and three Dutch) and again at least one native speaker assisted reviewer 5 in extracting the relevant data from these studies.

2.5.3 Studies of relevance but without primary empirical data

Studies that did not present data (categories 2 and 3) were used by the author to assist in describing the background to the review.

2.6 Assessment of risk of bias

Tools were developed by the author in order to assess the risk of bias in both epidemiological studies of suicide prevalence and survey studies of mental health and wellbeing in the veterinary profession. Interpretation of data presented in both study designs must take into consideration both the internal and external validity of the study's methodology[75]. The development process of the tools developed is described below and the final tool used for suicide prevalence studies and survey studies of mental health and wellbeing are included in appendices 5 and 6 respectively.

2.6.1 Assessment of quality and risk of bias in observational studies of suicide prevalence

Since there were no existing tools available to assess the quality or risk of bias in observational studies of suicide, the author developed a tool based on available literature including guidelines by groups developed to increase the quality of reporting of observational studies[73,72] and existing tools developed

by researchers investigating the prevalence of other diseases and illnesses[74]. Originally ten items were identified from these sources as being particularly important in assessing the quality of research and/or the risk of bias in the domain of epidemiological suicide research. These items were piloted on a selection of suicide prevalence studies that varied in perceived quality resulting in revision of the original items such that the final items assessed: 1. the definition of suicide used to identify cases, 2. the source of numerator data, 3. the source of denominator data, 4. the study duration, 5. the study period, 6. the amount of study population data, 7. the amount of comparison population data, 8. the number and type of comparisons made, 9. and 10. the appropriateness of the comparison population in terms of gender and age, 11. the statistical comparisons made and 12. whether the authors identified limitations of the methodology.

This measure yields a total score between 0-12 which reflects the overall quality of the research, where 0-4 indicates relatively low quality, 5-8 represents moderate quality and 9-12 indicates relatively high quality. Items related to the assessment of risk of bias are 1. definition of suicide, 2. source of numerator data, 3. source of denominator data, 9. the appropriateness of the comparison population in terms of gender and 10. the appropriateness of the comparison population in terms of age. Each of the 19 studies were randomly distributed to 3 members of the research team, who used the tool (appendix 4) to assess the quality and risk of bias for each study. Each study was also assessed on the same scale by a fourth member of the research team (BP) in order to prevent reviewer bias. When reviewers disagreed on the total score

allocated to each study, a discussion took place between the respective reviewers until a consensus decision was reached.

2.6.2 Assessment of quality in survey studies of suicide and related issues of wellbeing

Sufficient items in the data extraction form were available to assess the quality of the survey studies. In a similar process of item identification, piloting and revision, 12 items were selected from the original data extraction form to estimate risk of bias: 1. Peer review (Q1), 2. Study aims (Q10), 3. Information on response rate (Q120), 4. Response rate data (Q120), 5. Gender of sample (Q126), 6. Age of sample (Q127), 7. Reported validity and reliability of measures used (Q139, Q156 and Q171), 8. number of items in measures used (Q142, Q156 and Q171), 9. Prevalence of issue being measured (Q141, Q157 and Q171), 10. Statistical comparisons (Q149, Q161 and Q172), 11. Limitations identified by the authors (Q175), 12. Limitations identified by the reviewers (Q177) (Appendix 5).

The measure yields a total score between 0-12, where 0-4 represents relatively low quality, 5-8 represents moderate quality and 9-12 represents high quality. Each item was selected from the original data extraction form, which had been used by two independent members of the research team.

2.7 Data management and analysis

During data extraction, 11 studies were identified as not meeting the study's inclusion criteria after all. This was largely because they merged findings from veterinary and non-veterinary samples, because the data had been reported in other studies included in the review, or because the studies were published after the date on which the electronic search strategy was performed.

For each study in category 1, reviewer 5 manually transferred the data in the MS Word data extraction files to a MS Excel file which had been developed to store and manage the data. The data was analysed descriptively, as the studies varied greatly in the measures and methods used to collect and analyse data.

Chapter 3: Results

The systematic review process, including the number of studies at each stage, is illustrated in Figure 3 (overleaf). Reported in this chapter are; 1) the levels of inter-reviewer reliability at the abstract and full-text screening stages of the review, 2) the findings of observational studies of suicide prevalence in the veterinary profession, 3) data on the methods of suicide reported in these studies, 4) the findings of survey studies of suicidal behaviour, mental health difficulties, occupational issues and psychological characteristics in the veterinary profession.

3.1 Inter-reviewer reliability

3.1.1 Abstract screening

Table 2.1 shows the results of abstract screening. Kappa statistics were calculated to assess the strength of agreement between reviewers 1-4 (SS, RM, KH, LS) and reviewer 5 (BP) in deciding whether to include or exclude references from subsequent stages of the review (Appendix 8). The statistics were based on the 12,948 references left after 173 duplicates had been removed from the original electronic search strategy. Overall the four reviewers agreed to include 488 references in the next stage of the review and to exclude 11623. Disagreement about whether references met abstract screening criteria occurred in 837/12948 (6.5%) cases. This corresponded to an overall kappa value of 0.504, which indicated a moderate level of agreement[78]. When levels of agreement between reviewers 1-4 and reviewer 5 were compared individually, kappa values ranged from 0.415-0.593. These values suggested that moderate levels of agreement were reached.

Figure 3: Flow chart of systematic review process

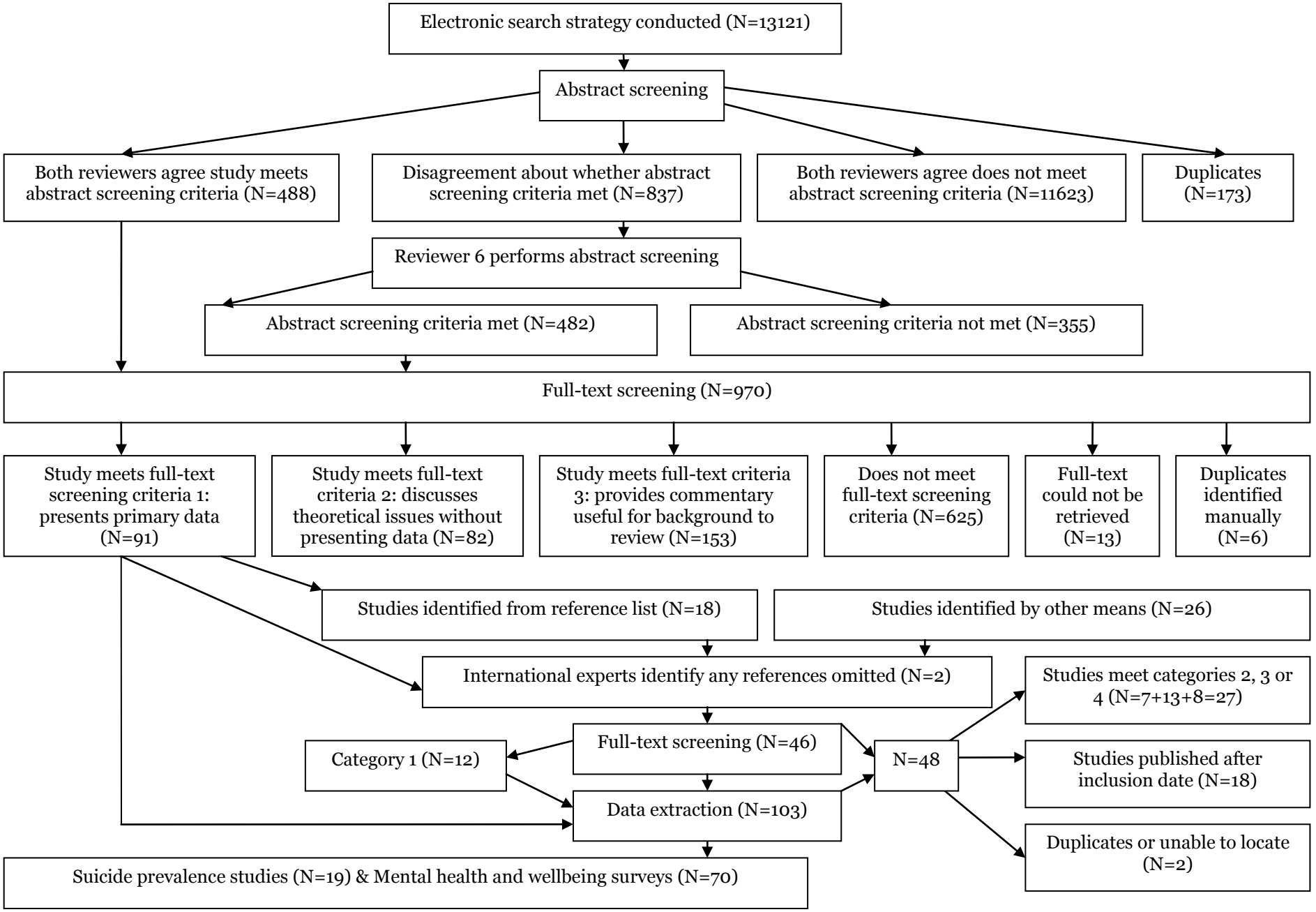


Table 2.1: Reviewer consistency in performing abstract screening

			Reviewer 5's decisions (number of studies)			Strength of agreement between first reviewer and reviewer 5 (kappa)
			Include	Exclude	Total	
First reviewer's decisions (number of studies)	Reviewer 1	Include	171	151	322	0.593
		Exclude	53	2862	2915	
		Total	224	3013	3237	
	Reviewer 2	Include	97	55	152	0.467
		Exclude	141	2942	3083	
		Total	238	2997	3235	
	Reviewer 3	Include	115	63	178	0.521
		Exclude	124	2940	3064	
		Total	239	3003	3242	
	Reviewer 4	Include	105	113	218	0.415
		Exclude	137	2879	3016	
		Total	242	2992	3234	
	Overall (reviewers 1-4)	Include	488	382	870	0.504
		Exclude	455	11623	12078	
		Total	943	12005	12948	

Kappa value	Strength of agreement*
<0.01	Poor
0.1-0.2	Slight
0.21-0.4	Fair
0.41-0.6	Moderate
0.61-0.8	Substantial
0.81-1	Almost perfect

* Landis and Koch (1977)

3.1.2 Full-text screening

Table 2.2 shows the decisions of reviewers 1-3 (SS, RM, KH) and reviewer 5 (BP) in allocating references selected for full-text review to one of four categories (Appendix 7). The table reports the results for the 862 English language references. An additional 89 non-English references were categorised by means of discussion between a translator and reviewer 5.

Chapter 3: Results

In order to assess the strength of agreement between reviewers, kappa statistics were calculated (Table 2.3). Rather than calculating agreement between the four categories of the full-text screening criteria, agreement about whether studies presented data of relevance to the review (studies were assigned to category 1) or not (studies were assigned to categories 2-4) was assessed.

Table 2.3 shows that overall, reviewers agreed to include 61 studies that presented primary data and agreed that 759 studies did not present data. There was disagreement over 42/862 (4.9%) studies. This corresponds to a kappa value of 0.717 which indicates a substantial level of agreement[78]. When the agreement about decisions of the three reviewers individually with reviewer 5 was calculated, kappa values ranged between 0.675-0.755. These values suggest that there was substantial agreement between reviewer 5 and the three reviewers individually.

Summary of 3.1: Inter-reviewer reliability

- 12948 studies retrieved in an electronic search strategy were each screened by two independent reviewers in order to decide whether they should be reviewed at the full-text level.
- Kappa statistics showed that there was moderate agreement between reviewers, who only disagreed on 6.5% of references.
- 862 references retrieved in the electronic search strategy were reviewed at the full-text level by two independent reviewers in order to decide whether they presented data on suicide or related issues of wellbeing in the veterinary profession.
- Kappa statistics showed that there was substantial agreement between reviewers, who only disagreed on 4.9% of papers.

Table 2.2: Full-text screening decisions

			Reviewer 5's decisions (number of studies)				
			Include	Theoretical	Background	Exclude	Total
First reviewer's decisions (number of studies)	Reviewer 1	Include	22	2	4	7	35
		Theoretical	1	18	5	6	30
		Background	4	7	12	40	63
		Exclude	0	2	16	143	161
		Total	27	29	37	196	289
	Reviewer 2	Include	20	3	5	1	29
		Theoretical	0	3	8	6	17
		Background	2	16	9	24	51
		Exclude	2	4	13	166	185
		Total	24	26	35	197	282
	Reviewer 3	Include	19	1	0	5	25
		Theoretical	3	11	5	1	20
		Background	2	10	17	20	49
		Exclude	0	3	15	179	197
		Total	24	25	37	205	291
	Overall (reviewers 1-3)	Include	61	6	9	13	89
		Theoretical	4	32	18	13	67
		Background	8	33	38	84	163
		Exclude	2	9	44	488	543
		Total	75	80	109	598	862

Table 2.3: Level of agreement between reviewers 1-3 and reviewer 5 in performing full-text screening

			Reviewer 5's decisions (number of studies)			Strength of agreement between first reviewer and reviewer 5 (kappa)
			Data	No data	Total	
First reviewer's decisions (number of studies)	Reviewer 1	Data	22	5	27	0.675
		No data	13	249	262	
		Total	35	254	289	
	Reviewer 2	Data	20	4	24	0.73
		No data	9	249	258	
		Total	29	253	282	
	Reviewer 3	Data	19	5	24	0.755
		No data	6	261	267	
		Total	25	266	291	
	Overall (reviewers 1-3)	Data	61	28	89	0.717
		No data	14	759	773	
		Total	75	787	862	

3.2 Observational studies of the prevalence of suicide in the veterinary profession

3.2.1 Description of the studies included

In total 19 observational studies were identified as presenting data in relation to the prevalence of suicide in the veterinary profession (Table 3.1). The majority were conducted in the USA (N=8), followed by the UK (N=6), Europe (N=3) and Australia (N=3) and utilised national mortality databases (N=11) as well as regional sources (N=7). One study did not state the source of mortality data[47]. Nearly half of the studies investigated suicide mortality solely in male veterinarians (N=9), whilst the rest either did not specify the gender of the study population or provided data on suicide in both males and females (N=10). Cases of suicide included deaths that received an open verdict in 6/19 studies whilst only verdicts of suicide were included in the other 13 studies.

3.2.2 Prevalence of suicide in the veterinary profession

Table 3.1 shows the methodological characteristics of the 19 studies, the geographic location of study populations, the time period for which the suicide prevalence data was calculated, the source of the data on veterinary suicide, whether or not open verdicts were included in the analysis, a description of the veterinary population in the analysis (including where the population may have overlapped with that of another study in the review) and a description of the comparison population where comparisons are made.

Chapter 3: Results

In terms of prevalence data, the table shows the number of suicides in the veterinary population and the total number of deaths in the veterinary population, where this data is available. The proportional mortality (PM) of suicides to all deaths is also reported. Where information on the rate of suicide was available (cases per 100,000 veterinary surgeons), these data are shown, including the corresponding confidence intervals. Where comparisons were made with another population, the number of suicides and the total number of deaths in that population are reported, along with the PM.

The majority of studies make statistical comparisons between the rate or prevalence of suicide in the veterinary profession and the rate in a comparison population (N=11). The type of statistical test performed is presented in Table 3.1 along with the corresponding chi-square value or the 95% confidence interval (C.I.). The significance of these comparisons, where reported, is expressed as a p-value. The data are presented as they are reported in the papers from which they are sourced, except that percentages are rounded to one decimal place for simplicity of interpretation. In addition, where comparative statistics were not reported in a paper and there was sufficient information available to calculate these, the author has performed the relevant statistical tests.

Table 3.1: Observational studies of the prevalence of suicide in the veterinary profession

Study author (year) Country	Quality rating (risk of bias)	Time period	Veterinary study population		Veterinary suicide data		Comparison population		Comparative statistics
			Data source (Verdict)	Description (overlap)	Suicide/ All deaths (PM)	Rate per 100,000 (95% C.I.)	Description	Suicide/ All deaths (PM)	Mortality ratio X^2 or 95% C.I. p-value
Charlton (1995)[87] England and Wales	10 (5)	1990-1992	National/Official (Suicide and Open)	Male veterinarians aged 16-44 (*Kelly and Bunting, 1998[18] and Mellanby, 2005[46]*)			Married, UK born men, aged 16-19, not in 10 highest occupational groups[a]		RR=4.61 C.I.=1.49-14.25 p<0.01
				Male veterinarians aged 45-64 (*Kelly and Bunting, 1998[18] and Mellanby, 2005[46]*)			Married, UK born men, aged 60-64, not in 10 highest occupational groups[a]		RR=5.62 C.I.=1.6-19.74 p<0.01
				Female veterinarians aged 16-64 (*Kelly and Bunting, 1998[18] and Mellanby, 2005[46]*)	2 suicides 3 deaths from natural causes		Married, UK born women, aged 16-19, not in 10 highest occupational groups[a]		RR=7.62 C.I.=1.04-55.94 p<0.05
Stark et al (2006)[83] Scotland	10 (5)	1981-1999	National/Official (Suicide and Open)	Male veterinarians aged 16-45			General male population of Scotland		PMR=293 C.I.=80-749 'not significant'
				Male veterinarians aged 46-64			General male population of Scotland		PMR=301 C.I.=36-1088 'not significant'

Study author (year) Country	Quality rating (risk of bias)	Time period	Veterinary study population		Veterinary suicide data		Comparison population		Comparative statistics
			Data source (Verdict)	Description (overlap)	Suicide/ All deaths (PM)	Rate per 100,000 (95% C.I.)	Description	Suicide/ All deaths (PM)	Mortality ratio X^2 or 95% C.I. p-value
Mellanby (2005)[46] England and Wales	10 (4)	1979-1990 except 1981	National/Official (Suicide)	Female veterinarians aged 20-74	7/30 (23.3%)		General population of England and Wales		PMR=414 C.I.=166-853 Cf. medical practitioners X^2=8.3 (p<0.005)
		1991-2000	National/Official (Suicide and Open)	Female veterinarians aged 20-74 (Charlton et al, 1995[87])	6/36 (16.7%)				PMR=1240 C.I.=446-2710 Cf. medical practitioners X^2=4.5 (p<0.05)
		1979-1990 except 1981	National/Official (Suicide)	Male veterinarians aged 20-74 (Charlton et al, 1993[84])	35/383 (9.1%)				PMR=361 C.I.=252-503 Cf. medical practitioners X^2=32.1 and dentists X^2=13.7 (p<0.001)
		1991-2000	National/Official (Suicide and Open)	Male veterinarians aged 20-74 (Charlton et al, 1995[87])	26/295 (8.8%)				PMR=374 C.I.=244-548 Cf. medical practitioners X^2=12.8 (p<0.0005)

Study author (year) Country	Quality rating (risk of bias)	Time period	Veterinary study population		Veterinary suicide data		Comparison population		Comparative statistics
			Data source (Verdict)	Description (overlap)	Suicide/ All deaths (PM)	Rate per 100,000 (95% C.I.)	Description	Suicide/ All deaths (PM)	Mortality ratio X^2 or 95% C.I. p-value
Agerbo et al (2007)[79] Denmark	9 (5)	1991-1997	National/Official (Suicide)	Veterinarians aged 25-60 who had been resident in Denmark for preceding 2 years	0 suicides		General population controls (matched for gender and year of birth) alive when the case died and resident in Denmark for previous 2 years	3195 suicides	None
Lange (1992)[88] USA	9 (3)	1965-1989	Regional/Official (Suicide)	Veterinarians on active duty in commissioned corps	1/3 (33.3%)		General population adjusted for age, race, ethnicity	24/118 (20.3%)	RR=4 'significant'
Milham and Ossiander (2001)[81] USA	9 (3)	1950-1999	Regional/Official (Suicide)	Male Washington State Veterinarians aged 20 or over	19 suicides		Male Washington State Residents aged 20 or over	18736 suicides	PMR=197 p=0.00156
		1974-1999		Female Washington State Veterinarians aged 20 or over	3 suicides		Female Washington State Residents aged 20 or over	2128 suicides	PMR=180 p=0.23326
Kelly and Bunting (1998)[18] England and Wales	8 (4)	1982-1987	National/Official (Suicide and Open)	Male veterinarians aged 20-64 (*Charlton, 1995[87] and Mellanby, 2005[46]*)	17 suicides		General population of England and Wales (adjusted for age and gender)		PMR=349 C.I.=203-559 'significant'
		1991-1996		Male veterinarians aged 20-64 (*Charlton, 1995[87] and Mellanby, 2005[46]*)	9 suicides				PMR=324 C.I.=148-615 'significant'
		1991-1996		Female veterinarians aged 20-59 (*Charlton, 1995[87] and Mellanby, 2005[46]*)	4 suicides				PMR=500 C.I.=136-1279 'significant'

Study author (year) Country	Quality rating (risk of bias)	Time period	Veterinary study population		Veterinary suicide data		Comparison population		Comparative statistics
			Data source (Verdict)	Description (overlap)	Suicide/ All deaths (PM)	Rate per 100,000 (95% C.I.)	Description	Suicide/ All deaths (PM)	Mortality ratio X^2 or 95% C.I. p-value
Kinlen (1983)[85] Great Britain	8 (4)	1949-1975	National/Unofficial (Suicide)	Male veterinarians	27/699 (2.2%)		Males in social class 1 and aged less than 75	13.1 suicides expected	PMR=2.06*
Blair and Hayes (1980)[82] USA	8 (3)	1966-1977	National/Unofficial (Suicide)	White male veterinarians (*Blair and Hayes, 1982[48]*)	65/1551 (4.2%)		White males in the USA matched for age and time period	30.1 suicides expected	PMR=216 X^2=42.91 p<0.005
Blair and Hayes (1982)[48] USA	8 (3)	1947-1977	National/Unofficial (Suicide)	White male veterinarians (*Blair and Hayes, 1980[82]*)	137/5016 (2.7%)		White males in the USA matched for age and time period	80.5 suicides expected	PMR=170 X^2=41.31 p<0.005
Hem et al (2005)[16] Norway	8 (3)	1960-2000	National/Official (Suicide)	Male veterinarians educated in veterinary medicine aged 20+	13 suicides	43.7 (25.4-75.2)			
Charlton et al (1993)[84] England and Wales	7 (4)	1979-1990	National/Official (Suicide and Open)	Male veterinarians aged 16-64 (*Mellanby, 2005[46]*)	35 suicides		Males in general population aged 16-64		PMR=364
Fasal (1966)[89] USA	7 (3)	1950-1962	Regional/Unofficial (Suicide)	White male veterinarians resident and licensed to practice in California (*Milller and Beaumont, 1995[80]*)	4/148 (2.7%)		Californian white males in 1960 adjusted for age		SMR=79 'Not significant'
Miller and Beaumont (1995)[80] USA	7 (2)	1960-1992	Regional/Unofficial (Suicide)	Californian veterinarians (Fasal, 1966[89])	42/450 (9.33%)		General population	15.99 suicides expected	PMR=263 C.I.=199-347 P<0.05
				Californian male veterinarians (Fasal, 1966[89])	36/436 (8.3%)		General male population	14.54 suicides expected	PMR=248 C.I.=183-335 P<0.05
				Californian female veterinarians	6/14 (42.9%)		General female population	not stated	PMR=589 C.I.=302-1148 P<0.05

Study author (year) Country	Quality rating (risk of bias)	Time period	Veterinary study population		Veterinary suicide data		Comparison population		Comparative statistics
			Data source (Verdict)	Description (overlap)	Suicide/ All deaths (PM)	Rate per 100,000 (95% C.I.)	Description	Suicide/ All deaths (PM)	Mortality ratio X^2 or 95% C.I. p-value
Jones-Fairnie et al (2008)[49] Australia	6 (2)	1990-2002	Regional/Official (Suicide and Open)	Veterinarians in Victoria	61 deaths	41.8 (19.9-87.7)	Adults in Victoria matched for age		SMR=3.8
				Veterinarians in Western Australia	26 deaths	52.6 (19.7-140.1)	Adults in Western Australia matched for age		SMR=4
				Veterinarians in Western Australia and Victoria	11/89 (12.4%)	45.2 (25-81.6)			
Schnurrenberger et al (1977)[86] USA	6 (1)	1950-1973	Regional/Unofficial (Suicide)	White male Illinois State veterinarians	13/481 (2.7%)		Illinois white male vets in 1950	7.9/491.8 (1.6%)	PMR=168.3* C.I.=72.0-394.4*
							Californian vets (Fasal et al, 1966)[89]	7.7/368.3 (2.1%)	PMR=129.3* C.I.=55-304.8*
							Illinois white male vets in 1960	6.4/457.1 (1.4%)	PMR=193.0* C.I.=78.1-479.2*
							Illinois white male vets in 1970	5.5/455.2 (1.2%)	PMR=223.7* C.I.=86.4-581.5*
Botts et al (1966)[45] USA	4 (0)	1949-1964	Regional/Unofficial (Suicide)	Male veterinarians in Missouri	2/127 (1.6%)				
Mammerickx (1985)[47] Belgium	4 (0)	Not stated	Not stated (Suicide)	Veterinarians in Belgium	13/367 (3.5%)		Non-veterinarians in Belgium	918/57814 (1.6%)	PMR=223* C.I.=130.6-377.2*
				Veterinarians in Belgium who died before age 70	13/206 (6.3%)		Non-veterinarians in Belgium who died before age 70	918/23567 (3.9%)	PMR=162* C.I.=95.3-270.6*
Jeyaretnam et al (2000)[91] Australia	2 (0)	10 year period	Regional/Unofficial (Suicide)	Veterinarians in Western Australia	4/20 (20%)				

* comparative statistics were calculated by the author of the review based on available data

[a] in urban wards with owner occupancy >85%, <6.5% of occupants changing address every year, <9% of adults below pensionable age living alone

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Data on the absolute rate of suicide in the veterinary profession is provided by the majority of studies. Suicide PM varied from 0/3195 (0%) in a study of veterinarians in Denmark[79], to 6/14 (42.9%) in a study of female veterinary suicides in California, USA[80]. The lowest absolute rate of suicide (per 100,000) was 41.8 (19.9-87.7) for veterinarians in Victoria, Australia[49] and the highest rate was for veterinarians in Western Australia, 52.6 (19.7-140.1)[49].

By far, the most common statistical method used to estimate the relative risk of suicide in the veterinary profession was Proportional Mortality Ratio (PMR, N=11). Suicide PMR ranged from 162 in a study that compared Belgian veterinary surgeons to non-veterinarians in Belgium[47] to 1240 (95% C.I. 446-2710) in a sample of female veterinary surgeons in England and Wales compared to members of the general population[46]. When compared to the general population, none of the studies found suicide to be lower in the veterinary profession (PMR<100), six found it to be significantly elevated[81,18,82,48,80,47], three found raised rates of suicide in the veterinary profession that were not statistically significant (or else data on the statistical significance were not reported)[83,84,85]. One study found the PMR for suicide in the veterinary profession was significantly greater than the PMR in the medical profession[46]. Another study, of Illinois veterinarians, found that the PMR for suicide was elevated (although not significantly so) when data on expected suicides came from the rates of suicide in Californian veterinarians and Illinois veterinarians from earlier time periods[86].

The Relative Risk (RR) of suicide in the veterinary profession was reported in two studies[87,88]. These studies found the risk of suicide to be 4 in a sample of

veterinary surgeons in the military in USA[88] and between 4.61-7.62 in subgroups of veterinarians in England and Wales[87].

The Standardised Mortality Ratio (SMR) of suicide was reported by two studies[89,49]. One study found that the rate of suicide in male veterinarians in California was not statistical different to that of males in the general population matched for age (SMR=79)[89]. The other study found that suicide was elevated in veterinarians in Victoria (SMR=3.8) and Western Australia (SMR=4) compared to members of the general population of the respective regions[49]. However, the statistical significance of these differences was not reported.

3.2.3 Relative quality and risk of bias of the included studies

Before generalising the results of these studies it is important consider various aspects of study quality. A tool was developed by the author and colleagues to quantify the relative quality of the studies as well as to assess the risk of bias of the studies (Appendix 4). Each observational study of suicide prevalence was rated by a randomly selected member of the review team (SS, RM, or KH) as and by reviewer 5 (BP). The score on individual items from the measure as well as the overall quality rating and the risk of bias for each of the studies are presented in Table 3.2. The overall score provides an indication of the relative quality and risk of bias of the studies. There was wide variation in the quality, scores ranged from 2/12 to 10/12. Studies were grouped into those of relatively low quality (score 0-4, N=3), moderate quality (score 5-8, N=11) and relatively high quality (score 9-12, N=5). None of the studies achieved the maximum score of 12.

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In order to assess the risk of bias associated with each study, the binomial scores on 5 items from the quality rating scale (Appendix 4) were summed: clarity of the definition of suicide used to identify cases (Item 1), source of the population numerator data (Item 2), source of the population denominator data (Item 3), appropriateness of the comparison population in terms of gender (Item 9), and appropriateness of the comparison population in terms of age (Item 10). The risk of bias score for each of the 19 studies of suicide prevalence is indicated in Table 3.2. A maximum score of 5 indicates the lowest risk of bias and a score of 0 indicates the highest risk of bias. In total three studies obtained the maximum score of 5 on this scale and therefore probably have the lowest risk of bias. Scores on the risk of bias scale ranged from the minimum score of 0 to the maximum score of 5. Three studies achieved the maximum score of 5/5 and were therefore identified as having a relatively low risk of bias[79,83,87].

Table 3.2: Quality rating scores and risk of bias for studies presenting data on the prevalence of suicide in the veterinary profession

Study (year) country	Items on quality rating scale (0=poor quality, 1=good quality)												Overall quality (1-12)	Risk of bias (1-5)
	1*	2*	3*	4	5	6	7	8	9*	10*	11	12		
Charlton (1995)[87] England and Wales	1	1	1	0	1	1	1	0	1	1	1	1	10	5
Stark et al (2006)[83] Scotland	1	1	1	1	1	0	0	1	1	1	1	1	10	5
Agerbo et al (2007)[79] Denmark	1	1	1	1	1	1	1	0	1	1	0	0	9	5
Mellanby (2005)[46] England and Wales	1	1	1	1	1	1	0	1	1	0	1	1	10	4
Kelly and Bunting (1998)[18] England and Wales	1	1	1	1	1	0	0	0	1	0	1	1	8	4
Kinlen (1983)[85] Great Britain	0	1	1	1	1	1	0	0	1	1	0	1	8	4
Charlton et al (1993)[84] England and Wales	1	1	1	1	1	0	0	0	1	0	0	1	7	4
Lange (1992)[88] USA	0	0	1	1	1	1	1	0	1	1	1	1	9	3
Blair and Hayes (1980)[82] USA	1	0	0	1	1	1	0	0	1	1	1	1	8	3
Blair and Hayes (1982)[48] USA	1	0	0	1	1	1	0	0	1	1	1	1	8	3
Hem et al (2005)[16] Norway	1	1	1	1	1	1	0	0	0	0	1	1	8	3
Milham and Ossiander (2001)[81] USA	1	0	0	1	1	1	0	0	1	1	1	1	8	3
Fasal (1966)[89] USA	1	0	0	1	1	1	0	0	1	1	1	0	7	3
Miller and Beaumont (1995)[80] USA	0	0	0	1	1	1	0	0	1	1	1	1	7	2
Jones-Fairnie et al (2008)[49] Australia	1	0	0	1	1	1	0	0	0	1	0	1	6	2
Schnurrenberger et al (1977)[86] USA	0	0	0	1	1	1	0	0	1	0	1	1	6	1
Botts et al (1966)[45] USA	0	0	0	1	1	1	0	0	0	0	0	1	4	0
Mammerickx (1985)[47] Belgium	0	0	0	1	1	1	1	0	0	0	0	0	4	0
Jeyaretnam et al (2000)[91] Australia	0	0	0	1	0	1	0	0	0	0	0	0	2	0
Total score for each item	12	8	9	18	18	16	4	2	14	11	12	15		

Key-quality rating items

1. Suicide definition*
2. Numerator source*
3. Denominator source*
4. Duration
5. Study period
6. Veterinary surgeons absolute data
7. Comparison population absolute data
8. Comparisons (number and type)
9. Comparison appropriateness (gender)*
10. Comparison appropriateness (age)*
11. Significance of comparison(s)
12. Study limitations

* items used to calculate risk of bias

3.2.4 Findings from high-quality studies with a low risk of bias

The findings of studies of relatively high quality overall (scores 9-12) and relatively low risk of bias (4/5 or 5/5) are presented in Table 3.3 and are now considered in more detail.

The most recent of the four studies was a case control study of suicide in the population of Denmark[79]. This study identified cases of suicide (N=3195) in between 1991-1997 where the individual was of working age when they died and had been living in Demark for the preceding two years. Each case was matched to a random sample of 20 controls who were the same gender as the case, born the same year, and who were alive when the case died of suicide (N=63900). Of the control group, 49 deaths were of veterinary surgeons whilst none of the cases of suicide were of veterinary surgeons. Given the lack of cases of suicide, it was not possible to calculate the relative risk of suicide in the veterinary population.

Another case control study compared veterinarian suicide cases in England and Wales (by age group and gender) to controls who were married, aged 16-19 (or 60-64 for male cases aged 45-64), of the same gender and who were not employed in one of ten highest professional groups at risk of suicide[87]. This comparison group was also restricted by several other demographic variables (see Table 3.3). When RR was calculated, both female veterinarians aged 16-64 (RR=7.62, C.I.=1.04-55.94, $p<0.05$), male veterinarians aged 16-44 (RR=4.61, C.I.=1.49-14.25, $p<0.01$) and male veterinarians aged 45-64 (RR=5.62, C.I.=1.6-19.74, $p<0.01$) were found to be at a significantly increased risk of suicide compared to controls.

A third study investigated veterinary suicide in England and Wales between the years 1979 and 2000[46]. The study calculated the PMR of suicide in the veterinary profession, based on expected rates of suicide in the general population. Analysis of suicide between 1979-1990 (when deaths due to suicide alone were analysed), revealed that male and female veterinary surgeons were at increased risk of suicide (PMR=361, 95% C.I.=252-503 and PMR=414, 95% C.I.=166-853 respectively). The fact that the confidence intervals do not include 100 suggests that suicide is significantly elevated in these groups. Furthermore, male veterinary surgeons were found to be significantly more likely to die by suicide than males in the medical or dental profession. Analysis of suicide between 1991-2000 (when deaths due to suicide and deaths with an open verdict were included), revealed an even greater risk of suicide for male and female veterinary surgeons (PMR=374, 95% C.I.=244-548 and PMR=1240, 95% C.I.=446-2710 respectively). These confidence intervals also suggest that the elevated rate of suicide in the veterinary populations is statistically significant. In addition, chi-square tests showed that the PMR for suicide in the veterinary profession was significantly greater than those for members of the medical profession.

The final study compared cases of suicide (by age group) between males in the veterinary profession of Scotland and males from the general Scottish population[90]. Calculating the PMR for those aged 16-45 and 46-64, the authors report an elevated risk of suicide for veterinary surgeons (PMR=293, C.I.=80-749 and PMR=301, C.I.=36-1088 respectively). However, the wide confidence intervals suggest the PMR is not statistically significant. This is likely to be due to relatively few cases of suicide.

Summary of 3.2: Observational studies of the prevalence of suicide in the veterinary profession

- 19 studies were retrieved by the search strategy, the majority of which investigated the prevalence of suicide in the veterinary profession in the USA or UK.
- Proportional Mortality (Suicide/All deaths) ranged from 0% to 42.9%.
- Absolute rates of suicide ranged from 41.8/100,000 to 52.6/100,000.
- Proportional Mortality Ratio (PMR) was the most common statistic used to report relative rates of suicide in the veterinary profession (N=11).
- All 11 studies found suicide PMR to be elevated in the profession.
- 7/11 studies found this to be statistically significant.
- The Relative Risk (RR) of suicide in the veterinary profession was reported in 2 studies, both of which found veterinarians to have an elevated risk of suicide.
- The Standardised Mortality Ratio (SMR) for suicide was reported in two studies, neither of which found the rate of suicide in the veterinary profession was significantly different from the general population.
- 4/19 studies were of relatively high quality and presented a low risk of bias. These studies reported mixed results about the risk of suicide in veterinary surgeons.

Table 3.3: Studies of relatively high quality with a low risk of bias

Study author (year) Country	Quality rating (risk of bias)	Time period	Veterinary study population		Veterinary suicide data	Comparison population		Comparative statistics
			Data source (Verdict)	Description (overlap)	Suicide/ All deaths (PM)	Description	Suicide / All deaths (PM)	Mortality ratio X^2 or 95% C.I. p-value
Charlton (1995)[87] England and Wales	10 (5)	1990-1992	National/Official (Suicide and Open)	Male veterinarians aged 16-44 (*Kelly and Bunting, 1998[18] and Mellanby, 2005[46]*)		Married, UK born men, aged 16-19, not in 10 highest occupational groups[a]		RR=4.61 C.I.=1.49-14.25 p<0.01
				Male veterinarians aged 45-64 (*Kelly and Bunting, 1998[18] and Mellanby, 2005[46]*)		Married, UK born men, aged 60-64, not in 10 highest occupational groups[a]		RR=5.62 C.I.=1.6-19.74 p<0.01
				Female veterinarians aged 16-64 (*Kelly and Bunting, 1998[18] and Mellanby, 2005[46]*)	2 suicides 3 deaths from natural causes	Married, UK born women, aged 16-19, not in 10 highest occupational groups[a]		RR=7.62 C.I.=1.04-55.94 p<0.05
Stark et al (2006)[83] Scotland	10 (5)	1981-1999	National/Official (Suicide and Open)	Male veterinarians aged 16-45		General male population of Scotland		PMR=293 C.I.=80-749 'not significant'
				Male veterinarians aged 46-64		General male population of Scotland		PMR=301 C.I.=36-1088 'not significant'

[a] in urban wards with owner occupancy >85%, <6.5% of occupants changing address every year, <9% of adults below pensionable age living alone

Study author (year) Country	Quality rating (risk of bias)	Time period	Veterinary study population		Veterinary suicide data	Comparison population		Comparative statistics
			Data source (Verdict)	Description (overlap)	Suicide/ All deaths (PM)	Description	Suicide/ All deaths (PM)	Mortality ratio X^2 or 95% C.I. p-value
Mellanby (2005)[46] England and Wales	10 (4)	1979-1990 except 1981	National/Official (Suicide)	Female veterinarians aged 20-74	7/30 (23.3%)	General population of England and Wales		PMR=414 C.I.=166-853 Cf. medical practitioners X^2=8.3 (p<0.005)
		1991-2000	National/Official (Suicide and Open)	Female veterinarians aged 20-74 (Charlton et al, 1995[87])	6/36 (16.7%)			PMR=1240 C.I.=446-2710 Cf. medical practitioners X^2=4.5 (p<0.05)
		1979-1990 except 1981	National/Official (Suicide)	Male veterinarians aged 20-74 (Charlton et al, 1993[84])	35/383 (9.1%)			PMR=361 C.I.=252-503 Cf. medical practitioners X^2=32.1 and dentists X^2=13.7 (p<0.001)
		1991-2000	National/Official (Suicide and Open)	Male veterinarians aged 20-74 (Charlton et al, 1995[87])	26/295 (8.8%)			PMR=374 C.I.=244-548 Cf. medical practitioners X^2=12.8 (p<0.0005)
Agerbo et al (2007)[79] Denmark	9 (5)	1991-1997	National/Official (Suicide)	Veterinarians aged 25-60 who had been resident in Denmark for preceding 2 years	0 suicides	General population controls (matched for gender and year of birth) alive when the case died and resident in Denmark for previous 2 years	3195 suicides	None

3.3 Methods of suicide in the veterinary profession

Data on the methods of suicide in veterinary surgeons was provided in eight of the 19 studies of suicide prevalence (Table 3.4). These studies provided information of suicide methods in the national veterinary populations of the USA (N=3), the UK (N=2), and Belgium (N=1) and in regional studies of methods of suicide in Australian veterinary surgeons (N=2).

The total number of cases of suicide for which data on methods of suicide were available was 357, although not all studies could account for the methods used by all of the study population. Studies varied greatly in the number of cases of suicide from which data on methods were based. For example, in a national study of suicide in the veterinary profession in the USA, the methods of suicide used in 137 suicides were analysed[48], whereas in a study of suicide in veterinarians in Western Australia, data on methods of suicide were analysed for just four cases[91]. The mean number of cases included by each study was 44.6.

The two most common methods of suicide used by veterinary populations were poisoning and firearms. Three of the four study groups for which firearms were the most common method of suicide, were from the USA. The fourth study was conducted in Great Britain and the only information available on methods of suicide was that 18.5% of veterinary suicide cases involved firearms[85]. In all other analyses (N=10), self-poisoning was the most common form of suicide by veterinary surgeons. In these studies, the percentage of self-poisoning cases ranged from 23.1%[47] to 100%[18,49]. The two populations for which all cases of

suicide were by self-poisoning were females in England and Wales and females in Western Australia and Victoria. Three studies compared methods of suicide between male and female veterinarians. Whilst poisoning was the most common method of suicide overall in these studies, it was more frequent among female veterinarians than male veterinarians, although tests of the significance of these differences were not reported.

One study compared methods of suicide between 54 practising and 11 non-practising male veterinarians in the USA between 1966 and 1977[82]. For practising veterinarians, self-poisoning was a more common method of suicide than firearms (54% versus 33% of cases respectively) whereas in non-practising veterinarians, the most common method of suicide was firearms (64% of cases) with poisoning being less common (27% of cases). In a replication of this study with a longer study period (1947-1977) the methods of suicide used by 137 male veterinarians were studied. Whilst firearms were still more commonly used by non-practitioners than poisoning (69% versus 13% respectively), there was little difference between firearms and poisoning as a means of suicide in practising veterinarians (37% versus 36% respectively). Again, the statistical significance of these differences was not presented. Also, the study only reported the methods of suicide for 73% of the practising veterinarians and 82% of the non-practising veterinarians.

Information on the type of drugs with which veterinarians poisoned themselves was presented in three of the studies[82,48,91]. The frequency with which barbiturates (a class of drug commonly used in animal euthanasia) were involved varied from never, in a sample of non-practising veterinarians in the

USA[48], to 50% in a small sample (N=4) of veterinarians in Western Australia[91]. In the study that compared methods of suicide between practising and non-practising veterinarians, the use of barbiturates as a means of self-poisoning varied between the two groups. Barbiturates were not used by non-practising veterinarians, however they were used in 28% of the cases of suicide by self-poisoning in practising veterinary surgeons[48]. The statistical significance of these differences was not reported.

Summary of 3.3: Methods of suicide in the veterinary profession

- Observational studies of the methods of suicide in the veterinary profession are few and are of relatively low quality
- 4/14 veterinary samples found firearms to be the most common method of suicide
- 10/14 veterinary samples found self-poisoning to be the most common method of suicide
- There is preliminary evidence that factors such as gender and type of veterinary work may be associated with method of suicide

Table 3.4: Methods of suicide in the veterinary profession

Study (year) country	Time period	Veterinary study population	Number of suicides	Method of suicide (% of all suicide cases)					Modal method of suicide	Percentage of suicide cases accounted for
				Poisoning (% barbiturates)	Firearms	Hanging	Drowning	Other		
Blair and Hayes (1980)[82] USA	1966-1977	White males in clinical practice	54	54% (37%)	33%				Poisoning	87%
		White males not in clinical practice	11	27% (0%)	64%				Firearms	91%
Blair and Hayes (1982)[48] USA	1947-1977	Practitioners	137	36% (28%)	37%				Firearms	73%
		Non-practitioners		13% (0%)	69%				Firearms	82%
Jeyaretnam et al (2000)[91] Australia	10 year period	Western Australians	4	50% (50%)					Poisoning	50%
Jones-Fairnie et al (2008)[49] Australia	1990-2002	Western Australians and Victorians	11	81.8% (not stated)	9.1%	9.1%			Poisoning	100%
		Male western Australian and Victorians	4	50% (not stated)	25%	25%			Poisoning	100%
		Female western Australian and Victorians	7	100% (not stated)					Poisoning	100%

Study (year) country	Time period	Veterinary study population	Number of suicides	Method of suicide (% of all suicide cases)					Modal method of suicide	Percentage of suicide cases accounted for
				Poisoning (% barbiturates)	Firearms	Hanging	Drowning	Other		
Kelly and Bunting (1998)[18] England and Wales	1982-1996	Males aged 20-64	38	79% (not stated)	16%	5%	0%	0%	Poisoning	100%
		Females aged 20-59	9	100% (not stated)	0%	0%	0%	0%	Poisoning	100%
Kinlen (1983)[85] Great Britain	1949-1975	Males	27		18.5%				Firearms	18.5%
Mammerickx (1985)[47] Belgium	Not stated	Aged less than 70	13	23.1% (not stated)	7.7%	15.4%		15.4%*	Poisoning	61.6%
Miller and Beaumont (1995)[80] USA	1960-1992	Males	36	47.2% (not stated)	38.9%	8.3%		5.6%	Poisoning	100%
		Females	6	66.7% (not stated)	0%	16.7%		16.7%	Poisoning	100%

* 1 train, 1 car, 5 unknown

Chapter 3: Results

Survey studies

In total, 70 papers presented survey studies of suicide and related issues of wellbeing in the veterinary profession. Some papers reported more than one study; the total number of individual survey studies retrieved was 75.

The format in which data on each issue of wellbeing are reported is as follows: a brief description of the methodological characteristics for all studies is first presented. Data about the prevalence of the phenomena are then discussed for the studies that received an overall quality rating of 9/12 to 12/12 on the author-developed rating scale (Appendix 5). Whilst data from lower quality studies are presented in the corresponding tables, the author decided that attention should be paid to those studies over sufficient quality to provide relatively reliable and valid findings. Data on the factors associated with each issue are then presented, again only for those studies that received a quality rating of 9/12 to 12/12. The exception to this format is survey studies of stress and surveys of occupational issues, where too many studies were retrieved to include studies of low quality (scores 0/12 to 4/12) or moderate quality (5/12 to 8/12).

Details of the most important statistical information presented in the studies, are provided in the accompanying tables. Where percentages are reported these have been rounded to 1 decimal place in order to aide interpretation and comparison. Studies varied greatly in the level of detail that they included.

3.4 Survey studies of suicidal behaviour

3.4.1 Description of survey studies of suicidal behaviour

Seven papers present data about suicidal behaviour in the veterinary profession. These studies are summarised in Table 4.1. The quality of the studies, as measured by the author-developed rating scale (Appendix 5), varied greatly from 3/12 to 10/12, and only two studies reported relatively high quality research (defined by a score of 9-12)[92,51]. Two of the studies were conducted in Ireland, and two in France, and single studies were conducted in the USA, New Zealand and Australia. Questionnaire methodology was used for five of the surveys and semi-structured interviews for the other two. Whilst six of the studies reported suicidal behaviour of veterinarians, only study reported suicidal ideation in veterinary medicine students[54]. The numbers of respondents included in the analysis of questionnaire-based studies ranged from 32[93] to 849[51]. Of the interview-based studies, four respondents were included in one study[92] and 45 in the other[94]. Response rates were reported in all but one of the questionnaire studies, and ranged from 43.5% to 81.7%. The main aspects of suicidal behaviour studied were the prevalence of suicide attempts, suicidal ideation, and completed suicide by colleagues.

Table 4.1: Survey studies of the prevalence of suicidal behaviour in the veterinary profession

Author (year) Country	Quality rating	Research method	Sample description	N (Response Rate)	Type of suicidal behaviour	Measure of suicidal behaviour	Data on prevalence of suicidal behaviour
Bourdet-Loubere (2006a)[92] France	10	Questionnaire (postal)	French veterinarians	94 (81.7%)	Suicide protective factors	Mean score (percentage of respondents who scored >3) for each of the 6 sub-scales of the 'Reasons for Living' questionnaire (assesses the prevalence of various protective factors against suicide)*	Survival and coping beliefs: 4.14 (91.5%) Responsibilities to family: 4.37 (92.6%) Child related concerns: 4.04 (74.5%) Fear of social disapproval: 1.82 (7.5%) Moral objections: 1.42 (6.4%) Fear of suicide: 1.93 (10.6%)
Gardner and Hini (2006)[51] New Zealand	9	Questionnaire (postal)	Members of Veterinary College of New Zealand (VCNZ)	849 (48.6%)	Suicide attempt	"Have you ever tried to commit suicide?"	2.4% have tried to commit suicide
				849 (48.6%)	Suicidal Ideation	"Have you ever seriously thought about committing suicide?"	16% have thought about committing suicide.
Fairnie (2005a)[94] Australia	8	Interview (semi-structured)	Practising vets who had incurred an occupational injury/disease or had emotional health issues.	45	Suicidal ideation	Respondents who have thought about suicide before	27% have thought about suicide before
Kogan et al (2005)[54] USA	6	Questionnaire (Internet link)	Students at a US veterinary school.	233 (43.5%)	Suicidal Ideation	"How many times have you seriously thought about attempting suicide?"	4.7% had thought about attempting suicide more than once in the past year.

*48 items. Each item rated from 1-6 as to how important they would be as a reason for not attempting suicide. Higher scores indicate lower suicide risk

Author (year) Country	Quality rating	Research method	Sample description	N (Response Rate)	Type of suicidal behaviour	Measure of suicidal behaviour	Data on prevalence of suicidal behaviour
Bourdet-Loubere (2006b)[92] France	4	Interview (semi-structured)	French veterinarians that took part in a postal questionnaire	4	Thoughts about suicide	Open ended questions, not specified.	None had suicidal ideation but were concerned about suicide because of friends or people close to them who had thought about it
Kinsella (2006)[93] Ireland	4	Questionnaire	Veterinarians working in the counties of Carlow and Wexford, Ireland.	32 (43.8%)	Suicide of a colleague	Respondents who knew a colleague who had died by suicide.	14 knew a colleague who had died by suicide, 2/14 knew 8 colleagues who had died by suicide, 1/14 knew 6 colleagues who had died by suicide.
Connolly (2004)[133] Ireland	3	Questionnaire	Members of the Connaught Clinical Society.	176	Suicide of a colleague	Respondents who knew a colleague who had died by suicide (%)	More than 50% knew a colleague who had died by suicide

3.4.2 Prevalence of suicidal behaviour

As shown in Table 4.1, two reports of suicidal behaviour in the veterinary profession were rated as of relatively high quality (9-12 on the quality rating scale)[51,92]. The study of highest quality presented data on the prevalence of protective factors against suicide in a sample of 94 French veterinary surgeons[92]. The measure required respondents to indicate how important various factors would be in preventing them from taking their life on a scale of 1-6 (increasing scores represent increasing importance of that particular factor). A score greater than 3 was used to indicate that a factor is particularly protective against suicide. The three most salient protective factors (and the percentage of respondents reporting a score greater than 3) were: survival and coping beliefs (91.5%), responsibilities to their family (92.6%) and child-related concerns (74.5%). Less influential factors were fear of social disapproval (7.5%), moral objections (6.4%) and fear of suicide (10.6%).

The second high quality study was of the prevalence of suicidal behaviour in New Zealand veterinary surgeons, in which 2.4% of respondents reported having attempted to take their life before and 16% having seriously thought about taking their life[51].

3.4.3 Factors associated with suicidal behaviour

The factors associated with suicidal behaviour in the two relatively high quality studies are shown in Table 4.2. In the study of French veterinarians[92], demographic and social factors associated with suicidal behaviour were gender (fear of suicide was higher in males than females), marital status and having

children (those who had children or who were married were more protected by responsibilities to the family and child-related concerns). In terms of occupational issues, professional isolation had no impact on the protective factors against suicide in the sample, nor did the length of time respondents had spent in practice. The protective effect of survival and coping beliefs were significantly associated with both state and trait anxiety as well as with depression, such that those who reported survival and coping beliefs to be important protective factors against suicide were less anxious and less depressed.

In the study of New Zealand veterinarians[51], both suicide ideation and reported suicide attempts were associated with support in general, as well as with various specific forms of support e.g. the Vets in Stress phone-line, private counselling and spiritual support. Those who reported suicidal ideation and suicide attempt(s) were more likely to use support than those who did not. In addition, for this sample the only demographic and occupational factors that were associated with suicidal behaviour were gender and type of work in relation to suicidal ideation. Those in small animal practice and females were more likely to report suicidal ideation.

Table 4.2: Survey studies of the factors associated with suicidal behaviour in the veterinary profession

Study (year) country	Quality rating	Sample description	Type of suicidal behaviour	Factors associated with suicidal behaviour
Bourdet-Loubere (2006a)[92] France	10	French veterinarians	Suicide risk Mean score (percentage of respondents who scored >3) for each of the 6 sub-scales of the 'Reasons for Living' questionnaire (assesses the risk of suicide and protective factors against suicide)*	Geographic location: no significant differences in scores of subscales of Reasons for Living between those living in city and rural areas
				Gender: fear of suicide scores higher in males than females (t=-1.99, p<0.05)
				Children: mean scores on responsibilities to family and child-related concerns higher for those with children (t=2.84 and t=7.09 respectively, p<0.05)
				Professional isolation: no significant differences in scores of subscales of Reasons for Living between those working in practice and alone
				Marital status: survival and coping beliefs, child-related concerns and fear of suicide higher in couples than single veterinarians (t=2.15, t=4.30 and t=2.64 respectively, p<0.05)
				Age: no significant correlation between scores of subscales of Reasons for Living and age
				Membership of 'vetos-entraide' (veterinary support association): no significant correlation between scores of subscales of Reasons for Living and membership of vetos-entraide
				Length of time in practice: no significant correlation between scores of subscales of Reasons for Living and length of time in practice
				Anxiety: survival and coping beliefs negatively correlated with anxiety as measured by STAI-A (-0.45) p<0.05
				Anxiety: survival and coping beliefs negatively correlated with anxiety as measured by STAI-B (-0.42), p<0.05
				Depression: survival and coping beliefs negatively correlated with depression as measured by BDI (-0.51), p<0.05

*48 items. Each item rated from 1-6 as to how important they would be as a reason for not attempting suicide. Higher scores indicate lower suicide risk

Study (year) country	Quality rating	Sample description	Type of suicidal behaviour	Factors associated with suicidal behaviour
Gardner and Hini (2006)[51] New Zealand	9	Members of Veterinary College of New Zealand (VCNZ)	Suicide attempt "Have you ever tried to commit suicide?"	Support: those who had attempted were more likely to be using support (t547=1.96, p<0.05)
				Vets in Stress phoneline: those who had attempted were more likely to be using Vets in Stress phoneline (X2=28.41, p<0.001)
				Private counselling: those who had attempted were more likely to be using professional counselling (X2=16.78, p<0.001)
				Health professionals: those who had attempted were more likely to be using a health professional (X2=7.54, p<0.001)
				Spiritual support: those who had attempted were more likely to be using spiritual support (X2=11.51, p=0.003)
				Demographic variables: there were no significant differences in gender, age and type of work between those who had attempted suicide and those who had not
		Members of Veterinary College of New Zealand (VCNZ)	Suicidal Ideation "Have you ever seriously thought about committing suicide?"	Gender: those who have thought about suicide were more likely to be female (X21=12.62, p<0.01)
				Type of work: those who have thought about suicide were more likely to be working in small animal practice (X23=19.37, p<0.01)
				Support: those who have thought about suicide were more likely to be using more support (t544=4.69, p<0.001)
				Vets in Stress phoneline: those who have thought about suicide were more likely to be using Vets in Stress phone line (X2=13.27, p=0.001)
				Employee funded counselling: those who have thought about suicide were more likely to be using employer-funded counselling (X2=11.57, p=0.002)
				Private counselling: those who have thought about suicide were more likely to be using private counselling (X2=41.55, p<0.001)
				Health professionals: those who have thought about suicide were more likely to be using health professionals (X2=56.13, p<0.001)
				Spiritual support: those who have thought about suicide were more likely to be using pastoral/spiritual support (X2=6.65, p<0.008)

Study (year) country	Quality rating	Sample description	Type of suicidal behaviour	Factors associated with suicidal behaviour
Bourdet-Loubere (2006b)[92] France	4	French veterinarians who took part in a postal questionnaire	Thoughts about suicide Respondents asked about the protective factors against suicide	Family/parental responsibilities: the main reason not to attempt suicide
				Having children: a protective factor for those who did not have their own children as well as those that did
				Social disapproval: not thought to be particularly important factor.
				Miscellaneous protective factors: being optimistic people, having outside interests, having a 'taste for life', fear of suicide, knowing a family member who has died by suicide.
Kinsella (2006)[93] Ireland	4	Veterinarians working in the counties of Carlow and Wexford, Ireland	Suicide of a colleague Contribution to thoughts of 3 factors rated from 0-5	Stress=4.35
				Depression=4.21
				Marriage/relationship problems=3

Summary of 3.4: Survey studies of suicidal behaviour

- There were seven survey studies of suicidal behaviour in the veterinary profession.
- Just 2/7 studies were of relatively high quality.
- One study found that 2.4% of veterinary surgeons had attempted suicide before and 16% had thought seriously about suicide.
- Salient suicide protective factors in one study included family and parental responsibilities.
- There was limited evidence of the demographic and occupational factors associated with suicidal behaviour.
- There was preliminary evidence that those who were experiencing suicidal thoughts or behaviour were also receiving support of various kinds.

3.5 Survey studies of general mental health

3.5.1 Description of general mental health surveys

There were 47 survey-based studies that reported data on mental health difficulties in the veterinary profession. Ten of these reported data on the general mental health and wellbeing of veterinary surgeons and students of veterinary medicine (see Table 5.1). Studies of specific mental health difficulties are reported later in this chapter.

Surveys of general mental health were conducted in the USA (N=2), UK (N=1), Australia (N=3), New Zealand (N=2) and the Netherlands (N=2). The quality of these studies (as defined by the quality rating scale; Appendix 5) ranged from 3/12 to 12/12. Eight of the surveys used questionnaires to assess mental health, however one study involved data linkage between a regional register of veterinary surgeons and a database of mental health service users[49] and another study investigated the insurance claims for veterinarians who have had to take

time off work due to mental health difficulties[95]. Nine of the studies reported data on the mental health of qualified veterinary surgeons whilst one reported data on the wellbeing of veterinary medicine students[96]. The number of respondents included in the analysis of mental health problems ranged from 35 to 419 and response rates range from 20% to 91%. Nine of the ten studies presented prevalence data. Six of these studies reported data on mental health in general and one of each reported data on current mood states, psychological distress, psychological problems, and psychological wellbeing. All of the questionnaire-based studies classified mental health according to self-reported symptoms rather than a clinical measure, although six of these measures were validated. Four of the studies reported relatively high quality research (score 9-12 on the quality rating scale) and the data from these studies are now presented and discussed.

3.5.2 Prevalence of general mental health difficulties

One study investigated the current mood states of veterinary medicine students at the University of Minnesota using a well-known and validated measure (Profile of Mood States; POMS)[97]. Scores on the six subscales of the measure were compared to those of the general student population although no statistical tests were reported. The veterinary sample reported lower scores on the mood states 'tension', 'depression', 'anger', 'fatigue' and 'confusion' than members of the general student population. 'Vigour' was slightly higher in the veterinary sample than the general population.

The three studies of the general mental health of qualified veterinary surgeons compared the scores obtained to those of the general population[98,94,57]. A study in Australia[57] compared the mean score on the General Health Questionnaire (GHQ)[99] between veterinary surgeons and members of the general population. No statistical tests were reported however the authors stated that the score was lower in the veterinary population. In a similar study of mental health of veterinary surgeons in the UK[98], there was no statistically significant difference in the mean score of a validated measure of mental health between a veterinary sample and the general population.

The final high-quality study of mental health used a validated measure to assess psychological distress in veterinary surgeons of Western Australia[49]. Moderate to high levels of psychological distress were reported by 56% of the sample and 5% reported levels of psychological distress likely to correlate to severe mental disorder. Levels of psychological distress were significantly greater in the study population than in the general population of New South Wales and Western Australia. Behavioural correlates of psychological distress (such as the number of days on which respondents were unable to perform activities of daily living) suggested psychological distress had less of an impact on the lives of veterinary surgeons than members of the general population.

3.5.3 Factors associated with general mental health difficulties

Table 5.2 presents the three studies that report data on factors associated with general mental health in the veterinary profession[96,94,57]. A survey of the mood states of veterinary students in the USA[96] reported that whilst gender alone was

not significantly associated with mood state, second-year female students were significantly more likely to experience anxiety, anger, fatigue and confusion than students in other years. In addition, fourth year students were more likely to experience anxiety and anger than those in other academic years and first year students experienced significantly more vigour and less confusion than students in other years. There was no evidence that depressive mood states were influenced either by gender or academic year.

The factors thought to contribute to the elevated levels of psychological distress reported in a sample of Australian veterinary surgeons were assessed with a logistical regression model[94]. The model suggested that those who reported high levels of psychological distress were more likely to have had a recent back injury, to have taken drugs within the past year, and to be under the age of 35 years old than those experiencing low levels of psychological distress. Psychological distress was generally more common in females than males, and in younger veterinarians. In a separate study of the mental health of Australian veterinary surgeons, overall mental health was found to be significantly correlated with job stress[57].

Summary of 3.5: Survey studies of mental health

- Ten survey studies reported data on the general mental health of veterinary surgeons and veterinary medicine students.
- Four studies were of relatively high quality
- The general mood of veterinary students was lower than that of general student populations
- There was little evidence that veterinary surgeons' scores on measures of general mental health were significantly different from those in the general population
- There was preliminary evidence that whilst psychological distress was relatively high in the veterinary profession, this did not appear to impact on activities of daily living
- Limited data were available on the factors associated with general mental health in the veterinary profession although gender and age were found by at least one study to be related to mental health.

Table 5.1: Survey studies of the prevalence of general mental health difficulties in the veterinary profession

Author (year) country	Quality rating	Research method	Sample description	N (Response rate)	Depression measure	Measure of depression prevalence	Prevalence data	Comparisons with other populations
Melbo (1981)[96] USA	12	Questionnaire (mixed methods of distribution)	Students enrolled in the College of Veterinary Medicine at the University of Minnesota during Spring 1980.	288 (91%)	**Mood state** Multi-item symptoms (validated) Profile of Mood States (POMS; McNair et al, 1971) 64 items assessing 6 mood states. 5 point rating scale.	**Standardised t-scores for POMS subscales (veterinary students)**		Each subscale compared to general population (mean=50, s.d.=10)
						Tension-Anxiety	44	Low to moderate levels
						Depression-Dejection	45	Low to moderate levels
						Anger-Hostility	48	Low to moderate levels
						Vigour	51	Average levels
						Fatigue	48	Below average
						Confusion-Bewilderment	44	Low to moderate levels
Kahn and Nutter (2005)[98] England	11	Questionnaire (postal)	Veterinary surgeons in the UK	35 (70%)	**Mental health** Multi-item symptoms (validated) Subscale of the Occupational Stress Indicator (OSI; Cooper et al., 1988) 18 items scored 1-6 (Higher score indicates poorer self-perceived mental health)	Mean score (s.d.)	58.77 (13.92)	Mean score not significantly from that of the general population (mean=55.51, s.d.=12.95, t=-1.38, p>0.05)

Author (year) country	Quality rating	Research method	Sample description	N (Response rate)	Depression measure	Measure of depression prevalence	Prevalence data	Comparisons with other populations
Fairnie (2005c)[94] Australia	10	Questionnaire (postal)	Veterinarians on the Veterinary Registration Board (VSB) register in Western Australia	419 (43%)	**Psychological Distress (PD)** Multi-item symptoms (validated) K10 (Kessler, 2002) 10 items about mental health in the previous 4 weeks 5-point scale Scores over 30 indicate likely severe mental disorder.	**Percentage of respondents reporting each level of PD**		
						Low PD (10-15)	47%	The study population were significantly more distressed than the general population of New South Wales (X^2=55.09, p<0.001) and Western Australia (X^2=91.34, p<0.001)
						Moderate PD (16-21)	32%	
						High PD (22-29)	17%	
						Very high PD (30-50)	5%	
						Scores >15	56%	
						Behavioural correlates of PD for those scoring >15		
						Number of days had to cut down on daily activities	2.9	3 in New South Wales population
						Number of days unable to manage daily activities	0.4	3.5 in New South Wales population
						Number of visits to health professional	0.2	0.8 in New South Wales population
Meehan and Bradley (2007)[57] Australia	9	Quetsionnaire (postal)	Members of the Australian Small Animal Veterinary Association (ASAVA)	231 (20%)	**General mental health** Multi-item symptoms (validated) GHQ-12 12 items rated on 6 point likert scale	Mean score (s.d.) on GHQ	4.23 (0.76)	Mental health was no lower than general population but data was not reported
Shouksmith and Hesketh (1986)[134] New Zealand	8	Questionnaire	Members of the New Zealand Veterinary Association	406 (59%)	**Mental health** Multi-item symptoms (validated) Mental Health Inventory (15-item version; Viet and Ware, 1983)	Scores on Mental Health Inventory	"in general, veterinarians are not stressed and show relatively low levels of anxiety and depression, as a group."	

Author (year) country	Quality rating	Research method	Sample description	N (Response rate)	Depression measure	Measure of depression prevalence	Prevalence data	Comparisons with other populations
Drijfhout and de Leeuw (2005)[135] Netherlands	6	Questionnaire	Veterinary surgeons in the Netherlands	56 (55.45%)	**Mental health**	**% of respondents who were 'mentally healthy'**		
						Those who experienced foot and mouth in their own practice	23%	
						Those who experienced foot and mouth but not in their own practice	50%	
						Those who were not affected by the foot and mouth outbreak	72%	
Fairnie (2005b)[94] Australia	5	Database linkage study	Veterinarians in Australia	50	**Mental health conditions of any kind** Vets in Australia linked to two databases of people suffering from mental health problems	Number of veterinarians experiencing mental health problems	50/1073 (4.7%) including schizophrenia, bipolar affective disorder and other psychoses	
Anonymous (2005)[136] USA	3	Questionnaire (implied)	Veterinary practitioners	Not stated	**Psychological wellbeing** Single item measure of symptoms	Percentage of respondents who consider themselves emotionally and mentally healthy	90%	

Author (year) country	Quality rating	Research method	Sample description	N (Response rate)	Depression measure	Measure of depression prevalence	Prevalence data	Comparisons with other populations
Stembert et al (2003)[95] Netherlands	3	Investigation of insurance health reports filed when veterinarians take time off work due to ill health	Veterinary surgeons in the Netherlands	123	**Psychological problems**	Number of cases where psychological problems are a cause for time off work	64/123 (52%)	
						Number of cases by speciality		
						Pets	29 (50%)	
						Horses	2 (5%)	
						Agriculture	8 (14%)	
						Pigs	5 (9%)	
						Miscellaneous	18 (22%)	

Table 5.2: Survey studies of the factors associated with general mental health in the veterinary profession

Author (year) country	Quality rating	Sample description	Measure of depression	Factors associated with depression
Melbo (1981)[96] USA	12	Students enrolled in the College of Veterinary Medicine at the University of Minnesota during Spring 1980.	**Mood state** Multi-item symptoms (validated) Profile of Mood States (POMS; McNair et al, 1971)	Gender: Males scored significantly higher on the vigour scale than females (F=5.501, p=0.02)
				Depression: The were no significant effects of gender or academic year on scores on the depression-dejection scale
				Academic year
				Fourth year students reported significantly more tension-anxiety than other academic years (F=4.794, p=0.003) and significantly more anger (F=4.728, p=0.003)
			64 items covering 6 mood states (5 point rating scale)	Fourth and second year students reported significantly more fatigue than first and third year students (F=3.218, p=0.023)
				First year students reported significantly more vigor than other years (F=6.806, p=0.001) and significantly less confusion-bewilderment than other years (F=5.455, p=0.001)
				Interaction between gender and academic year
				Second year female students reported significantly more tension-anxiety (F=5.827, p=0.001), anger (F=4.714, p=0.003), fatigue (F=5.164, p=0.002) and confusion (F=4.118, p=0.007) than students in other academic years
Fairnie (2005c)[94] Australia	10	Veterinarians on the VSB register in Western	**Psychological Distress (PD)** Multi-item symptoms (validated) K10 (Kessler, 2002) 10 items about mental health in the previous 4 weeks (5-point likert scale) Scores over 30 indicate likely severe mental disorder.	Gender: 27% females vs 16% males had high or very high levels of PD (chi-squared=9.828, p<0.05)
				Age: those under 35 had significantly more distress than those who were older (chi squared=20.510, p<0.001)
				Other variables
				Significant associations with hours worked, risk-taking when first graduated, having a back injury over past 5 years, drug taking over past 12 months, anger, unhappiness and job satisfaction Best predictors of PD: logistic regression was performed and suggests that the best predictors of PD were back injury in past 5 years, taking drugs in past 12 months, <35 years old.

Author (year) country	Quality rating	Sample description	Measure of depression	Factors associated with depression
Meehan and Bradley (2007)[57] Australia	9	Members of the Australian Small Animal Veterinary Association (ASAVA)	**General mental health** Multi-item symptoms (validated) GHQ-12 (12 items on 6 point likert scale)	Job stress: Significant negative correlation with job stress ($p<0.001$)

3.6 Survey studies of depression

3.6.1 Description of survey studies of depression

There were eight studies that reported data related to depression in the veterinary profession (Table 6.1). The quality of these studies varied from 4/12 to 12/12 and four of the studies reported relatively high quality research (as defined by a score of 9-12 on the quality rating scale)[52,100,92,51]. Four of the eight studies are conducted in the USA, two in France and two in New Zealand. Whilst one study used a semi-structured interview to investigate depression, the other seven studies were questionnaire-based. None of the studies used clinical diagnostic tools to identify depression. Three studies reported the prevalence of depression according to multi-item measures of depressive symptoms which were validated, and a further three did so without validation of the measure reported. One questionnaire study used a single item to record depressive symptoms as defined by the respondent and the interview study involved open-ended and semi-structured questions about depression. All four studies published in the USA investigated depression in students of veterinary medicine whereas the other four studies investigated depression in qualified veterinary surgeons. Aside from the interview study of depression in which four respondents were studied, the number of respondents ranged from 31 to 849. Response rates ranged from 40-90%. The prevalence or frequency of depression was reported in seven studies and the factors associated with depression were reported in four studies.

3.6.2 Prevalence of depression

Table 6.1 shows data on the prevalence of depression in the veterinary profession as reported in the four studies of relatively high quality. The two high quality studies that reported depression in students of veterinary medicine in the USA overlapped slightly in their study samples[52,100]. The first study provided data on first year students alone[52] whereas the second paper provided additional data on depression in second year students[100]. The mean score on the validated multi-item measure of depression (Center for Epidemiological Studies Depression Scale[101]) was slightly higher in first year students than second year students. The maximum score was 60 and scores in the first year sample ranged from 1-46. The corresponding percentage of students experiencing clinical levels of depression as defined by a score greater than 16/60 on the CES-D was 32% in first-year students and 28% in second year students.

Of the two studies reporting the prevalence of depression in qualified veterinary surgeons, a study conducted in France found that 3.2% of respondents were experiencing clinical levels of depression, as defined by a score greater than 15 on the 13 item version of the Beck Depression Inventory[102]. The majority of respondents (N=58) were experiencing no symptoms of depression. In the study of New Zealand veterinary surgeons[51], 4.1% report current depression and 11.9% reported having been diagnosed with depression in the past.

Table 6.1: Survey studies of the prevalence of depression in the veterinary profession

Author (year) country	Quality rating	Research method	Sample description	N (Response rate)	Depression measure	Measure of depression prevalence	Prevalence data	Comparisons with other populations
Hafen et al (2006)[52] USA	12	Questionnaire	First year veterinary students in their first semester at Kansas State University	93 (90%)	Multi-item measure of symptoms (validated) Center for Epidemiological Studies Depression Scale (CES-D) 20 items 0 (no depressive symptoms)-60 (maximum depression score)	Mean (s.d) score on CES-D	14.31 (9.26)	National college student sample: A significantly higher proportion of veterinary students scored above the clinical level of depression than in national college samples [quoted; no data]
						Range of CES-D scores	1-46.	Human medical student prevalence of depression: A higher proportion of veterinary students scored above clinical level compared to human medical students (23%) [quoting Rosal et al., 1997]
						Number of respondents who report clinical levels of depression (CES-D score greater than 16)	28 (32%)	
Hafen et al (2008)[100] USA	10	Questionnaire (issued in class)	First year veterinary medical students at Kansas State University	78 (84%)	Multi-item measure of symptoms (validated)	Mean (s.d) score on CES-D	13.30 (7.63) for second-semester students	14.31 (9.26) for first semester students
					Center for Epidemiological Studies Depression Scale (CES-D) 20 items 0 (no depressive symptoms)-60 (maximum depression score)	Number of respondents who report clinical levels of depression (CES-D score > than 16)	28% of second-semester students	32% of first-semester students
						Percentage of 'Adaptive' students[a]	64%	
						Percentage of 'Struggling' students[b]	36%	

[a] clinical levels of depression at T1, non-clinical levels at T2, non-clinical levels throughout, or reduced depression score by 1 s.d. from T1 to T2.
[b] clinical depression levels at both time-points, non-clinical levels at T1 and clinical levels at T2, or increased depressive symptoms by 1 s.d. from T1 to T2.

Author (year) country	Quality rating	Research method	Sample description	N (Response rate)	Depression measure	Measure of depression prevalence	Prevalence data	Comparisons with other populations
Bourdet-Loubere (2006a)[92] France	10	Questionnaire (postal)	French veterinarians	94 (81.7%)	Multi-item measure of symptoms (no validation reported) 13 item version of BDI Each item rated from 1-4	Mean score on BDI	3.9	
						Range of BDI scores	0-21	
						No depression (0-3)	N=58	
						Light depression (4-7)	N=19	
						Moderate depression (8-15)	N=14	
						Severe depression (>15)	N=3 (3.2%)	
Gardner and Hini (2006)[51] New Zealand	9	Questionnaire (postal)	Veterinarians registered with the Veterinary College of New Zealand (VCNZ)	849 (48.6%)	Multi-item measure of symptoms (no validation reported)	Number of respondents who are currently suffering from depression	35/849 (4.1%)	
						Number of respondents who have been diagnosed with depression at some point	101/849 (11.9%)	
Hesketh and Shouksmith (1986)[137] New Zealand	8	Questionnaire (postal)	Members of New Zealand Veterinary Association	401 (59%)	Multi-item measure of symptoms (validated) Mental Health Inventory (shortened version; Viet and Ware, 1983). 4-item subscale for depression	Only data on factors associated with depression are reported		

Author (year) country	Quality rating	Research method	Sample description	N (Response rate)	Depression measure	Measure of depression prevalence	Prevalence data	Comparisons with other populations
Kogan et al (2005)[54] USA	6	Questionnaire (internet link)	Veterinary students at a US veterinary school.	233 (43.5%)	Multi-item measure of symptoms (no validation reported) Items related to feelings of hopelessness, sadness and depression	How often they had felt hopeless in the past year	Never: 53.3%	
							<5 times: 30.5%	
							6-10 times: 10%	
							>10 times: 5.6%	
						How often they had felt sad in the past year	Never: 18%	
							<5 times: 52%	
							6-10 times: 18.5%	
							>10 times: 10.9%	
						How often they had felt depressed	Never: 61.2%	
							<5 times: 29%	
							6-10 times: 4.3%	
							>10 times: 4.3%	

Author (year) country	Quality rating	Research method	Sample description	N (Response rate)	Depression measure	Measure of depression prevalence	Prevalence data	Comparisons with other populations
Sutton (2007)[138] USA	6	Questionnaire (internet link)	Veterinary students who had just completed their first year at veterinary college in the southeastern United States.	31 (40%)	Self-reported symptoms	"Did you experience any of the following during your first year as a vet student: Anxiety, Depression, Time management problems, Study skill problems, Relationship problems, Other?"	35% reported experiencing depression	
Bourdet-Loubere (2006b)[92] France	4	Interview (semi-structured)	French veterinarians that took part in a postal questionnaire	4	Open ended semi-structured questions, not specified	Prevalence of depression	One had depression as a student. One had Seasonal Affective Disorder	

3.6.3 Factors associated with depression in the veterinary profession

The four studies of relatively high quality that reported data on the factors associated with depression in the veterinary profession are shown in Table 6.2. The authors of the two studies of depression in students studying veterinary medicine in the USA[52,100] constructed predictive models of depression with various stressors as independent variables (controlling for demographic variables such as age and gender). Hafen et al (2006) included various stressors in the first year as independent variables and found that depression (as defined by scores CES-D scale) was significantly associated with homesickness, unclear instructor expectations, worries about not being as smart as other students and perceived physical health. Hafen et al (2008) considered stressors in both the first and second semesters of first year veterinary medicine as potential predictors of depression (as defined by scores on the CES-D scale). Homesickness in semester 1, academic concerns in semester 1, physical health in semester 2 and difficulty fitting in semester 2 were significantly associated with depression when relationship distress, relationship status, financial concerns, unclear professional expectations, doubting intelligence and age were controlled for.

In a study of French veterinarians[92], depression (as measured by the 13-item version of the BDI[102]) were unrelated to many demographic and occupational variables. However, those working alone reported significantly greater symptoms of depression than those working with others. Depressive symptoms were also negatively correlated with the 'survival and coping beliefs' item of the Reasons for Living questionnaire[103], suggesting that those who were more

Table 6.2: Survey studies of the factors associated with depression in the veterinary profession

Author (year) country	Quality rating	Sample description	Measure of depression	Factors associated with depression
Hafen et al (2006)[52]USA	12	First year veterinary students in their first semester at Kansas State University	Multi-item measure of symptoms (validated) Center for Epidemiological Studies Depression Scale (CES-D): 20 items Measures cognitive, affective and behavioural symptoms of depression Scores range from 0 (no depressive symptoms)-60 (maximum depression score)	Gender: no significant differences in mean score
				Relationship status: no significant correlation with CES-D scores
				Homesickness, unclear instructor expectations, worries about not being as smart as other students and perceived physical health: hierarchical regression model with these stressors as independent variables (and age and gender controlled for) accounted for 47% of the variance in depression scores (F=11.97, p<0.001)
Hafen et al (2008)[100] USA	10	First year veterinary medical students at Kansas State University	Multi-item measure of symptoms (validated) Center for Epidemiological Studies Depression Scale (CES-D): 20 items Measures cognitive, affective and behavioural symptoms of depression Scores range from 0 (no depressive symptoms)-60 (maximum depression score)	Homesickness in semester 1, academic concerns in semester 1, physical health in semester 2 and difficulty fitting in semester 2: logistic regression with the above stressors as independent variables (and relationship distress, relationship status, financial concerns, unclear professional expectations, doubting intelligence and age controlled for) significantly predicted depression scores (p<0.05)
Bourdet-Loubere (2006a)[92] France	10	French veterinarians	Multi-item measure of symptoms (no validation reported) 13 item version of BDI Each item rated from 1-4	Gender: no signficant correlation with BDI scores
				Age: no significant correlation with BDI scores
				Children: no significant difference in BDI scores between those with children and those without
				Geopgraphic location: no correlation with city versus rural locations and BDI scores
				Marital status: no significant correlation with BDI scores
				Membership of 'vetos-entraide' (veterinary support association): no significant correlation with BDI scores
				Time in practice: no significant correlation with with BDI scores
				Professional isolation: those working alone scored significantly higher on BDI (mean=5.38) than those working with other (mean=3.15; t=-2.32, p<0.02)
				Survival and coping beliefs (sub-scale of Reasons for Living): scores on BDI significantly negatively correlated with survival and coping beliefs (r=-0.51)

Author (year) country	Quality rating	Sample description	Measure of depression	Factors associated with depression
Gardner and Hini (2006)[51] New Zealand	9	Veterinarians registered with the Veterinary College of New Zealand (VCNZ)	Multi-item measure of symptoms (no validation reported) Number of respondents who are currently suffering from depression Number of respondents who have been diagnosed with depression at some point	Age: more frequent in younger than older women ($X^2$16=35.63, p=0.003)
				Gender: more frequent in women than men ($X^2$4=17.95, p<0.001)
				Support: those currently experiencing depression used more forms of support (t544=3.34, p=0.001)
				Vets in Stress phoneline: those who were currently experiencing depression were more likely to use Vets in Stress phone line ($X^2$1=6.27, p=0.03)
				Private counselling: those who were currently experiencing depression were more likely to use private counselling ($X^2$1=22.58, p<0.001)
				Health professional: those who were currently experiencing depression were more likely to use a health professional ($X^2$1=44.89, p<0.001)
				Type of work: those in small animal practice report more than those in other areas ($X^2$3=16.99, p<0.01).
				Gender: reported more in women than men ($X^2$1=11.91, p<0.01)
				Support from family and friends: those who were depressed were more likely to seek support from friends/family ($X^2$1=4.91, p=0.02)
				Support: those who were depressed used more forms of support (t549=6.36, p<0.001)
				Vets in Stress phoneline: those who were depressed were more likely to use the Vets in Stress phone line ($X^2$1=10.19, p=0.005)
				Private counselling: those who were depressed were more likely to use private counselling ($X^2$1=106.42, p<0.001)
				Health professionals: those who were depressed were more likely to use health professionals ($X^2$1=146.11, p=0.001)
				Spiritual/pastoral support: those who were depressed were more likely to use spiritual/pastoral support ($X^2$1=6.74, p=0.009)

depressed rated survival and coping beliefs as less of a reason to avoid suicide than those who were less depressed.

In the study of veterinarians in New Zealand[51], several demographic and occupational variables were related to both current depressive symptomology and a previous clinical diagnosis of depression[51]. Current depression (as measured by an un-validated multi-item measure of depressive symptoms) was more common among women than men, as was a previous diagnosis of depression. Gender also interacted with age, such that current depression was more common among younger women than older women. In terms of occupational factors, previous diagnosis of depression was significantly more frequently reported among those working in small animal practice as opposed to other areas of veterinary work. Both current depressive symptoms and previous diagnosis of depression were associated with various factors related to support. More forms of support were used by those who had previously been diagnosed with depression and those who were currently depressed. In particular, use of the Vets in Stress phone-line was positively correlated with current depressive symptomology and previous depression diagnosis, with use of private counselling, and use of a health professional. In addition, previous diagnosis of depression was also significantly positively correlated with support from family and friends and spiritual or pastoral support.

Summary: 3.6 Survey studies of depression

- Eight studies presented data on depression in the veterinary profession
- 4/8 studies were of relatively high quality
- 2 studies of veterinary medicine students in the USA found that 28% to 32% showed symptoms of clinical depression
- 2 studies of veterinary surgeons in France and New Zealand found that between 3% to 4% demonstrated symptoms of depression
- Academic concerns and homesickness were the main factors associated with depression in the students
- There was mixed evidence about the contributory effects to depression of demographic and occupational factors for veterinary surgeons
- Veterinary surgeons who had been or who were currently depressed were more likely to be using various forms of support

3.7 Survey studies of anxiety

3.7.1 Description of surveys investigating anxiety

Table 7.1 identifies the nine survey-based studies of anxiety in the veterinary profession. The quality of these studies ranged from 4/12 to 12/12 and five of these studies were of relatively high quality (score 9-12). Six studies were conducted in the USA, two in France and one in New Zealand. Questionnaires were used in eight of these studies and an interview methodology in the other study. None of the studies included a clinical diagnostic tool to assess the prevalence of anxiety in the veterinary profession. However, five measured anxiety using a validated multi-item measure, two used a multi-item measure but did not report the validity of this measure, and two relied of self-reported symptoms of anxiety. Students at veterinary colleges in the USA were the sample for five of the studies of anxiety and the other four studies investigated anxiety in qualified veterinary surgeons. The number of respondents included

in the analyses of questionnaire-based studies ranged from 10-401 and response rates ranged from 40-100%. The interview study was of just four veterinarians.

3.7.2 Prevalence of anxiety

Five studies of relatively high quality (that scored 9-12 on the quality rating scale), presented data on the prevalence of anxiety in the veterinary profession (see Table 7.2). The validation of the measures used to assess anxiety in these studies was reported in four of the studies and the fifth study used a measure for which the validity is reported in one of the other studies. The highest quality studies (N=2) were of anxiety in veterinary students in the USA. They provide the mean (standard deviation) and range of scores on the anxiety measure that was used (CSAQ[104]) but do not relate these to behavioural correlates. Two of the three studies compared the scores of the veterinary study population to another population. In one study, anxiety (as measured by the CSAQ[104]) of veterinary students was compared to a general college sample[96]. No statistics were reported, but the authors stated that anxiety scores were lower in the veterinary sample. In another study, anxiety (as measured by the Sport Anxiety Scale[105]) of the veterinary study population was compared to scores obtained using the same measure on elite athletes[106]. Again no statistical analyses were reported although the overall score on the anxiety scale was greater in the elite athlete population than the veterinary study population.

The remaining two high-quality studies of the prevalence of anxiety in the veterinary profession used the same measure (State Trait Anxiety Inventory, STAI[107]). The study of French veterinary surgeons reports the mean (and

standard deviation) scores on the state anxiety scale to be 37.841 (10.51) and mean trait anxiety to be 39.54 (9.05). The scores on the two subscales could be translated into levels of stress. The percentage of respondents that experienced state anxiety was: no anxiety (0-29, 22.3%), light anxiety (30-39, 44.7%), medium anxiety (40, 4.3%), high anxiety (41-50, 14.9%) and severe anxiety (51-80, 13.8%). The percentage of respondents that experienced state anxiety was: no anxiety (0-29, 8.5%), light anxiety (30-39, 52.1%), medium anxiety (40, 52.1%), high anxiety (41-50, 21.3%) and severe anxiety (51-80, 13.8%).

Finally, a study of USA veterinarians who worked in emergency clinics[108] used the same measure of anxiety and reports the mean score of respondents on the state- and trait-anxiety subscales before and after a stress reduction intervention was administered. Prior to the intervention, state anxiety was 38.2 in the experimental group and 41.6 in the control group. Trait anxiety was 34.6 in the experimental group and 35 in the control group. Post-intervention state anxiety did not differ significantly between those in the control group and those in the experimental group when pre-test anxiety, trait anxiety and empathy were controlled for, or when just pre-test anxiety was controlled for. These results suggest that the anxiety reduction programme had no impact on levels of stress.

Table 7.1: Survey studies of the prevalence of anxiety in the veterinary profession

Author (year) country	Quality rating	Research method	Sample description	N (Response Rate)	Anxiety measure	Measure of anxiety prevalence	Prevalence data
Hafen et al (2006)[52] USA	12	Questionnaire	First year veterinary students in their first semester at Kansas State University	93 (90%)	Multi-item symptoms (validated) 5-item subscale of 18-item version of Mental Health Inventory (MHI-A) Likert scale from 0-5 for each item Min summed score 0, Max score 30 Higher scores represent higher anxiety	Mean (s.d.) score on anxiety subscale	18.92 (4.94)
						Range of anxiety scores	7-29
Melbo (1981)[96] USA	12	Questionnaire (mixed methods of distribution)	Students enrolled in the College of Veterinary Medicine at the University of Minnesota during Spring 1980	288 (91%)	Multi-item symptoms (validated) Cognitive and Somatic Anxiety Questionnaire (CSAQ; Schwartz et al, 1978) 14 items to assess trait anxiety Rated on 7 point likert scale (original version used 5 but authors have modified)	Mean (s.d.) score on cognitive anxiety subscale	2.61 (1.06)
						Mean (s.d.) score on somatic anxiety subscale Comparison with college sample of Yale University, USA (Christoph, unpulished dissertation)	2.82 (0.93) "Veterinary study population scores on CSAQ were lower than normative college sample"

Author (year) country	Quality rating	Research method	Sample description	N (Response Rate)	Anxiety measure	Measure of anxiety prevalence	Prevalence data
Zenner et al (2005)[106] USA	11	Questionnaire	1st year veterinary students at Washington State University	61 (80%)	Multi-item symptoms (validated) Sport Anxiety Scale (SAS; Smith et al., 1990) 9 item subscale of somatic anxiety 12 item subscale of cognitive anxiety (5 items for concentration disruption, 7 items for worry) Frequency measured on 4 point likert scale from 1 (not at all) to 4 (very much so)	Mean (s.d.) score on SAS	41.99 (9.15)
						Mean (s.d.) somatic anxiety subscale	19.18 (6.08)
						Mean (s.d.) worry subscale	14.45 (3.39)
						Mean (s.d.) concentration subscale	8.36 (2.11)
						Elite athletes (N=59): Mean score on SAS	46.8
						Elite athletes (N=59): Mean (s.d.) somatic anxiety subscale	19.6 (5.7)
						Elite athletes (N=59): Mean (s.d.) worry subscale	17.1 (5.1)
						Elite athletes (N=59): Mean (s.d.) concentration subscale	10.1 (3.4)
Bourdet-Loubere (2006a)[92] France	10	Questionnaire (postal)	French veterinarians	94 (81.7%)	Multi-item (no validation reported) STAI-40 items. Total score 20-80 with 80 being most anxious Section A-state anxiety. 20 items. Scale 1-4 Section B-trait anxiety. 20 items. Scale 1-4	Mean (s.d.) STAI-A score	37.84l (10.51)
						Range of STAI-A scores	22-69
						No anxiety (0-29)	N=21 (22.3%)
						Light (30-39)	N=42 (44.7%)
						Medium anxity (40)	N=4 (4.3%)
						High anxiety (41-50)	N=14 (14.9%)
						Severe (51-80)	N=13 (13.8%)
						Mean (s.d.) STAI-B score	39.54 (9.1)
						Range of STAI-B scores	27-69
						No anxiety (0-29)	N=8 (8.5%)
						Light (30-39)	N=49 (52.1%)
						Medium (40)	N=4 (4.3%)
						High (41-50)	N=20 (21.3%)
						Severe (51-80)	N=13 (13.8%)

Author (year) country	Quality rating	Research method	Sample description	N (Response Rate)	Anxiety measure	Measure of anxiety prevalence	Prevalence data
Wessells (1982)[108] USA	10	Questionnaire	Staff members from emergency veterinary clinics	10 (100%)	Multi-item symptoms (validated) STAI 40 item questionnaire (20 state anxiety, 20 trait).	Mean pre-treatment trait anxiety score	34.6 (experimental group) 35 (control group)
						Mean pre-treatment state anxiety score	38.2 (experimental group) 41.6 (control group)
						Mean post-treatment state anxiety	32.6 (experimental group) 35.6 (control group)
						ANCOVA test comparing state anxiety levels between experimental and control group before and after a stress reduction program	No significant difference between those in control group and those in experimental group in post-test state anxiety when pre-test anxiety, trait anxiety and empathy are controlled for, or when just pre-test anxiety is controlled for.
Hesketh and Shouksmith (1986)[137] New Zealand	8	Questionnaire (postal)	Members of New Zealand Veterinary Association	401 (59%)	Prevalence of anxiety not reported		

Author (year) country	Quality rating	Research method	Sample description	N (Response Rate)	Anxiety measure	Measure of anxiety prevalence	Prevalence data
Sutton (2007)[138] USA	6	Questionnaire (internet link)	Veterinary students who had just completed their first year at veterinary college in the southeastern United States.	31 (40%)	Self-reported symptoms (1 question)	“Did you experience any of the following during your first year as a vet student: Anxiety, Depression, Time management problems, Study skill problems, Relationship problems, Other?"	84% report experiencing anxiety
Kogan et al (2005)[54] USA	6	Questionnaire (internet link)	Veterinary students at a US veterinary school.	233 (43.5%)	Multi-item symptoms (no validation reported) Items not stated	How many students had suffered from anxiety disorder in past year	26 (11.3%) had suffered some type of anxiety disorder in the past year.
Bourdet-Loubere (2006b)[92] France	4	Interview (semi-structured)	French veterinarians that took part in a postal questionnaire	4	Open ended semi-structured questions, not specified	Respondents who were exposed to anxiety	"All"

3.7.3 Factors associated with anxiety

Three of the high-quality studies of anxiety in the veterinary profession also report the factors associated with the prevalence of anxiety in this population (see Table 7.2). Two of these were of anxiety in veterinary students in the USA[52,96]. There was no evidence that gender was associated with anxiety in either of these studies. There was also no evidence for an association with relationship status in the first study[52] or for an association with the year of study in the second study[96]. A model to predict anxiety scores that contained the stressors homesickness, unclear instructor expectations, being behind on studies and perceived physical health, accounted for a substantial proportion of the variance (44%) in anxiety scores[52].

In the study of anxiety in French veterinarians[92], there was also little evidence that anxiety levels were associated with the demographic factors gender, age, having children or marital status. Neither was there evidence that anxiety was associated with the geographic location (rural or city) in which the veterinarian worked, the length of time they had been in practice, or whether they were a member of vetos-entraide (vets helping each other association). Veterinarians working alone scored significantly higher on trait anxiety than those working with others. Those respondents who scored highly on state and trait anxiety measures were also more likely to score lowly on the survival and coping beliefs measure of the Reasons for Living Questionnaire[103], suggesting that anxious individuals did not perceive survival and coping beliefs as a reason to avoid suicide. Finally, state anxiety and trait anxiety were both highly correlated with depression as measured using the Beck Depression Inventory[102].

Summary: 3.7 Survey studies of anxiety in the veterinary profession

- Nine studies presented data on anxiety within the veterinary profession (the majority in the USA)
- 5/9 studies were of relatively high quality
- Studies of veterinary medicine students found little evidence that anxiety was elevated compared to a general college sample
- Studies of qualified veterinary surgeons suggested the majority of respondents experienced low to moderate levels of anxiety but that around 13% experienced severe symptoms of anxiety
- Veterinary medicine students' anxiety was predicted by academic factors and homesickness.
- Anxiety of veterinary surgeons was positively correlated with symptoms of depression

Table 7.2: Survey studies of the factors associated with anxiety in the veterinary profession

Authors/ country	Quality rating	Sample description	Measure of anxiety	Factors associated with anxiety
Hafen et al (2006)[52] USA	12	First year veterinary students in their first semester at Kansas State University	Multi-item symptoms (validated) 5-item subscale of 18-item version of Mental Health Inventory (MHI-A) Likert scale from 0-5 for each item (min score 0, max score 30) Higher scores represent higher anxiety	Gender: no significant correlation with mean anxiety score
				Relationship status: no significant correlation with mean anxiety score
				Homesickness, unclear instructor expectations, being behind on studies, perceived physical health: hierarchical regression model with these stressors (and age and gender controlled for) accounted for 44% of the variance in anxiety scores ($F=9.16$, $p<0.001$)
Melbo (1981)[96] USA	12	Students enrolled in the College of Veterinary Medicine at the University of Minnesota Spring 1980.	Multi-item symptoms (validated) Cognitive and Somatic Anxiety Questionnaire (CSAQ[104]) 14 items to assess trait anxiety Rated on 7 point likert scale (although the original version used 5)	Gender: no significant relationship with mean anxiety score
				Year of study: no significant relationship with mean anxiety score
Bourdet-Loubere (2006a)[92] France	10	French veterinarians	Multi-item (no validation reported) STAI-40 items. Total score 20-80 with 80 being most anxious Section A-state anxiety. 20 items. Scale 1-4. Section B-trait anxiety. 20 items. Scale 1-4	Gender: no significant relationship with mean anxiety score
				Location (rural or city): no significant relationship with mean anxiety score
				Having children: no significant relationship with mean anxiety score
				Age: no significant relationship with mean anxiety score
				Marital status: no significant relationship with mean anxiety score
				Membership with vetos-entraide (vets helping each other association): no significant relationship with mean anxiety score
				Length of time in practice: no significant relationship with mean anxiety score
				Professional isolation: those who work alone ($N=32$) scored significantly higher on measures of trait anxiety ($x=42.31$) than those working with others ($N=62$, $x=32.11$; $t=-2.17$, $p<0.03$)
				Survival and coping beliefs: significant correlation between scores on the survival and coping subscale of the Reasons for Living Questionnaire, state anxiety ($r=-0.45$) and trait anxiety ($r=-0.42$)
				Depression: scores on the BDI were significantly correlated with state ($r=0.7$) and trait anxiety ($r=0.8$)

3.8 Stress and burnout

3.8.1 Description of studies investigating stress and burnout

In total 43 studies were identified by the search strategy as presenting results of survey studies of stress (N=36), burnout (N=2), or both (N=5). The quality of these studies (as defined by the score obtained on the quality rating scale) ranged from 2/12 to 12/12. The majority of studies were conducted in the USA (N=19) or Australia (N=12), while the rest were conducted in Belgium (N=2), Germany (N=2), Ireland (N=2), England (N=2), Finland (N=1), France (N=1), the Netherlands (N=2) and New Zealand (N=1). The majority of the studies were questionnaire based (N=38), whilst three were interview based, one combined interview and questionnaire methods and a final study was a focus group study. Around two-thirds of studies were of veterinary surgeons (N=28) whilst the remaining studies investigated stress in students of veterinary medicine (N=15). The number of respondents in the questionnaire-based studies ranged from 31 to 849 and response rates ranged from to 9% to 98.5%. The three interview studies included 24 and 45 and 154 respondents and the focus group consisted of 34 participants.

3.8.2 Prevalence of stress and burnout

In total 16 survey studies of stress and burnout were of relatively high quality (scored 9-12 on quality rating scale) and 13 of these report the prevalence of stress or burnout in the veterinary surgeons or veterinary students (Table 8.1).

Chapter 3: Results

Six studies report stress in students of veterinary medicine, including five attending universities in the USA and one in Western Australia. Questionnaire methodology was used predominantly, although one study complimented a questionnaire with interviews with students and staff. The questionnaires contained a mixture of validated multi-item measures of stress (N=3) and multi-items for which validation was not reported (N=3). Four studies relate mean scores on these measures to levels of stress or symptoms of stress, whereas two studies only report numerical data on the distribution of scores.

In a study of student stress at the University of Minnesota, 68% of students reported stress in a 'moderate' range and 14% report 'high' stress, as defined by a mean score greater than 6 on a scale of 0-10[96]. In a study of stress in students at the University of Illinois, a roughly equal number of students reported 'low stress' (36%), defined by a total score <156 and 'high stress' (31%), defined by a total score >190[109]. Students at the University of Colorado were asked to rate the level of strain they were experiencing in relation to 11 stressors. Whilst the data on the scores obtained are not reported, the authors concluded that the majority of students reported levels of strain in the mid-range [110]. Finally, in a study of the symptoms of stress in Australian veterinary medical students in their fourth or fifth year, 50% of respondents strongly agreed that they had felt tired and fatigued over the past month, 20% had experienced unintentional weight loss, just over one third had trouble sleeping and the same number had concerns about their physical health suffering as a result of the demands placed on them[111].

Table 8.1: Survey studies of the prevalence of stress and burnout in the veterinary profession

Authors/ country	Quality rating	Research method	Sample description	N (Response rate)	Stress/burnout measure	Measure of prevalence of stress/burnout	Prevalence data	Comparisons with other populations
Melbo (1981)[96] USA	12	Questionnaire (mixed methods of distribution)	Students enrolled in the College of Veterinary Medicine at the University of Minnesota during Spring 1980.	288 (91%)	**Stress** Multi-item symptoms (no validation reported) List of 25 potential stressors that may or may not cause stress or anxiety among students (identified from interviews with staff and students and literature review) 11 point scale (0-10) from 'causes no stress' to 'causes extreme stress' or 'not applicable'	Mean (s.d) stress score	4.37 (1.42)	
						Range of stress scores	0.40-8.52	
						Percentage reporting stress in the moderate range (2.95-5.79)	68%	
						High stress (score > 6)	14%	
Kahn and Nutter (2005)[98] England	11	Questionnaire (postal)	Veterinary surgeons in the UK	35 (70%)	**Stress** Single item measure of symptoms An item from OSI (Occupational Stress Inventory)	Number of participants who have encountered major stressful event over past year that had an important effect on them	20/35 (57.1%)	
Kent-Acre (1991)[109] USA	11	Questionnaire (postal)	Students at the College of Veterinary Medicine at the University of Illinois.	174 (55%)	**Stress** Multi-item symptoms (validated) Veterinary Medical Stressor Inventory (VMSI). Self-developed survey tool to measure stressors for veterinary students and their impact on students 55 items with 3 subscales (Academic, Clinical-graduation, Negative Evaluation)	Number of respondents experiencing low stress (score <156) Number of respondents experiencing high stress (score >190)	63 54	

Authors/ country	Quality rating	Research method	Sample description	N (Response rate)	Stress/burnout measure	Measure of prevalence of stress/burnout	Prevalence data	Comparisons with other populations
Strand et al (2005)[118] USA	11	Questionnaire (recruitment by email)	Students in all 4 years of veterinary school at the University of Tennessee	157 (55%)	**Stress** Multi-item symptoms (validated) Derogatis Stress Profile (DSP[139]): 77 items that tests interactional effects of environmental events, emotional responses, personality mediators Rated on a 5 point likert scale from 'not at all true of me' to 'extremely true of me'. Total Stress Score (TSS) aggregates all 3 domains and is then transformed to a 't' score.	TSS Mean (s.d.)	47.81 (10.24)	T-test (one-tailed) to compare stress scores to the general population (test value of 50 for general population was set): Veterinary students scored significantly higher than general population for 'time pressure', 'depression' and TSS
						Subjective Stress Score (s.d.)	55.37 (10.49)	
						Mean anxiety score (s.d.)	51.38 (12.58)	
						Mean depression score (s.d.)	53.37 (11.02)	
Welsch (1998)[56] USA	11	Questionnaire (postal)	Members of American Association of Equine Practitioners (AAEP) who were currently practising and in private practice	457 (51%)	**Burnout** Multi-item symptoms (validated) Burnout Measure (BM[140]): 21 'feelings' rated from 1-7 Degree of burnout=((32-score of positive items) + score of negative items)/21 1-2=low burnout 2-3=acceptable levels of stress/manageable work dissatisfaction 3-4=beginning of burnout syndrome 4-5=clinical burnout 5-7=severe problems	Overall mean score (s.d.)	3.29 (0.8)	
						Mean score for males (s.d.)	3.07 (0.8)	
						Mean score for females (s.d.)	3.47 (0.8)	
					Stress Multi-item symptoms (validated) Health Professions Stress Inventory (HPSI[141]): 30	Mean score (s.d.)	7.01 (2.7)	

Authors/ country	Quality rating	Research method	Sample description	N (Response rate)	Stress/burnout measure	Measure of prevalence of stress/burnout	Prevalence data	Comparisons with other populations
					potentially stressful job situations and frequency of occurrence rated from 0 (never) to 4 (very often) Overall score created from cross-product of severity and frequency scores and can range from 1-25			
Hansez et al (2008)[112] Belgium	10	Questionnaire	French-speaking veterinary surgeons	216 (9%)	**Stress** Multiple measures including Multi-item symptoms (validated)			
					Positive and Negative Occupational Stress Inventory (PNOSI[142]) 19 items to measure job engagement and job strain on a 4 level scale from one (never/rarely) to 4 (almost always/always). Moderate scores are 40-60, with scores below 40 indicating low job engagement and scores above 60 indicating severe job strain	Mean score on job engagement (s.d.) and % reporting normal or high job engagement	54.06 (8.89) (95.4%)	
						Mean score on job strain (s.d.) and percentage of sample reporting high job strain	52.19 (8.15) (14.8%)	
					Burnout Multi-item symptoms (validated) Burnout was measured using a sub-scale of PNOSI 9 items scaled from 1-7 in terms of how many days a week they feel it	Percentage suffering from high burnout	14.40%	

Authors/ country	Quality rating	Research method	Sample description	N (Response rate)	Stress/burnout measure	Measure of prevalence of stress/burnout	Prevalence data	Comparisons with other populations
Elkins and Kearney (1992)[55] USA	9	Questionnaire (postal)	Female veterinarians in USA on AVMA database	572 (57.2%)	**Burnout** Multi-item symptoms (no validation reported) Burnout self-diagnosis instrument[143] 21 item measure of symptoms with likert scale from 1-7 of how frequently they occur. 1-2=low levels of stress/job satisfaction 2-3=acceptable levels of stress/job satisfaction 3-4=beginnings of burnout syndrome 4-5=clinical burnout 5-6=burnout where professional counselling needed 6-7=severe burnout/probable impairment of professional performance	Mean burnout score	3.41 (1.81-6.14)	Male veterinarians[113]: 3.09
						% who scored >3	67%	Male veterinarians[113]: 53%
						'I am happy in my current position'	83% agreed/ strongly agreed	Female Texan veterinarians[144]:79%
						'If I had to chose again I would chose the veterinary profession' 'I consider my position stressful' 'Women are treated equally to men in the veterinary profession'	71% agreed/ strongly agreed 87% agreed/ strongly agreed 80% disagreed/ strongly disagreed	
Kelman (1977)[110] USA	9	Questionnaire (distributed at assemblies) and Interview (structured)	Questionnaire sample were veterinary students at Colorado State University. Interviews were conducted with students and staff at the veterinary school	284 (80% approx)	**Stress** Multi-item (no validation reported) A list of 11 environmental stressors was identified through exploratory interviews with 24 students Semantic differential scales (Osgood et al, 1971) were attached to each stressor (polar adjectives pairs to describe mood and physiological states associated with strain) Scale from 1-7 with 7 being the most negative pole	Levels of strain	'Responses to stressors tended to be in the mid-range on the semantic difference scale. Most students were not feeling excessively strained.'	

Authors/ country	Quality rating	Research method	Sample description	N (Response rate)	Stress/burnout measure	Measure of prevalence of stress/burnout	Prevalence data	Comparisons with other populations
Meehan and Bradley (2007)[57] Australia	9	Questionnaire (postal)	Members of the Australian Small Animal Veterinary Association (ASAVA)	231 (20%)	**Stress** Multi-item symptoms (validated) Items from the Job Content Questionnaire (Karasek, 1985). 12 items (8 about psychological work demands/stress) Rating on a 5 point likert scale from strongly agree to strongly disagree	Mean score on job demands scale (1-5)	3.47	
Nelsen (2007)[116] USA	9	Questionnaire (email and internet link)	Veterinary students from veterinary training courses in the USA	466 (25.5%)	**Stress** Multi-item symptoms (validated) Perceived Stress Scale 10 (PSS10; Cohen et al 1983) 10 items on 5 point likert scale	Mean score on PSS10 (s.d.) Range of scores	29.19 (6.98) 11-50	
Ptacek et al (2004)[114] USA	9	Questionnaire (postal)	Practising veterinarians who were either graduates of Bucknell University or living in the Harrisburg, Pennsylvania	62 (56.8%)	**Stress** Multi-item symptoms (no validation reported) 40-50 minute questionnaire about delivering bad news Each rating was made on a 5 point scale and was also completed for client stress	Mean stress ratings for preparing for the transaction, delivering the bad news, and overall transaction	"under 3.5 i.e. only moderately stressful"	

Authors/ country	Quality rating	Research method	Sample description	N (Response rate)	Stress/burnout measure	Measure of prevalence of stress/burnout	Prevalence data	Comparisons with other populations
Williams et al (2005)[111] Australia	9	Questionnaire (postal, email and handed out in lectures)	Students in their 4th or 5th (final) year in Department of Veterinary Clinical Sciences at Murdoch University in Western Australia.	57 (41%)	**Stress** Multi-item symptoms (no validation reported) 81 item researcher-developed questionnaire Current level of stress: 27 items covering 6 items covered by stressors with the addition of a subscale for physical stress reactions, all rated on 7-point likert scale from strongly disagree to strongly agree	Number of students that felt tired and fatigued over past month	52/57	
						Number of students that strongly agreed they had felt tired/fatigued	50%	
						Percentage reporting they had experienced unintentional weight gain/loss	20%	
						Number reporting they had trouble sleeping	"just over 1/3"	
						Number reporting they had concerns about their health suffering as a result of the demands place on them	"just over 1/3"	
Wimberley (1992)[117] USA	9	Questionnaire (postal)	Practising veterinarians who graduated from a large US university	242 (40.1%)	**Stress** Multi-item measure (validated) Subscale of Career/Marital Stress of Women Inventory (CSMWI; Thomas et al 1984) 15 items that measure effect of work stress on career on 1-4 scale (max score 60) Higher scores indicate greater impact	Mean score (s.d.) males	27.77 (6.9)	
						Mean score (s.d.) females	28.50 (6.55)	

Seven studies report the prevalence of stress or burnout in veterinary surgeons, four from the USA and one from each of England, Belgium and Australia. The studies either used a single-item measure of stress (N=1), a multi-item measure that had been validated (N=4) or a multi-item measure for which validation was not reported (N=2). Five of these studies related the scores on these measures to meaningful levels of stress and burnout experienced by the veterinarians.

In a survey of veterinarians in the UK, 57.1% of respondents said they had encountered a major stressful event in the past year that had an important effect on them[98]. In a study of French-speaking veterinarians in Belgium, 14.8% of respondents reported a high level of job strain and 14.4% were suffering burnout[112]. The mean score on a measure of burnout administered to equine veterinary surgeons in the USA correlated with the beginnings of burnout syndrome[56]. The mean score obtained using a similar measure of burnout in a sample of female veterinary surgeons in the USA replicates these results[55]. Of the latter sample, 67% scored above 3 (indicating at least the beginnings of burnout syndrome) and 87% considered their position stressful. The authors compared these findings to a study of male veterinarians which found that 53% of respondents scored above 3 on the measure[113]. Finally, in a study of veterinarians in the USA the mean stress score obtained from respondents in relation to delivering bad news was 'moderate'[114].

3.8.3 Factors associated with stress and burnout

Of the 16 studies reporting high quality research on the prevalence of stress and burnout, all but one[57] also report data on the factors associated with stress and

burnout in the veterinary profession. Eight studies provide data on the factors associated with stress in veterinary medicine students (see Table 8.2), at seven colleges of veterinary medicine in the USA and one college in Western Australia. Seven studies report data on the factors associated with stress in qualified veterinary surgeons (see Table 8.3), four from those working in the USA and one each from England, Belgium and New Zealand.

3.8.3.1 Factors associated with stress in students of veterinary medicine

In a study of students at Kansas State University, first year veterinary medicine students rated how often (on a scale of 0-3) several potential stressors had an impact on them. Although there was no statistical analysis of the difference in frequency with which the 17 stressors were experienced, the mean score of the stressor most frequently experienced was 1.77, suggesting that none of the stressors had a uniquely large impact on the students. The most frequently experienced stressors (and the corresponding mean score) were concerns about academic performance (1.77), financial concerns (1.7) and a heavy workload (1.7)[52]. In a study of students at the College of Veterinary Medicine at the University of Minnesota[96], the most and least common stressors were reported as well as the demographic and psychological variables that correlated with overall stress. The stressor causing the most stress for students was 'tests and evaluations' (53.1% of students marked 7 or above on a scale of 0-10), and the stressor causing the least amount of stress was 'talking to clients about their pets or animals' (4.1% of students marked 7 or above on a scale of 0-10).

Table 8.2: Survey studies of the factors associated with stress in veterinary medicine students

Authors/ country	Quality rating	Sample description	Measure of stress	Measure of factors associated with stress	Factors associated with stress
Hafen et al (2006)[52] USA	12	First year veterinary students in their first semester at Kansas State University	16 researcher-developed questions about the impact of specific stressors.	Mean (s.d.) score for each stressor	Concerns about academic performance 1.77 (1.0)
					Financial concerns 1.7 (0.87)
					Heavy workload 1.7 (0.99)
					Being behind in studies 1.61 (0.96)
			Possible stressors identified from review of literature and researcher's clinical/administrative experience. Scored from 0-3 in terms of frequency Higher scores indicate stressor experienced more often.		Amount of time spent studying 1.6 (0.93)
					Balancing school with personal life 1.18 (1.02)
					Perception that not as smart as other students 1.11 (1.01)
					Difficulty understanding lectures or textbooks 1.08 (0.89)
					Uncertain of professors expectations 0.84 (0.97)
					Homesickness 0.83 (0.89)
					Perception of difficulty fitting in with other students 0.76 (0.81)
					Family illness 0.61 (0.96)
					Personal relationship conflict 0.55 (0.81)
					Death of a loved one 0.52 (1.06)
					Moving from rural to urban environment 0.18 (0.57)
					Moving from urban to rural environment 0.18 (0.52)
					Transportation difficulties 0.18 (0.53)

Authors/ country	Quality rating	Sample description	Measure of stress	Measure of factors associated with stress	Factors associated with stress
Melbo (1981)[96] USA	12	Students enrolled in the College of Veterinary Medicine at the University of Minnesota during Spring 1980.	Multi-item symptoms (no validation reported)	Top 5 stressors (% participants reporting 7-10 for each of stressor)	Making an error in diagnosis/treatment (44.4%)
					Taking several tests in one week (51.4%)
			List of 25 potential stressors that may or may not cause stress or anxiety among students (identified from interviews with staff and students and literature review)		Tests and evaluations (53.1%)
					No time to learn material (47.9%)
					Having more work than can handle (48.3%)
				Bottom 5 stressors (participants reporting 7-10 for each stressor)	Performing techniques on animals (6.2%)
					Establishing good working relationships with faculty (7.2%)
					Talking to clients about their pets/animals (4.1%)
					Making friends with other vet students (5.1%)
			11 point scale (0-10) from 'causes no stress' to 'causes extreme stress' or 'not applicable'		Talking to my advisor (4.8%)
				Mean scores to each of 4 stress factors	Academic/evaluation stress (5.6)
					Technical skills stress (3.15)
					Lack of time stress (5.1)
					Interpersonal relationships (2.4)
				Gender	Females had higher stress score (4.64) than males (4.16; p=0.003), higher academic/evaluation stress scores (5.89 v 5.37, p=0.011), and higher technical skills related stress (3.54 v 2.85, p=0.006)
				Emotional support	Those who had low perceived emotional support had high stress scores
				Test anxiety and stress	Those with higher test anxiety (TAS; Sarason, 1958) had higher overall stress scores
				Locus of control and stress	Those with an internal locus of control scored lower on stress score than those with external
				Test anxiety, academic performance and locus of control and stress	7 variables were entered into regression analysis of stress. Test anxiety was best predictor and accounted for 24.87% of variance, cumulative Grade Point Average provided additional 2.88%, followed by emotional support with additional 1.36%

Authors/ country	Quality rating	Sample description	Measure of stress	Measure of factors associated with stress	Factors associated with stress
Kent-Acre (1992)[109] USA	11	Students at the College of Veterinary Medicine at the University of Illinois.	Multi-item symptoms (validated) Veterinary Medical Stressor Inventory (VMSI) Self-developed survey tool to measure stressors for veterinary students and their impact on students 55 items with 3 subscales (Academic, Clinical-graduation, Negative Evaluation) Pilot tested on 36 students and only changes made afterward were to the instructions about how to complete the inventory.	Number of respondents reporting low and high stress	Academic (Low=48, High=67)
					Clinical-Graduation (Low=60, High=57)
					Negative evaluation (Low=62, High=65)
				Ten most stressful items experienced during the past academic year	1.Tests, testing system etc
					2. Inability to absorb all information
					3. Final exams
					4. Lack of time incl for social recreation etc
					5. Number of hours studying
					6. Grades and grading system
					7. Pace of the curriculum
					8. Getting bad grades
					9. How I feel this year at campus
					10. Financial problems concerning school
				Results compared to similar studies of veterinary students[145, 146] and were 'somewhat consistent' in terms of the top 3 ranked stressors	
				Year group and stressful events	Differences between classes in their ratings of stressful events e.g. final exams was most stressful for 1st years and progressively less so for subsequent years
				Year group and level of stress	Total level of stress: 3rd year students experienced more stress than 1st and 2nd years,
					Academic stress: 3rd years experienced more than 1st, 2nd and 4th years
					Clinical-graduation stress: 4th years experienced more than 1st, 2nd and 3rd years
				Demographics and stress	No significant differences
				Personality and stress Personality and type of stress	Low stress students scored higher on time competence, self-acceptance and nature of man than high stress students Those who scored low on the academic subscale scored higher on time competence, lower on acceptance of aggression, and higher on nature of man. Those who scored low on clinical-graduation scale scored higher on self-acceptance. Those who scored low on negative evaluation scored higher on nature of man

Authors/ country	Quality rating	Sample description	Measure of stress	Measure of factors associated with stress	Factors associated with stress
Strand et al (2005)[118] USA	11	Students in all 4 years of veterinary school at the University of Tennessee	Multi-item symptoms (validated) Derogatis Stress Profile[139] 77 items 5 point likert scale from 'not at all true of me' to 'extremely true of me' Total Stress Score (TSS) aggregates 3 domains and is transformed to a 't' score	Year group and subjective stress	The 1st year perceived significantly more stress than the 3rd and 4th year classes (F(3,149)=5.16, p<0.002)
				Gender and subjective stress	Females experienced significantly more perceived stress than males (F(1,150)=16, p<0.001). Females SSS=57.01, Males SSS=48.83
				Gender and overall stress	Females scored significantly higher than males (F(1,153)=8.92, p=0.003). Females TSS=48.94, Males TSS=43.0
Trehearne-Riel (1996)[115] USA	11	First and second year students at Colorado State University College of Veterinary Medicine	Multi-item symptoms (validated) Spielberger's State-Trait Anxiety Inventory (STAI[107])	State anxiety and gender	Significant relationship (F(3,118)=2.46, p=0.0495)
				Exams and state anxiety in semester 1	Mean STAI-A score after exams=42.2
					Mean STAI-A score during final exam week=44.7
					Mean STAI-A score significantly greater during final exam week (t(1,125)=-2.18, p=0.031)
				Exams and state anxiety in semester 2	Mean STAI-A score after exams=40.2
					Mean STAI-A score during final exam week=45.4
					Mean STAI-A score significantly greater during final exam week (t(1,83)=-4.44, p=0.000)
				Ethnicity and state anxiety	Significant relationship with state anxiety (F(3,118)=4.73, p=0.0038)
				Trait anxiety and state anxiety	Significant relationship with trait anxiety (F(3,118)=12.2204, p=0.000)
Kelman (1978)[110] USA	9	Questionnaire sample were veterinary students at Colorado State University. Interviews were conducted with students and staff at the	Multi-item (no validation reported) A list of 11 environmental stressors was identified through exploratory interviews with 24 students. Semantic differential scales[149] were attached to each stressor (polar adjectives	Stressors ranked by frequency of occurance (mean score)	1. 'tests and testing' (4.172)
					2. 'lack of time for family, friends and social and recreational activities due to pressures of work and study' (4.153)
					3. 'lack of facilities for studying between classes and in evenings in College' and 'rules for dress and appearance of students' (3.937)

Authors/ country	Quality rating	Sample description	Measure of stress	Measure of factors associated with stress	Factors associated with stress
		veterinary school.	pairs to describe mood and physiological states associated with strain). Scale from 1-7 with 7 being the most negative		All other stressors received positive ratings: interpersonal relations with administrators, grades and the grading system, how I feel at campus, interpersonal relations with professors, attitudes to women in Veterinary Science, how I feel at home, interpersonal relationships with students
				Year group and intensity of stressors	1st and final year students rated 'grades and grading system' more positively than 2nd and 3rd year
					1st and final year students rated 'tests and testing system' more positively than 2nd and 3rd year
					1st year students rated 'facilities for study between classes and in evenings in college' to be very positive and 2nd year very negative
					'lack of time for family, friends and social and recreational activities due to pressures of work and study' reported most by 3rd years and least by 4th years
					3rd year reported more strain from 'interpersonal relationships with students' than other years
				Demographics, personality and stress (Stepwise regression to distinguish high strain (>4.5) and low strain (<3.5) students.	Significant predictors low strain were high need for affiliation, low need for freedom, 1st or 4th year student, to study less, have more time for social/recreational activities, to be aiming for small or large animal veterinary practice. High strain group membership was generally opposite, although less predictable.
				Demographics, personality and stress (as defined by respondents) Cluster analysis was performed to identify the types of students most at risk of high strain. These were type 9 and type 11 and together accounted for about 10% of sample	Type 9: admitted with low grades and remained at bottom of class. They showed high academic and general strain and state anxiety. High need for achievement and devoted a lot of time to study. Type 11: high strain on most stressor scales and trait anxiety. Preparatory education had been academically competitive. Less sociable than others.

Authors/ country	Quality rating	Sample description	Measure of stress	Measure of factors associated with stress	Factors associated with stress
				Year group and level of stress	First year students reported least strain (94.4% of class in low-moderate category). Junior class reported most strain (31.9% scored above 4).
Nelsen (2007)[116] USA	9	Veterinary students from veterinary training courses in the USA	Multi-item symptoms (validated) Perceived Stress Scale 10 (PSS10[147]) 10 items on 5 point likert scale Respondents also asked to rank various sources of stress.	Main sources of stress	1. grades and personal performance
					2. time constrains
					3. relationships with significant others
					4. finances
				Self-esteem	Negative correlation with stress ($p<0.001$)
				Academic satisfaction	Negative correlation with stress($p<0.001$)
				Life satisfaction	Negative correlation with stress ($p<0.001$)
				Relationship satisfaction	Negative correlation with stress ($p<0.001$)
				Gender	Males scored significantly lower (26.34) than females (29.83) on PSS10 ($t=4.053$, $p<0.001$)
				Age and stress	No significant differences
				Regression model of stress for females (ABCX[148])	Best model suggests stress reduces life satisfaction directly, but also via the pathways of relationship satisfaction, academic satisfaction and self-esteem. Interactive effects between life satisfaction and martial and academic satisfaction.
				Regression model of stress for males (ABCX[148])	Stress directly affects self-esteem, academic satisfaction and life satisfaction but not relationship satisfaction. This is only directly affected by life satisfaction.

Authors/ country	Quality rating	Sample description	Measure of stress	Measure of factors associated with stress	Factors associated with stress
Williams et al (2005)[111] Australia	9	Students in their 4th or 5th (final) year in Department of Veterinary Clinical Sciences at Murdoch University in Western Australia.	Multi-item symptoms (no validation reported) 81 items (researcher-developed) Stressors: 28 items covering 6 subscales (interpersonal, intrapersonal, academic, environmental, work-related, and professional) 5 point likert scale from rarely to always	Most frequent stressor	Academic stressors were significantly more frequent than other forms of stressor ($F(5,334)=21.794$, $p<0.001$)
				Exams and other assessments	90% of students experienced it as a stressor
				Academic and practical workload of the program	85% of students experienced it as a stressor
				Achieving lower grades than desired	50% of students experienced it as a stressor
				Being inexperienced	80% of students experienced it as a stressor
				Diagnosing unfamiliar conditions	58% of students experienced it as a stressor
				Financial difficulties	68% of students experienced it as a stressor
				Balancing study/work/non-work activities	65% of students experienced it as a stressor
				Transition to working life	Just under 66% of respondents
				Overwhelmed trying to balance study, work and non-working life.	40% of respondents
				Panicked by assessments	Just under 66% of respondents
				Worried about financial situation	50% of respondents
				Experienced stress from euthanasia	50% of respondents

Female students had significantly higher overall stress scores than males (p=0.003). Higher stress scores were also significantly associated with low perceived emotional support and an internal locus of control. The best predictor of overall stress levels was anxiety about tests, which accounted for 24.9% of the variance in stress scores.

The three most stressful items on a scale administered to veterinary medicine students at the University of Illinois were 'tests and the testing system', 'inability to absorb information' and 'final exams'[109]. The authors report that these stressors were similar to the stressors reported in other studies of veterinary medicine students. Whilst there was no evidence that stress was related to demographic factors in this student population, students in their final years of study were significantly more stressed than those in their first year. However, contrasting findings were reported in a study of stress in veterinary medicine students at the University of Tennessee, where perceived stress was significantly higher in first year students than third or fourth year classes and higher in females than males.

In a fifth study[115], stress was measured using the state factor of the State and Trait Anxiety Inventory[107] and levels of stress were found to be significantly correlated with gender, ethnicity and trait anxiety. Stress was also significantly greater during exam week than after exams in both first year students and second year students.

Students at Colorado State University Veterinary School ranked the frequency of several environmental stressors[110]. 'Tests and the testing system', 'balancing

studying with family and social life', 'lack of facilities for studying between classes' and 'rules for dress and appearance' were the most commonly reported. High and low levels of stress were associated with several educational and personality factors. In particular, first year students experienced the least amount of stress (94.4% reported low levels of stress).

In a recent survey of the stressors and factors associated with stress in US veterinary medicine students, the most common sources of stress were grades and personal performance, time constraints, relationships with significant others and finances[116]. Following the finding that females reported significantly greater perceived stress than males and that stress was correlated with various other personal and educational variables, the authors developed models to explain the relationships between these variables for males and females separately. For females, there was evidence of a direct relationship between stress and general life satisfaction as well as an indirect effect via relationship satisfaction, academic satisfaction and self-esteem. Males differed in that relationship satisfaction did not mediate the relationship between stress and general life satisfaction.

The final survey of stress was conducted in Australian veterinary medical students[111] and assessed the frequency with which 28 stressors from 6 subscales occurred. Academic stressors occurred significantly more frequently than interpersonal, intrapersonal, environmental, work-related or professional stressors. In terms of particular stressors, 90% of respondents reported exams and assessments as stressors, 85% reported that the academic and practical

workload of the program was a common source of stress and 50% experienced stress from euthanasia.

3.8.3.2 Factors associated with stress and burnout in veterinary surgeons

In a study of stress in UK veterinary surgeons, the relative impact of six areas of stress was studied[98]. The difference between the six stressors was not assessed. However, 'factors intrinsic to the job' and the 'managerial role of being a veterinarian' were particularly salient stressors. Comparisons with the general population revealed that career and achievement was more of a stressor in the general population than the veterinary population as was organizational structure and climate.

In a study of stressors in Belgian veterinary surgeons[112], a validated measure of assessing stress in the veterinary profession and an open-ended question about sources of stress confirmed that client relations and time and work management were significant sources of stress for veterinary surgeons. Significant correlations with gender and the type of work were reported such that stress was higher in males than females and higher in those in mixed practice as opposed to small animal practice. Burnout, as measured by a validated multi-item measure, was also reported to be significantly higher in males than in females.

A correlation between stress and several demographic and occupational factors was also reported in a study of equine veterinarians in the USA, although in this sample burnout levels were higher in female than male veterinarians[56]. Those

with higher scores on the burnout measure were also more likely to use emotional coping strategies rather than rational or detached coping styles.

In a study of female veterinarians in the USA, managing the practice, economic concerns and client relations were the main stressors reported and stress was also related to whether or not the respondent owned the practice they worked in or not[55].

In a thorough investigation of the sources of stress for New Zealand veterinarians the main causes of stress as well as the interactions between various demographic and personal factors in relation to occupational stress were studied[51]. Hours worked, client expectations and unexpected outcomes were the main sources of stress for veterinarians. Living up to one's own expectations was also identified as an important personal stressor. In relation to specific occupational factors that are potentially a source of stress for veterinarians, the effects of delivering bad news were reported in a study of US veterinarians[114]. An analysis of stress by gender revealed that males reported significantly less stress than females from delivering bad news and that this stress lasted longer in females than males.

Another specific occupational factor that was reported to cause stress in a sample of US veterinarians was having to take emergency calls outside office hours[117]. This was the most significant stressor for both male and female veterinarians in the sample studied, whilst the smallest stressor for both genders was reported to be the physical danger of working with animals. Gender differences in this study included the fact that females were more

affected than males by the unwillingness of owners to have the recommended procedures carried out on their animals, the emotional strain of animal euthanasia, and abusive behaviour of owners. Male veterinarians were more stressed than their female counterparts by the responsibility of owning and running a business.

Table 8.3: Survey studies of the factors associated with stress and burnout in veterinary surgeons

Authors/ country	Quality rating	Sample description	Measure of stress/burnout	Measure of factors associated with stress/burnout	Factors associated with stress/burnout
Kahn and Nutter (2005)[98] England	11	Veterinary surgeons in the UK	**Stress** Occupational Stress Inventory (OSI[120]) Higher scores indicate greater stress	Mean (s.d.) scores on 6 subscales for the veterinary population	Factors intrinsic to job 31.8 (7.37)
					Managerial role 35.87 (8.59)
					Relationships with other people 30.46 (8.10)
					Career and achievement 23.11 (7.25)
					Organizational structure and climate 34.86 (9.99)
					Home/work interference 32.94 (11.24)
				Mean (s.d.) scores on 6 subscales for the general population	Factors intrinsic to job 30.22 (6.48)
					Managerial role 35.55 (8.47)
					Relationships with other people 30.31 (7.71)
					Career and achievement 28.40 (8.11)
					Organizational structure and climate 38.99 (9.21)
					Home/work interference 30.00 (10.26)
				T-tests revealed career and achievement was more of a stressor in general population than veterinary population (28.40 vs 23.11, t=4.3, p<0.0005). Organizational structure and climate was more of a stressor in the general population than the veterinary population (38.99 vs 34.86, t=2.44, p<0.01)	
Welsch (1998)[56] USA	11	Members of American Association of Equine Practitioners (AAEP) who were in private practice	**Burnout** Multi-item symptoms (validated) Burnout Measure (BM[140]) 21 'feelings' listed and rated from 1-7 Degree of burnout=((32-score of positive items) + score of negative items)/21	Job stress	Positive correlation with burnout (r=0.54, p<0.0001)
				Age	Negatively correlated with burnout
				Years in profession	Negatively correlated with burnout
				Years in the job	Negatively correlated with burnout
				Income	Negatively correlated with burnout
				Hours worked	Positively correlated with burnout
				Gender	Women (3.47, s.d.=0.8) reported significantly higher levels of burnout than men (3.07, s.d.=0.8).
				Coping style Coping style and gender	Correlated with coping style (positive correlation with emotional coping and negative correlation with rational and detached coping). Coping style did not mediate the effect of stress on burnout for men, but in women, emotional coping strengthened the positive relationship between stress and burnout level.

Authors/ country	Quality rating	Sample description	Measure of stress/burnout	Measure of factors associated with stress/burnout	Factors associated with stress/burnout
			Stress Multi-item symptoms (validated) Health Professions Stress Inventory (HPSI[141])	Level of burnout and stress	Effect of stress on burnout is moderated by emotional coping in men.
Hansez et al (2008)[112] Belgium	10	French-speaking veterinary surgeons	**Stress** Multi-item symptoms (validated) Positive and Negative Occupational Stress Inventory (PNOSI[142]) 19 items to measure job engagement and job strain The Veterinary Stress Inventory (VSI[150]) 45 items used to identify job stress factors	Main sources of stress (from an open ended question)	1. Client relations
					2. Working time management
					3. Occupational risks
				Major sources of stress (from VSI)	1. Emergency time/working management
					2. Client relations
				Gender	Job strain was higher in men (p=0.01)
				Type of work	Small animal vets had lower job strain than mixed practitioners (p=0.04)
			Burnout Multi-item symptoms (validated) Sub-scale of PNOSI: 9 items	Gender	Burnout was higher in men (p=0.05)
				Type of work	No significant differences.
Elkins and Kearney (1992)[55] USA	9	Female veterinarians in USA on American Veterinary Medical Association (AVMA) database	**Burnout** Multi-item symptoms (no validation reported) Burnout self-diagnosis instrument[143] 21 item measure of symptoms with likert scale from 1-7 of how frequently they occur.	Ranking of 6 stressors	1. managing the practice
					2. economic concerns
					3. client relations
					4. lay staff relationships
					5. professional relationships,
					6. personal/family relationships.
				Gender and hours worked, job stress and burnout	Women who worked over 40 hours and found job stressful scored higher on burnout
				Ownership of a practice and burnout	Those who were not involved in the ownership of the practice scored higher on burnout

Authors/ country	Quality rating	Sample description	Measure of stress/burnout	Measure of factors associated with stress/burnout	Factors associated with stress/burnout
Gardner and Hini (2006)[51] New Zealand	9	Veterinarians registered with the Veterinary College of New Zealand (VCNZ) in 1999.	**Stress** Multi-item symptoms (no validation reported) Researcher-developed survey. 3 questions on prevalence of stress: Rating scale from 1 (not at all stressed) to 6 (extremely stressed) A list of 10 work-related factors, 6 skill and expertise related factors, and 11 personal factors were also presented. A likert-type rating scale from 1 (does not contribute to the stress I feel) to 7 (is a major contributor to the stress I feel) was used	Overall major sources of stress	Hours worked, client expectations, and unexpected outcomes.
				Major skills and expertise stressors	Ability to keep up with new knowledge, level of technical skills and ability to keep up with technology
				Major personal factors stressors	Living up to one's own expectations was the greatest source
				Age, gender and stress	Males who were younger experienced more stress in general ($X^2_{25}=49.70$, $p<0.002$), more stress on a typical day ($X^2_{25}=71.87$, $p<0.001$) and more stress from their most stressful situation at work ($X^2_{25}=80.79$, $p<0.001$) than those who were older.
				Type of work and stress	The most stressful situation at work was rated as more stressful for those in small animal practice than other types of work ($X^2_{15}=39.18$, $p<0.001$). Those in larger organisations were more stressed in a typical working day than those in smaller organisations ($X^2_{15}=33.41$, $p<0.001$).
Ptacek et al (2004)[114] USA	9	Practising veterinarians who were either graduates of Bucknell University or living in the Harrisburg, Pennsylvania area	**Stress** Multi-item symptoms (no validation reported) 40-50 minute questionnaire about delivering bad news Frequency and duration of 8 stressors measured on 5 point scale and reported for client stress	Mean score for each of 8 stress outcome variables is given	1. Preparation anxiety = 3
					2. Delivery stress = 2.89
					3. Overall stress = 3.38
					4. Length of stress = 2.32
					5. Perceived client stress = 4.32
					6. Lowered own stress = 3.36
					7. Lowered client stress = 3.38
					8. Perceived client satisfaction = 4.15
				Gender and amount of stress	Males ($M=3.13$, $sd=0.99$) experienced significantly less stress than females ($M=3.65$, $sd=0.97$) ($t_{60}=2.07$, $p=0.043$).
				Gender and length of stress	Women reported that stress lasted longer than men ($t_{60}=-2.31$, $p=0.024$).

Authors/ country	Quality rating	Sample description	Measure of stress/burnout	Measure of factors associated with stress/burnout	Factors associated with stress/burnout
Wimberley (1992)[117] USA	9	Practising veterinarians who graduated from a large US university	**Stress** Multi-item measure (validated) Subscale of Career/Marital Stress of Women Inventory (CSMWI[151]) 15 items that measure effect of work stress on career on 1-4 scale (max score 60) Higher scores indicate greater impact.	Stressor with biggest impact for males (mean, s.d.)	'Other' then 'emergency calls outside office hours': 2.70 (0.972)
				Stressor with biggest impact for females (mean, s.d.)	Other' then 'emergency calls outside office hours': 2.94 (1.008)
				Stressor(s) with smallest impact for males (mean, s.d.)	Physical danger of working with animals: 1.92 (0.856)
					Abuse of animals by owners: 1.92 (0.742)
					Emotional strain caused by euthanasia: 1.92 (0.844)
				Stressor with smallest impact for females (mean, s.d.)	Physical danger of working with animals: 2.06 (0.773)
				Gender and causes of stress	Unwillingness of owners to have recommended procedures carried out: significantly greater cause of stress for females than males
					Emotional strain due to euthanasia of animals: significantly greater cause of stress for females than males
					Abusive behaviour of animals by owners: significantly greater cause of stress for females than males
					Responsibility of owning and managing own business: significantly greater cause of stress for males than females

3.8.4 Coping with stress

Factors related to coping with stress in the veterinary profession were reported in five of the studies reporting high quality research on stress and burnout in the veterinary profession (Table 8.4). Single studies were conducted in the USA, UK, New Zealand and Australia and included validated multi-item measures of coping with stress as well as author-developed questions about common sources of support. Three studies investigated the coping strategies of veterinary medicine students.

A study of veterinary students in the USA[118], found that involvement in non-veterinary activities was a coping strategy used by around 22% of students and that around 26% relieved stress by spending time with friends. When asked about the availability of counselling through their program of study, 45.3% of a US student sample said it was available, 39.6% were not sure, and 15.2% said it was not[116]. Finally, a study of fourth and fifth year veterinary medicine students at Murdoch University, Australia studied the use of adaptive and non-adaptive coping strategies for dealing with stress[111]. Adaptive coping strategies were used more commonly than non-adaptive ones and the most frequent coping strategies were emotionally based. Also, 37% of students reported using food, alcohol or drugs to cope with their stress and 14.0% reported engaging in harmful behaviours such as binge drinking.

A study of veterinary surgeons in the UK[98] did not report the statistical significance of differences in coping strategies but did compare them to those used by members of the general population. Veterinary surgeons were

significantly more likely to use home and work relationships as a coping strategy than members of the general population. A sample of veterinary surgeons in New Zealand[51] also reported using more informal coping strategies, such as spending time with family and friends, rather than approaching health professionals. The females in this sample used more coping strategies than the males.

Summary 3.8: Stress and burnout in the veterinary profession

- 43 studies investigated stress and/or burnout in the veterinary profession, predominantly in the USA
- 16/43 studies were of relatively high quality
- Veterinary medicine students generally experienced moderate levels of stress, although 14-31% were highly stressed and experienced physical symptoms such as weight loss or loss of sleep as a result
- The main cause of student stress was the testing system of veterinary medicine.
- Veterinary medicine students largely used adaptive coping strategies although around 14% engaged in harmful behaviour such as binge drinking
- Rates of stress/burnout were more varied in qualified veterinary surgeons.
- In one study, as many as 67% of respondents showed early signs of burnout syndrome
- The managerial aspect of their work and worries about their career were the main concerns for veterinarians
- Coping strategies used by veterinarians tended to be informal rather than professional

Table 8.4: Survey studies of stress coping mechanisms in the veterinary profession

Authors/ country	Quality rating	Sample description	Measure of stress	Measure of coping with stress	Factors associated with coping with stress
Kahn and Nutter (2005)[98] England	11	Veterinary surgeons in the UK	Coping with stress subscale of Occupational Stress Inventory[120] 28 items Higher scores indicate coping measure is used more.	Mean (s.d.) scores on each subscale for veterinary population	Social support: 15.8 (4.17)
					Task strategies: 25.49 (4.37) Logic: 12.11 (2.59) Home and work relationships: 16.71 (4.01) Time: 14.57 (2.25) Involvement: 22.77 (3.5)
				Veterinary surgeons used home and work relationships as a coping strategy more than members of the general population (15.54 vs 16.71; t=-1.72, p<0.05).	
Strand et al (2005)[118] USA	11	Students in all 4 years of veterinary school at the University of Tennessee	Derogatis Stress Profile[139]	Best method of relieving stress: Mean (s.d.) or (%)	Involvement: 22.77 (3.5) Spending time with friends: 26% Involvement in some form of non-veterinary activity: 22%
Gardner and Hini (2006)[51] New Zealand	9	Veterinarians registered with the Veterinary College of New Zealand (VCNZ) in 1999.		Sources of support	'Informal' supports e.g. family and friends, used more than health professionals etc.
				Mean number of forms of support (range)	3.5 (0-8)
				Forms of support and gender	Female respondents used more forms of support than men.
				Respondents who had a good network of friends and family to talk about stress related issues	83%
Nelsen (2007)[116] USA	9	Veterinary students from veterinary training courses in the USA		"Is Counselling offered through your program?"	45.23% said yes, 39.55% said didn't know, 15.23% said no
				Main reasons for using counselling services	Stress management
					Anxiety
					Depression
					Significant relationship issues

Authors/ country	Quality rating	Sample description	Measure of stress	Measure of coping with stress	Factors associated with coping with stress
Williams (2005)[152] Australia	9	Students in their 4th or 5th (final) year in Department of Veterinary Clinical Sciences at Murdoch University in Western Australia.	26 items on coping strategies covering 6 subscales Rated on a 5-point likert scale from rarely used to always used.	Frequency of adaptive versus non-adaptive coping strategies	Adaptive coping strategies used more frequently than non-adaptive ones.
				Most frequent coping mechanisms	Emotionally based
				Percentage who occasionally or never discussing workload or pressures with supervisors or lecturers	86%
				Percentage using certain physical coping strategies	Maintaining healthy sleeping and eating habits (both 65%). Making time for interests outside of work (51%). Exercise (40%).
				Frequency of cognitive strategies	73% regularly used a systematic approach such as problem solving, 49% regularly expressed feelings, talked to friends and family, 53% often asked for advice/support from others.
				Infrequent coping strategies	Less common strategies included spiritually based ones, professional counselling (87% rarely/never used) and relaxation (81% occasionally/never used).
				Frequent non-adaptive strategies	Using food/alcohol/drugs (37%), procrastination (28%), compulsive use of displacement activities (23%), sleeping (21%). 8/57 (14.0%) reported occasionally engaging in harmful behaviours such as binge-drinking.

3.9 Drug and alcohol abuse in the veterinary profession

Table 9 describes the five survey studies that presented data on the prevalence of drug and alcohol abuse by US veterinary surgeons[119,67], US veterinary students [54] and Australian veterinary practices [91,94]. Whilst four of the studies were of relatively low or moderate quality (score 0-4 or 5-8 on the quality rating scale respectively), one study presented high quality data[94]. In this sample, alcohol use (as defined by the National Health and Medical Research Council of Australia; NHMRC) was low risk for 92% of the sample, risky for 6.5% and high risk for 1.5% of the sample. The prevalence of prescribed anti-depressant use was around 7% in the sample. When asked about their use of non-prescription drugs, 20% of the respondents did not answer. Of those who did, 8% used tranquilisers or sleeping tablets, 6% used marijuana, 4% used ecstasy and 3% used amphetamines. Non-prescribed anti-depressants, cocaine, heroine and ketamine were each used by 1% of respondents.

Table 9: Survey studies of drug and alcohol use in the veterinary profession

Authors/ country	Quality rating	Research method	Sample description	N (Response Rate)	Measure of drug abuse	Prevalence measure	Prevalence data
Fairnie (2005c)[94] Australia	10	Questionnaire (postal)	Veterinarians on the VSB register in Western Australia (21% were not working as veterinarians at the time of the survey (4% retired, 4% home duties, 6% working overseas or foreign vets working in Australia, 3 had not worked in past 5 years due to ill health)	419 (43%)	Alcohol use as categorised by NHMRC guidelines for risky alcohol use (low risk, risky, high risk)	Low risk alcohol use	370/402 (92%)
						Risky alcohol use	26/402 (6.5%)
						High risk alcohol use	6/402 (1.5%)
						Respondents who used prescribed anti-depressants (%)	7%
						Respondents who did not answer question about use of non-prescription drugs	20%
						Respondents who used analgesics	16%
						Respondents who used tranquilisers/sleeping tablets	8%
						Respondents who used Marijuana	6%
						Respondents who used ecstacy	4%
						Respondents who used amphetamines	3%
						Respondents who used steroids	1%
						Respondents who used hallucinogens	1%
						Respondents who used non-prescribed anti-depressants	1%
						Respondents who used cocaine	1%
						Respondents who used heroine	1%
						Respondents who used ketamine	1%
Crowther et al (1977)[67] USA	6	Interview (structured)	Medical professionals in the Illinois area	54 physicians, 52 dentists and 48 veterinarians	Questions about personal drug use and general attitude towards drugs	Veterinarians who used amphetamines to stay awake (%)	23%
						Dentists who used amphetamines to stay awake (%)	40%
						Physicians who used amphetamines to stay awake (%)	25%
						Vets and dentists significantly more likely than physicians to use drugs to relieve stress	

Authors/ country	Quality rating	Research method	Sample description	N (Response Rate)	Measure of drug abuse	Prevalence measure	Prevalence data
Kogan (2005)[54] USA	6	Questionnaire (internet link)	Veterinary students at a US veterinary school.	233 (43.5%)	Multi-item symptoms (no validation reported) Questions about the use of various drugs and alcohol in past 30 days	Marijuana (used it in the past 30 days)%	6%
						Cocaine (have never used it)%	95%
						Amphetamines (have never used them)%	90%
						Ecstasy (have never used it)%	92%
						Alcohol (drank alcohol 3-5 days a week)%	25%
						Alcohol (regretted doing something after drinking)%	20%
						Alcohol (forgot what they did after drinking)%	10%
						Alcohol (physically injured themselves after drinking)%	6%
						Alcohol (had unprotected sex after drinking)%	7%
Jeyaretnam (2000)[91] Australia	4	Questionnaire (completed per practice)	Veterinary personnel at practices in Western Australia	129 (81%)	Self-reported cases of drug abuse	Total number of incidences of drug abuse	10
						Number of practices reporting 1 incident	4
						Number of practices reporting 2 incidents	3
						Number of incidences involving methadone	2
						Number of incidences involving pethidine abuse	2 (1 addiction followed by death)
						Number of cases of physical abuse	1 (drug addict threatened staff with knife)
Roesner (2007)[119] USA (Source: www.vetmedteam.com)	3	Questionnaire	Not stated	Not stated	Multi-item symptoms (no validation reported) 5 questions about personal experiences with drug or alcohol abuse Fixed-choice responses.	Worked with a staff member who abused drugs/alcohol)%	60%
						Worked with a veterinarian who abused drugs/alcohol)%	17%
						Personal drug or alcohol abuse	Yes (4%), No (89%), prefer not to answer (7%)
						Practice had been investigated by the DEA	Yes (2%), No (89%), Don't know (25%)
						Outside party had stolen controlled substances from the practice	18% said yes

3.10 Occupational issues associated with wellbeing

3.10.1 Description of studies of occupational issues associated with wellbeing

Ten occupational issues identified in the literature as being potential stressors for veterinary surgeons were incorporated into the survey studies data extraction sheet: 1. Working hours, 2. Workload, 3. Financial issues, 4. Client demands/expectations, 5. Work-life balance, 6. Area of work, 7. Euthanasia, 8. Professional support, 9. Job satisfaction, 10. Career change.

In total, 38 studies presented data on at least one of these issues (Table 10.0). The quality of these studies varied greatly from 3 to 11 (on the 12-point quality rating scale). Eleven studies were conducted in the UK, ten in Australia, ten in the USA, two in France and one in each of Belgium, Finland, Germany, Ireland and New Zealand. Questionnaires were the predominant research method used to investigate these issues (N=34) although three studies were interview based and one study combined questionnaires and an interview. Of the questionnaire studies, the number of respondents included in the analysis ranged from 108 to 9671 and response rates from 8% to 98.5%. The number of respondents in the interview studies ranged from 12 to 154 and the response rates from 31.2% to 100%. Whilst 36 studies surveyed qualified veterinary surgeons,two investigated occupational issues relevant to veterinary medicine students: euthanasia and financial issues. The most commonly investigated occupational issue was job satisfaction (N=19). Working hours were the second most common occupational issue to be investigated although only 6/11 studies related data to wellbeing. Less commonly investigated issues were work-life balance (N=7),

Table 10.0: Survey studies of the prevalence of occupational issues associated with wellbeing in the veterinary profession

Occupational issue	No. surveys	Quality rating (range)	Geographic location	Research method	Veterinarians or students	Questionnaires		Interviews	
						N (range)	Response rate (range)	N (range)	Response rate (range)
Job satisfaction	19	3-11	UK (6), USA (5), Australia (4), Belgium (1), France (1), Ireland (1), New Zealand (1)	Questionnaire	Veterinarians	35-419	10.4-93.1%		
Working hours	11*	3-10	UK (4), Australia (3), Belgium (1), Finland (1), Germany (1), USA (1)	Questionnaire	Veterinarians (10) Students (1)	216-9671	9-88%		
Work-life balance	7	4-10	Australia (6), Belgium (1)	Questionnaire	Veterinarians	134-709	9-98.5%		
Career change	7	4-6	Australia (3), USA (3) UK (1)	Questionnaire (6) Interview (1)	Veterinarians	76-2482	8-98.5%	12	44.40%
Financial issues	5**	4-6	Australia (4) USA (1)	Questionnaire	Veterinarians (4) Students (1)	134-709	43.5-98.5%		
Euthanasia	3	6-9	Australia (1) UK (1) USA (1)	Questionnaire (2) Interview (1)	Veterinarians (2) Students (1)	167-231	20-56%	24	100%
Workload	1	9	Australia	Questionnaire	Veterinarians	231	20%		
Client demands and expectations	1	6	Australia	Questionnaire	Veterinarians	709	87%		
Level of professional support	4	4-7	Australia (2), UK (2)	Questionnaire	Veterinarians	108-240	27-96%		
All studies of occupational issues	38	3-11	UK (11), Australia (10), USA (10), France (2), Belgium (1), Finland (1), Germany (1), Ireland (1), New Zealand (1)	Questionnaire (34) Interview (3) Both (1)	Veterinarians (36) Students (2)	108-9671	8-98.5%	12-154	31.2-100%

* only 6 studies related this to wellbeing, ** only 3 studies related this to wellbeing

career change (N=7), financial issues (N=5), euthanasia (N=3), workload (N=1), client demands/expectations (N=1), and professional support (N=4). None of the surveys presented data on the association between the type of veterinary work and wellbeing.

3.10.2 High quality studies of occupational issues

Of the 38 studies that present data on the influence of occupational issues on veterinary wellbeing, six are of high quality as defined by a score of 9-12 on the quality rating scale. The data presented in these studies are reported for each occupational issue in the tables 10.1-10.5.

Two studies reported data on working hours in Australian veterinary surgeons[94,57] and one on Belgian veterinarians[112] (see Table 10.1). The study samples worked around 50 hours per week. However, standard deviations suggested the number of hours varied greatly between respondents and the response rates of the surveys were relatively low (9-43%). In one study[94], factors associated with working hours included gender (males worked more hours than females) and the type of veterinary work (those in mixed practice worked the longest hours). The same study found that being on call was associated with sleep difficulties, low energy levels and difficulties with family life. The statistical significance of the factors associated with wellbeing in the study were not reported. In a study of small animal veterinary surgeons in Australia[57], the number of hours worked was found to be significantly positively associated with self-reported levels of job stress.

The above study also reported the effect of workload on the wellbeing of small animal veterinary surgeons in Australia (see Table 10.2). The veterinarians in the sample had around 13 consultations per day, did an average of three surgeries per day, and spent around three hours per day in surgery. Each of these factors was significantly associated with self-reported stress.

Table 10.1: Survey studies of working hours in the veterinary profession and their associations with wellbeing

Authors/ country	Quality rating	Sample description	Number of respondents (Response rate)	Mean number of hours worked per week (standard deviation)	Factors associated with working hours
Fairnie (2005c)[94] Australia	10	Veterinarians on the VSB register in Western Australia	419 (43%)	44	Gender: males worked more hours (49) than females (39)
					Type of work: those in mixed animal practice worked longer hours (53) than those in small animal practice (38) and large animal practice (45)
					Sleep and being on call: being on call after hours had a major effect on sleep for 22%, moderate effect for 43% and no effect for 36%
					Energy levels and being on call: being on call after hours had an effect on energy levels for 24% of respondents
					Family life and being on call: being on call had a major effect on family life for 40% and no effect for 14%
Hansez et al (2008)[112] Belgium	10	French-speaking veterinary surgeons	216 (9%)	54.27 (18.75)	Not reported
Meehan and Bradley (2007)[57] Australia	9	Members of the Australian Small Animal Veterinary Association (ASAVA)	231 (20%)	45.03 (14.51)	Job stress: work hours were significantly positively correlated with job stress ($p<0.001$)

Table 10.2: Survey studies of workload in the veterinary profession and its associations with wellbeing

Authors/ country	Quality rating	Sample description	Number of respondents (Response rate)	Measure of workload	Workload	Factors associated with workload
Meehan and Bradley (2007)[57] Australia	9	Members of the Australian Small Animal Veterinary Association (ASAVA)	231 (20%)	Mean number of consultations per day	13.94 (range 0-40)	Stress: number of consultations per day significantly assciated with stress ($p<0.001$)
				Mean number of surgeries per day	3.21	Stress: number of surgeries per day significantly associated with stress ($p<0.001$)
				Mean number of hours in surgery per day	3	Stress: number of hours in surgery significantly associated with stress ($p<0.001$)

Job satisfaction was reported by five studies that received a score of 9-12 on the quality rating scale[98,56,94,117,57] (see Table 10.3). Two of these studies were conducted in the USA, two in Australia and one in the UK. The UK study found that veterinary surgeons in the sample had significantly greater job satisfaction than members of the general population[98]. Two other studies did not report data on job satisfaction, and a further two reported mean job satisfaction scores but did not translate these into meaningful behavioural correlates or compare them to other samples.

Four studies assessed the factors associated with high and low levels of job satisfaction and found that various occupational and demographic factors were associated with job satisfaction. These factors included age, gender, the number of years the respondents have been in their profession and job, their income, the number of hours they worked, how they got on with their colleagues, issues of responsibility and promotion as well as the conditions of working life. Two of the studies reported a significant negative correlation between job satisfaction and self-reported job stress[56,57].

Two studies reported data on the work-life balance of veterinary surgeons in Belgium[112] and Australia[57] (see Table 10.4). Stress most frequently involved a negative impact of work on home life. The authors compared the findings from the veterinary sample to 'other working populations' in Belgium and the Netherlands and found that veterinary surgeons experienced a negative effect of work on home life significantly more frequently than either of the other national samples.

Table 10.3: Survey studies of job satisfaction in the veterinary profession and its associations with wellbeing

Authors/ country	Quality rating	Sample description	No. respondents (Response rate)	Job satisfaction measure	Job satisfaction	Factors associated with job satisfaction
Kahn and Nutter (2005)[98] England	11	Veterinary surgeons in the UK	35 (70%)	Subscale of the Occupational Stress Indicator[120] 22 questions (Higher scores indicate more job satisfaction)	Mean (s.d.) score: 90.80 (14.35) Mean score (s.d.) in general population: 82.08 (16.60) T tests reveal significant difference between veterinary surgeons and the general population (t=-3.58, p<0.0005)	
Welsch (1998)[56] USA	11	Members of American Association of Equine Practitioners (AAEP) who were currently practising and in private practice.	457 (51%)	SAT[153] 5 items rated from 1 (strongly disagree) to 5 (strongly disagree)	Mean (s.d.) score: 3.7 (1.0)	Job stress: Moderate negative correlation (r=-0.39, p<0.0001) Gender: males reported significantly higher job satisfaction (x=3.73, s.d.=1.0) than females (x=3.68, s.d.=1.0) Age: significant positive correlation Years in profession: significant positive correlation Years in job: significant positive correlation Income: significant positive correlation Life stress: significant negative correlation
Fairnie (2005c)[94] Australia	10	Veterinarians on the VSB register in Western Australia	419 (43%)	Questions taken from standard job satisfaction scale[154] about 11 areas of work.	Not reported	Stress: authors link job satisfaction but do not report data Promotional opportunities/pay rise: greatest cause of dissatisfaction Pay rate: 2nd greatest cause of job dissatisfaction Working hours: 3rd greatest cause of job dissatisfaction Fellow workers: Least cause of dissatisfaction Responsibility: greatest cause of satisfaction Freedom at work: 2nd greatest cause of satisfaction Physical conditions: 3rd greatest source of satisfaction

Authors/ country	Quality rating	Sample description	No. respondents (Response rate)	Job satisfaction measure	Job satisfaction	Factors associated with job satisfaction
Wimberley (1992)[117] USA	9	Practising veterinarians who graduated from a large US university (Only married participants included in analysis (258/321)	242 (40.1%)	Single item: "All things considered, how satisfied or dissatisfied are you with your current job?" (rated 1-5) Index of Organizational Reactions (IOR[155]) related to 6 aspects of work (higher scores represents greater satisfaction)	Not reported	Gender: Males reported greater job satisfaction (x=3.43, s.d.=1.07) than females (x=3.56, s.d.=0.96) Type of work: source of high satisfaction Co-workers: source of high satisfaction Work conditions: source of high satisfaction Career future: source of high satisfaction Income: source of low satisfaction Amount of work: source of low satisfaction
Meehan and Bradley (2007)[57] Australia	9	Members of the Australian Small Animal Veterinary Association (ASAVA)	231 (20%)	Max=20	Mean score on job satisfaction scale: 15.57	Job stress: significant negative correlation with job stress ($p<0.001$)

The study also found the interaction between work and home life to be associated with the type of work veterinary surgeons were doing. Bovine and mixed practice veterinarians were more affected by the negative impact of work on home life than small animal veterinarians. Negative effects of work on home life were also more frequently experienced by males than females and the positive effect of work on home life was more frequently experienced by females than males. Both studies associated work-life balance with stress or burnout.

Another study reported data on the prevalence of performing euthanasia in small animal veterinarians in Australia[57] (see Table 10.5). Veterinarians varied greatly in the number of animals they euthanized per week (0-30) although the mean number of animal euthanasias performed per day was just less than 5. The number of animals a veterinary surgeon euthanized per day was significantly positively associated with self-reported job stress.

Summary of 3.10: Occupational issues associated with wellbeing

- 38 studies investigated the influence of various occupational factors on wellbeing in the veterinary profession
- The majority of these were of low-moderate quality and were conducted in the USA or the UK
- The most commonly investigated factors were job satisfaction, working hours, work-life balance and career change
- Veterinarians in the samples studied worked around 50 hours per week and long working hours were significantly associated with job stress
- Low job satisfaction was also associated with stress although job satisfaction was relatively high amongst veterinary populations
- Work-life balance was associated with stress, such that difficulties at work impacted negatively on veterinarians' home life
- There were few studies of the impact of animal euthanasia on stress and wellbeing although one study found that the number of euthanasias performed per day was positively associated with job stress

Table 10.4: Survey studies of work-life balance in the veterinary profession and its affect on wellbeing

Authors/ country	Quality rating	Sample description	No. respondents (Response rate)	Work-life balance measure	Prevalence data	Factors associated with work-life balance
Hansez et al (2008)[112] Belgium	10	French-speaking veterinary surgeons	216 (9%)	Survey Work-home Interaction Nijmegen (SWING) 27 items to measure how positive and negative actions at home and work affect each other 1. Negative work-home interaction (NegWHI) 2. Negative Home-work interaction (NegHWI) 3. Positive work home interaction (PosWHI) 4. Positive Home-work interaction (PosHWI) Frequency of each action measured on a scale of 0-3	Mean (s.d.) score Neg WHI: 1.45 (0.55)	Type of work: Bovine and mixed practice vets were significantly more affected by Neg WHI than small animal vets (p<0.001, p=0.001)
					Mean (s.d.) score Neg HWI: 0.45 (0.42)	
					Mean (s.d.) score Pos WHI: 1.17 (1.15)	Gender: Neg WHI was more prominent in males than females, and PosWHI was more common in females than males.
					Mean (s.d.) score Pos HWI: 1.21 (0.72)	
					When compared to other Belgian and Dutch working samples, Belgian vets scored significantly higher in terms of Neg WHI (p<0.001 and p=0.0).	Work-life balance identified as a possible contributor to the burnout rate.
Meehan and Bradley (2007)[57] Australia	9	Members of the Australian Small Animal Veterinary Association (ASAVA)	231 (20%)	10 statements rated on likert scale from 1-5	Not reported	Significantly negative correlation with job stress (p<0.001)

Table 10.5: Survey studies of animal euthanasia in the veterinary profession and its association with wellbeing

Authors/ country	Quality rating	Sample	No. respondents (Response rate)	Euthanasia measure	Euthanasia data	Factors associated with euthanasia
Meehan and Bradley (2007)[57] Australia	9	Members of the Australian Small Animal Veterinary Association (ASAVA)	231 (20%)	Mean number of euthanasias per week (s.d.)	4.84 (4.03)	Significant positive correlation with job stress (p<0.05)
				Range of number of euthanasias per week	0-30	

3.11 Psychological factors associated with wellbeing

3.11.1 Description of survey studies of psychological factors

Nine studies presented data on the personality traits, emotional states and coping styles of veterinary surgeons and students (see Table 11.1). Of these, six studies were of relatively high quality (score 9-12 on the quality rating scale) and five that presented data on the prevalence of personality-related factors. Three of the surveys studied veterinary medicine students in the USA[116,115,106], whilst one was of veterinary surgeons in the UK[98] and another was of veterinary surgeons in Australia[94]. Five studies of relatively high quality (that scored 9-12 on the quality rating scale) presented data on the factors associated with personality traits, emotions and coping styles of veterinary surgeons and students (see Table 11.2).

3.11.2 Data on the prevalence of psychological factors

In a study of broad personality types, the percentage of students at an American veterinary college that were categorised each of four personality types was reported[115]. The most common personality type in the study group was 'sensing/thinking'. However data was not presented on how this factor might have been related to veterinary wellbeing or how it compared to other student or general population samples.

Table 11.1: Survey studies of psychological factors in the veterinary profession

Authors/ country	Quality rating	Research method	Sample description	Number (Response Rate)	Psychological measure	Psychological factors
Kahn and Nutter (2005)[98] England	11	Questionnaire (postal)	Veterinary surgeons in the UK	35 (70%)	**Type A behaviour** OSI subscale[120] 14 items Higher scores indicate more type A behaviour	Mean score for the study population: 51.15 (10.16) Mean score in the general population: 51.16 (7.62) T-tests reveal no significant difference between populations.
					Locus of control OSI subscale[120] 12 items Higher scores indicate external control and lower scores indicate internal control	Mean score for the study population: 40.09 (4.15) Mean score in the general population: 43.05 (5.75) T-tests reveal this difference is significant ($t=4.20$, $p<0.0005$)
Trehearne-Riel (1996)[115] USA	11	Questionnaire (distriubted in class)	First and second year students at Colorado State University College of Veterinary Medicine	216 (81.8%)	**Personality types** Myers-Briggs Type Inventory (MBTI[156])	**Percentage of respondents of each personality type** Sensing/thinking: 41% Sensing/feeling: 20% Intuitive/thinking: 22% Intuitive/feeling: 17%

Authors/ country	Quality rating	Research method	Sample description	Number (Response Rate)	Psychological measure	Psychological factors
Zenner et al (2005)[106] USA	11	Questionnaire	First year veterinary students at Washington State University (WSU)	61 (80%)	**Coping skills** Athletic Coping Skills Inventory-28 (ACSI-28[157]) Scores between 0-84 Negatively coded	**Scores from study population**
						Overall score: 49.19
						Coping with adversity: 6.57
						Peaking under pressure: 5.86
						Goal setting/preparation: 6.72
						Concentration: 7.43
						Freedom from worry: 6.52
						Confidence: 7.88
						Coachability: 8.17
						Score from a sample of high school over achievers
						Overall score: 50.29
						Coping with adversity: 6.8
						Peaking under pressure: 6.7
						Goal setting/preparation: 5.55
						Concentration: 7.64
						Freedom from worry: 5.98
						Confidence: 8.26
						Coachability: 9.4
						Scores from a sample of professional athletes
						Overall score: 58.2
						Coping with adversity: 7.55
						Peaking under pressure: 8.66
						Goal setting/preparation: 6.56
						Concentration: 8.4
						Freedom from worry: 7.24
						Confidence: 9.51
						Coachability: 10.28

Authors/ country	Quality rating	Research method	Sample description	Number (Response Rate)	Psychological measure	Psychological factors
Fairnie (2005c)[94] Australia	10	Questionnaire (postal)	Veterinarians on the Veterinary Registration Board (VSB) register in Western Australia	419 (43%)	**Happiness** Perceived happiness rated on 4-point likert scale ('miserable' to 'very happy')	Respondents who reported being happy: 84% Respondents who reported being unhappy or miserable: 16%
					Anger Frequency participants were angry at work was measured.	Respondents who were angry rarely to once a week: 70% Respondents who were angry once a day: 12% Respondents who were angry several times a day: 5%
Nelsen (2007)[116] USA	9	Questionnaire (email and internet link)	Veterinary students in the USA	466 (25.5%)	**Self-esteem** Rosenberg Self-Esteem Survey (RSE[160])	Mean score (s.d.): 30.66 (5.93) Range of scores: 10-40
Tinga (2001)[158] Canada	8	Questionnaire (postal)	Students and graduates of Ontario Veterinary College	423 (70%)	**Discussing emotional issues** Respondents asked how comfortable they felt discussing emotional veterinary issues with instructors 7 point likert scale (strongly disagree to strongly agree)	Respondents who felt comfortable discussing emotional issues: 45% Respondents who felt neutral discussing emotional issues: 17% Respondents who felt uncomfortable discussing emotional issues: 38%
Ilgen (2003)[159] USA	6	Questionnaire (postal)	Students who had applied for veterinary medicine in the USA	2313 (31%)	**Personality traits** 6 items (self-esteem, conscientiousness, openness to experience, agreeableness, extroversion, emotional stability) 5 point likert scale	**Students admitted to the course (mean)** Self-esteem: 4.25 Conscientiousness: 3.97 Openness to experience: 3.67 Agreeableness: 4.16 Extroversion: 3.28 Emotional stability: 3.60 **Applied but not admitted (mean)** Self-esteem: 4.43 Conscientiousness: 4.22 Openness to experience: 3.86 Agreeableness: 4.24 Extroversion: 3.30 Emotional stability: 3.64 Significant differences between the groups for self-esteem, conscientiousness and openness to experience

In another study of students of veterinary medicine, the distribution of scores on a measure of self-esteem was reported[116]. Again, comparisons with other populations were not made, although data on the positive impact of self-esteem on veterinary wellbeing was reported. A third study compared the coping skills of veterinary medicine students with those of high school over-achievers and professional athletes[106]. The study allows anecdotal comparisons to be made between the populations, however statistical comparisons between the groups were not made. Furthermore, the direct effects of coping skills on wellbeing were not reported.

In a study of veterinary surgeons in the UK, the prevalence of type A personalities within the veterinary profession were assessed[98]. Individuals with Type A personalities tended to be highly ambitious, aggressive and competitive and had low self-esteem. Data on the prevalence of type A behaviour was reported in the form of a mean score on a subscale of the Occupational Stress Indicator[120]. The authors found no difference between the prevalence of type A personality in the veterinary population and the general population.

The same study also compared veterinary surgeons with members of the general population on a measure of locus of control. Locus of control describes the attributes that individuals make about success and failure and has been shown to be associated with depression. Those with an internal locus of control attribute success and failure to personal misgivings whereas those with an external locus of control might explain the same successes and failures as being caused by external/environmental factors. A t-test of the difference in mean scores on a measure of locus of control found that veterinary students were

significantly more likely to have an internal locus of control than members of the general population.

Another study of psychological factors of veterinary surgeons assessed the current emotional states of veterinarians in Western Australia[94]. The authors report that 84% of respondents were happy and 16% were described as unhappy or miserable. In terms of anger, the majority of respondents were rarely angry or angry once a week (70%). 12% of respondents were angry on a daily basis and 5% were angry several times a day.

3.11.3 Variables associated with psychological factors

The associations between low self-esteem and wellbeing were measured in a study of veterinary students in the USA[116]. In a model of self-esteem of female veterinary students, the authors reported that lowered self-esteem reduced relationship, academic and life satisfaction in female veterinary students. In another study of the self-confidence of veterinary medicine students, the scores on the Trait Self-Confidence Inventory (TSCI)[121] for male and female students were compared to samples of high school overachievers and professional athletes[106]. The scores of veterinary medicine students were higher than those of high school overachievers but lower than those of professional athletes. No statistical comparisons were reported.

Table 11.2: Survey studies of the factors associated with psychological issues in the veterinary profession

Authors/ country	Quality rating	Research method	Sample	Number (Response Rate)	Type of personality factor	Contributory factors measures	Data on contributory factors
Trehearne-Riel (1996)[115] USA	11	Questionnaire (distributed in class)	First and second year students at Colorado State University College of Veterinary Medicine	216 (81.8%)	**Personality types** Myers-Briggs Type Inventory[156]	Learning style	Personality type was not related to learning style.
Welsch (1998)[56] USA	11	Questionnaire (postal)	Members of American Association of Equine Practitioners (AAEP) who were currently practising and in private practice.	457 (51%)	**Coping styles** Coping Styles Questionnaire (CSQ[161]) 30 items measuring 4 styles: rational (RAT), detached (DET), emotional (EM), avoidance (AV) 4 point rating scale of frequency of item representing their reaction to stress.	Gender and rational coping	Rational coping used more by men (1.86) than women (1.96)
						Gender and emotional coping	Emotional coping used more by women (3.20) than men (3.30)
						Gender and detached coping	Detached coping used more by men (2.42) than women (2.55)
						Stress and coping	Emotional coping style mediated the effect of stress on burnout for men
Zenner et al (2005)[106] USA	11	Questionnaire	First year veterinary students at Washington State University (WSU)	61 (80%)	**Self-confidence** Trait Self-Confidence Inventory (TSCI[121]) 13 items with 9 point likert scale from strongly disagree to strongly agree. 13-117.	Gender	Mean scores: Female vets=87.51, Males vets= 93.67
						Results compared to female and male athletes (95.65 and 102.75 respectively)	
						Results compared to female and male high school students (68.20 and 76.75 respectively)	

Authors/ country	Quality rating	Research method	Sample	Number (Response Rate)	Type of personality factor	Contributory factors measures	Data on contributory factors
					Perfectionism Frost Multidimensional Perfectionism Scale (MPS[162]). 35 items with 6 subscales. 5 point likert scale from strongly disagree to strongly agree. Subscales: concern over mistakes (9-45), personal standards (7-35), parental expectations (5-25), parental criticism (4-20), doubts about actions (4-20).	Gender and aspects of perfectionism	Mean scores for females (N=28): concern over mistakes 21.28, doubts about actions 9.23, parental criticism 7.3, parental expectations 13.23, personal standards 27.20.
							Mean scores for males (N=12): concern over mistakes 20.08, doubts about actions 10.92, parental criticism 7.17, parental expectations 14.08, personal standards 27.33.
						Aspects of perfectionism	Scores on concern over mistakes, doubts about actions and parental criticism moderate to low.
							Parental expectations and personal standards are moderate to moderately high.
							"Net effect of perfectionism is positive i.e. overall performance is enhanced"
Fairnie (2005c)[94] Australia	10	Questionnaire (postal)	Veterinarians on the VSB register in Western Australia	419 (43%)	**Happiness** Perceived happiness rated on 4-point likert scale from 'miserable' to 'very happy'.	Working hours and happiness	Those who were more unhappy also worked more hours.
Nelsen (2007)[116] USA	9	Questionnaire (email and internet link)	Veterinary students from veterinary training courses in the USA	466 (25.5%)	**Self-esteem** Rosenberg Self-Esteem Survey[160]	Satisfaction and self-esteem	Self-esteem was significantly positively correlated with life satisfaction, academic satisfaction and relationship satisfaction.
						Stress and self-esteem	Self-esteem was significantly negatively correlated with perceived stress.
						Interaction of gender, satisfaction and stress	Regression model suggests that for females, lowered self-esteem reduces relationship satisfaction, academic satisfaction and life satisfaction.

The same study also reports data on gender differences in perfectionism. Whilst the mean scores for each aspect of perfectionism were reported for both male and female students, no statistical comparisons were made between the groups. The authors reported that aspects of perfectionism such as parental expectations and personal standards were particularly salient in the veterinary population. In general, the authors reported the effect of perfectionism be positive rather than negative.

Another survey studied the coping styles of qualified veterinary surgeons in the USA[56]. Rational and detached coping was more highly reported in male veterinarians than female veterinarians. Emotional coping was more common in females than in males. For male veterinary surgeons, emotional coping mediated the effect of stress on burnout. A study of veterinary surgeons in Australia[94] found that happiness was negatively correlated with the number of hours that veterinarians worked.

Summary of 3.11: Psychological factors associated with wellbeing in the veterinary profession

- Nine studies investigated various psychological aspects associated with the veterinary profession and six of these were of relatively high quality
- Few comparisons of personality factors were made between those in the veterinary profession and members other occupations, or the general population
- Veterinarians were more likely to attribute failure to personal factors than members of the general population
- Self-esteem and self-confidence were found to be related to satisfaction with various aspects of life for veterinarians
- Male veterinarians were more likely to use detached or rational coping strategies whereas females were more likely to use emotionally-based coping strategies

Chapter 4: Discussion

4.1 Summary of the research findings

The present study is the first systematic review of suicidal behaviour and related issues of mental health and wellbeing in the veterinary profession. The specific aims of the review were as follows:

1. To assimilate and describe the nature of all available population-based prevalence studies of suicide in the veterinary profession.
2. To summarise the prevalence of suicide in the veterinary profession internationally.
3. To summarise the methods of suicide used by the veterinary profession.
4. To assimilate and describe the nature of all other research investigating risk factors associated with suicidal behaviour in the veterinary profession, including that from questionnaire- and interview-based studies, psychological autopsy studies and reviews.
5. To summarise the contributory factors of suicide in the veterinary profession including the prevalence of mental illness and occupational difficulties.
6. To make suggestions about the direction of future research into suicidal behaviour in the veterinary profession.
7. To develop suggestions for suicide prevention strategies in the veterinary profession based on available evidence.

The findings obtained from this review will be summarised as they relate to each of the key aims above.

4.1.1 Observational studies of suicide prevalence

In 1966, the first studies to report the proportion of veterinary surgeons dying from suicide were published [89,45]. The present review identified an additional 17 studies which examined the prevalence of suicide in the veterinary profession until May 2008. These were predominantly conducted in the USA and the UK. Just under half of the studies were of mortality patterns in male veterinarians alone, most probably because the veterinary profession was male-dominated until relatively recently. Verdicts of suicide alone were included in 13 of the studies, whereas six studies also included open verdicts (which were introduced in 1968). The overall quality of studies retrieved in the present review varied greatly from 2/12 to 10/12, as defined by the quality rating scale designed by the present author and colleagues. Risk of bias (a subscale of the quality rating scale) ranged from 0/5 to 5/5.

The percentage of deaths that were due to suicide in the veterinary populations studied ranged from 0% to 42.9%. The absolute rate of suicide (per 100,000 persons) ranged from 41.8 to 52.6. Of the 19 studies, 11 reported the proportional mortality ratio (PMR) for suicide in the veterinary profession. PMR was statistically significant in 7/11 studies and non-significantly elevated in the remaining four studies. Two studies reported the relative risk (RR) of suicide in the veterinary profession[88,87] and both found it to be significantly elevated. An additional two studies reported the standardised mortality ratio (SMR) for suicide[89,49]. Neither found the rate of suicide in the veterinary profession to be significantly different from the rate in the general population.

Four studies were of relatively high quality (score 9/12 to 12/12) and low risk of bias (score 4/5 or 5/5)[87,83,46,79]. The first calculated the RR of suicide compared to natural causes of death for veterinarians in England and Wales between 1990 and 1992. Male and female veterinary surgeons were both significantly more likely to die by suicide than members of the general population. In a study of veterinary suicide in England and Wales between 1979 and 2000, PMRs ranged between 361 and 1240 and were significantly elevated, as indicated by confidence intervals[46]. Furthermore, these PMRs were significantly greater than those for medical practitioners. Calculating the PMR for male suicide in Scotland between 1981-1999, another study found suicide was more prevalent in the veterinary profession than in the general population[83]. However, the confidence intervals associated with the PMR show that the risk was not significantly elevated, probably because there were too few cases of suicide. A case-control analysis of suicide in veterinary surgeons living in Denmark between 1991 and 1997 did not identify any cases of suicide and therefore the authors were unable to calculate the relative risk of suicide[79].

In conclusion, the majority of observational studies of suicide prevalence to date involved calculating the PMR for suicide in veterinary populations in the UK and USA. All but one of these studies reported rates of suicide to be elevated in comparison to the general population, although they are also thwarted by methodological problems such as small populations and limited statistical analyses. However, the results of four relatively high quality studies provided evidence that the risk of suicide in the veterinary profession is indeed significantly greater than that of the general population, at least in the UK, by between 4 and 7 times.

4.1.2 Methods of suicide

Data on the methods of suicide were reported in eight of the observational studies of suicide prevalence described above. Little data is provided on the research methods involved in data collection and analysis and therefore it was not possible to quantify their relative quality.

In general, poisoning and firearms were the most common methods of suicide in veterinary surgeons. Firearms were predominantly used by US veterinarians. Initial comparisons of practising and non-practising veterinarians suggested that poisoning was more common among practising members of the profession[82,48]. However, subsequent analysis of a larger number of veterinary suicides from the same population found little difference between the two types of veterinary surgeon, making conclusions about access to means of suicide as a contributory factor to the elevated rate of suicide in the profession difficult to draw. Whilst some studies suggest that poisoning may also be more common in female rather than male veterinarians[49,18,80], and others suggest that barbiturates may be a particularly common means of self-poisoning[91,82], insufficient data are available to draw firm conclusions.

4.1.3 Survey studies of suicidal behaviour and related issues of wellbeing

In total the search strategy identified 75 survey studies that presented data on suicidal behaviour and related issues of wellbeing in the veterinary profession. A description of the nature of these is reported below, including information on

the relative quality of these studies as assessed by a rating scale developed by the present author and colleagues (Appendix 5).

Suicidal thoughts and behaviour

Six survey studies (four questionnaire-based and two interview-based) presented data on suicidal behaviour in veterinary surgeons. One study presented data on suicidal behaviour in veterinary medicine students. Only two of the seven studies were judged to present relatively high quality research. Both of these also presented data on the demographic and occupational factors associated with suicidal behaviour.

One study of particularly high quality suggested that around 2.4% of veterinary surgeons in New Zealand have attempted to take their life and 16% have seriously thought about taking their life[51]. A study in which the prevalence of self-reported protective factors against suicide is reported suggests that beliefs about survival and coping and responsibilities to family are the main factors that prevent distressed veterinarians from taking their lives[92]. Fears about social disapproval, the process of suicide itself and moral objections are not particularly salient for veterinarians. These survey studies also suggest that gender and marital status may be related to suicidal thoughts and behaviour. Evidence that individuals who report suicidal thoughts and behaviour may also be receiving support in one form or another is encouraging.

Chapter 4: Discussion

General mental health

Nine survey studies presented data on the general mental wellbeing of veterinary surgeons and one on the mental wellbeing of veterinary medicine students. Again, the majority of research consisted of questionnaire-based studies, although one study examined the number of veterinarians in a database of mental health service users in Australia[94] and another examined the insurance claims made by veterinarians who took time off work due to mental health difficulties[95]. Studies varied greatly in quality, as defined by the quality rating scale developed by the present author and colleagues (Appendix 5). Just four studies were of relatively high quality and presented data on the prevalence of issues of wellbeing in veterinary surgeons and students.

Due to the lack of studies investigating the general mental wellbeing of members of the veterinary profession, it is difficult to determine whether veterinarians have poorer mental health than the general population and other occupational groups. Of the three studies with data in the current review, only one provided evidence that mental health is significantly reduced in veterinary surgeons[94]. This study reported that 5% of respondents have levels of psychological distress likely to correlate to severe mental disorder and that psychological distress was significantly greater in the study population than the general population. Despite this, there was little evidence that this had an impact on activities of daily living for this population. Factors likely to be associated with general mental wellbeing include gender (females more frequently report psychological distress[96,94]), age (younger veterinarians more

frequently report psychological distress[94]) and academic year[94]. Psychological distress is likely to be associated with increased levels of stress[57].

Depression

Data from surveys of depression were reported in four studies of veterinary surgeons and four studies of veterinary medicine students. Half of the surveys were conducted in the USA, whilst the other studies were of New Zealand and French veterinary surgeons. The surveys varied greatly in their quality (4/12 to 12/12) and in the measures they used to assess depression. None of the studies used clinical diagnostic measures of depression and the majority used multi-item self-report measures of symptoms. Four of the studies presented relatively high quality research and provided data on both the prevalence of depression in the veterinary profession and the factors associated with it.

One study found that around 30% of students were currently experiencing depression[100], which suggests research in this area is certainly warranted. Two studies of depression in veterinary surgeons reported that 3-4% were currently experiencing depression[92,51]. Again, these figures are not compared to those in the general population or other occupational groups. There is evidence that depression in students might be related to aspects of the veterinary medicine course[52,100] and that depression in veterinary surgeons is related to various demographic factors[51].

Chapter 4: Discussion

Anxiety

Five survey studies present data on anxiety in veterinary medicine students and four present data on anxiety in veterinary surgeons. The majority were conducted in the USA although three were conducted in France or New Zealand. Quality ratings for the studies ranged from 4/12 to 12/12 according to the author-developed scale. Whilst none of the studies assessed anxiety using a clinical diagnostic tool, the majority use validated multi-item measures of self-reported anxiety. Five high quality studies present data on the prevalence of anxiety in the veterinary profession and three of these present data on the factors associated with anxiety in this population.

Two studies suggest that anxiety is in fact lower in veterinary students than general college students[96] and elite athletes respectively[106]. In these samples, anxiety tended to be associated with academic rather than demographic factors. A study of veterinary surgeons indicated that around 14% of respondents were currently experiencing severe anxiety, although these rates were not compared to other populations. There was little evidence that anxiety was related to demographic factors. However, anxiety was reported to be related to levels of depression.

Stress and burnout

Data on stress and burnout in the veterinary profession were presented in 43 survey studies. Around two thirds of studies were of veterinary surgeons whilst the remaining studies investigated stress in veterinary medicine students. The

studies were distributed through western European countries, the USA and Australasia. Quality ratings ranged from 2/12 to 12/12. Thirteen relatively high quality studies provided data on the prevalence of stress and burnout whilst 15 presented data on the factors associated with stress and burnout. Five high quality studies presented data on how veterinary surgeons and students cope with stress and burnout.

Surveys of veterinary students report that the majority experience moderate levels of stress and that high stress is experienced by 14% to 31% of students in the samples studied. No comparisons are made with students of other subjects. Several academic factors are hypothesised to contribute to the stress experienced by veterinary medicine students, although 'tests and the testing system' appear to be particularly salient. Research into the prevalence of stress and burnout in veterinary surgeons suggested that as many as 87% of veterinary surgeons in the USA find their job stressful and 67% demonstrate symptoms of the beginnings of burnout[55]. However, the factors associated with stress and burnout varied greatly between studies and samples, particularly in terms of demographic variables such as age and gender. Studies of the coping strategies used by veterinary students and surgeons suggest that respondents use relatively adaptive strategies for coping, such as spending more time with family and friends. One study compared the coping strategies of those in the veterinary profession with the general population[98]. The authors reported that veterinary surgeons used home and work relationships as a coping strategy more than members of the general population.

Chapter 4: Discussion

Drug and alcohol use

The prevalence of drug and alcohol abuse was reported in five survey studies (one of which was of veterinary medicine students) conducted in the USA and Australia. Only one of these was identified as of high quality as defined by the 12-point quality rating scale. This study provides data on the prevalence of alcohol and drug use in veterinary surgeons but does not identify contributory factors associated with the problem[94].

The only study to present high quality data on drug and alcohol use in the veterinary profession suggested that the vast majority of veterinarians drink sensibly[94]. When asked about their use of various non-prescription drugs, one fifth of the sample did not answer.

Occupational difficulties

The present review identified 38 studies that presented data on occupational issues associated with suicidal behaviour or mental health difficulties in the veterinary profession. These studies were predominantly conducted in the USA, UK and Australia. The most commonly researched occupational issue was job satisfaction, although more than one study investigated working hours, career change, work-life balance and animal euthanasia in the veterinary profession. Quality ratings varied from 3/12 to 11/12. Only six studies were of relatively high quality.

The studies included in the review suggested there is marked variation between veterinarians in the number of hours they work. Furthermore, whilst few studies relate working hours to wellbeing in the veterinary profession, there is preliminary evidence that longer working hours are associated with self-reported job stress[57]. Job satisfaction is likely to be significantly greater than in the general population[98] and to be related to various demographic and occupational factors as well as to stress levels[56,94,117,57]. One study of work-home life balance in the veterinary profession showed that poor work-home life balance was also significantly correlated with increased self-reported stress[57]. Another study found that work had a significantly more negative effect on home life for veterinary surgeons than for members of the general population[112]. A final occupational issue that was investigated by one high quality study is euthanasia[57]. The authors report that the number of animals that veterinary surgeons euthanize per day was positively correlated with job stress.

Psychological factors

Data on psychological factors such as personality traits, emotional states and coping styles were reported in three surveys of veterinary surgeons and six surveys of veterinary medicine students. Six of the nine studies were of relatively high quality and five provided data on the prevalence of psychological variables and five provided data on factors associated with these variables.

Assessing the impact of low self-esteem on the wellbeing of female veterinary students using regression models, one study found that it reduced life-relationship- and academic-satisfaction[116]. Veterinary surgeons were also found

to possess more of an internal locus of control than a sample of members of the general population. Males were more likely to use rational/detached coping styles whereas females were more likely to use emotional coping strategies. Limitations of studies of psychological factors in the veterinary profession include the fact that very few make comparisons with members of the general population or other occupations, making it difficult to draw conclusions about the contributory role that they may play in suicidal behaviour.

4.2 Limitations of the research studies

4.2.1 Observational studies of the prevalence and methods of suicide

Studies of the prevalence of suicide in the veterinary profession vary greatly in several aspects of quality and risk of bias. Overall, only 4/19 studies were of relatively high quality and low risk of bias[79,46,83,87]. The factors associated with risk of bias and general quality are now discussed as they relate to the studies in the present review.

The overall risk of bias of studies included was assessed in relation to five aspects of research design methodology: i) the definition of suicide used to identify cases, the source of ii) numerator and iii) denominator data and the appropriateness of the comparison group in terms of iv) age and v) gender. Earlier observational studies of suicide prevalence tend to define cases as deaths in which the coroner has classified the death as a suicide. In England and Wales, this requires there to be strong evidence that the individual intended to die by suicide. Coroners will tend to ascribe deaths by suicide with an 'open

verdict' when they are there is a lack of clear evidence for suicide intent, for example when a suicide note is not left or the individual did not communicate their intent to somebody else. For this reason, researchers in the field frequently consider including open verdicts when identifying suicide cases[122]. As a result, studies that identify suicide cases using verdicts of suicide alone are likely to under-estimate the prevalence of suicide. In the present study, just 6/19 studies included open verdicts in their definition of suicide. This is important as inconsistencies in the definitions used to identify cases of suicide make it difficult to compare studies of suicide prevalence.

A related factor that influences the risk of bias is the type of database from which veterinary mortality data are identified. In the present review, 11/19 studies used national mortality databases whereas seven used regional ones and one study did not report the database used. National databases allow more reliable generalisation of study findings. In addition, official mortality databases are preferable over unofficial ones such as listings in veterinary journal obituaries and data held by national veterinary organisations because they are likely to be more complete. In the present review, ten studies utilise official databases whereas eight studies use unofficial sources and one does not state the source of numerator data.

The nature of denominator data affects the risk of bias in observational studies of suicide prevalence in two ways. Firstly, denominator data are often not available in studies of occupational suicide. Where this is the case, the number of cases of suicide expected is based on general population rates, a cause of bias described in later discussions of statistical methodology. Secondly, where

denominator data are available, these are likely to be more reliable when the source is a national and official mortality database. In the present review, the nine studies that provided denominator data all used national and official sources.

The appropriateness of the comparison group is another important factor to consider when assessing risk of bias in suicide prevalence studies. Given that suicide is associated with both age[8] and gender[1,2,3,9], the group with which study suicide data are compared should be matched in terms of both of these factors in order to ensure that any differences in the rates of suicide between the populations cannot be explained by demographic differences. In the present study, five studies did not compare veterinary suicide data to a sample matched for gender and eight did not match for age.

Another aspect of study methodology that influences the risk of bias is the size of the population studied. When the risk of suicide is calculated based on a large number of deaths, they are more likely to be reliable than when data on few deaths are available. The total number of veterinary deaths (where reported) in the studies in this review ranged from three[88] to 10125[87]. The number of deaths is partly influenced by the number of years included in the study and the number of deaths per year within the population. There was great variation in these respects in the studies included in the present review. Ideally the total number of deaths would have been included in the risk of bias scale. However, it is difficult to decide what number of deaths would be sufficient to indicate a low risk of bias.

Other limitations of the studies of suicide in the veterinary profession relate to more general issues of quality. For example, reports of the exact time period studied, whether absolute data on the number of suicides and other types of mortality in both the study and comparison population were reported, the number and type of comparisons with other populations that are made and whether or not limitations of the study are reported were all included in the quality rating scale. Of the studies retrieved in the review, the time period studied and the data on absolute mortality in veterinary surgeons were comparatively well reported whereas few studies reported data on the absolute numbers of suicides and other causes of mortality in the comparison population and only two compared the rate of suicide in the study sample to the general population from which they were drawn and another population such as another high risk occupation. Around two thirds of studies reported the statistical significance of comparative statistics and 15/19 identified limitations of the study methodology.

A final limitation of some of the studies of suicide prevalence relates to statistical methodology. As previously discussed in chapter 1, there are various means by which absolute data on the prevalence of suicide in a study population can be compared to other populations in order to assess the relative risk the study population faces. The most reliable and accurate method of performing comparative statistics involves comparing the rate of suicide in the study population (usually per 100,000 members) to the rate in another (Relative Risk; RR). This statistic relies on investigators knowing the size of the two populations. Of the 19 studies reviewed, just two present the relative risk of suicide in the veterinary profession[88,87].

Where population denominator data are unavailable, the proportion of deaths from suicide in the comparison population is applied to the number of deaths in the study population in order to estimate how many suicides are expected in the study population (Proportional Mortality Ratio; PMR). The main limitation of this method is that it assumes the distribution of causes of mortality is the same in the two populations. Therefore an elevated suicide PMR may be due to another cause of death being relatively infrequent in the study population. Conversely, a low PMR may be due to another cause of death being more frequent in the comparison population. In the present review, 11 studies presented PMR for suicide in the veterinary profession.

The specific limitations in relation to the data supplied on methods of suicide by observational studies should also be noted. The number of suicide cases included in the analysis is equally important as it is in prevalence studies. For the studies identified in the present review, the number of suicide cases in the sample ranged from four to 137. However, not all studies provided data on methods for all of the cases of suicide. The percentage of cases of suicide for which the method used was reported ranged from 18.5% to 100%. Another limitation of the studies in the present review is that only two reported details about the nature of self-poisoning, such as the type of drug ingested. In order to assess the impact of access to means on the suicide rate in veterinary surgeons, it would be useful to know whether the drug ingested was one that could be obtained easily in a veterinary environment.

4.2.2 Limitations of survey studies of suicidal behaviour and related issues of wellbeing

One limitation of the survey studies of suicidal behaviour and related issues of wellbeing relates to the topics of veterinary wellbeing that have been studied and the number of studies that have been conducted in each of these areas. In particular, studies of suicidal thoughts and behaviour are relatively uncommon compared to those of other issues of wellbeing. Survey studies of suicidal behaviour have the potential to provide information on the prevalence of suicide attempts, suicidal thoughts and the demographic and academic/occupational factors associated with these. Adopting the tip of the iceberg analogy to understanding suicide [61], this might be important in developing our understanding of the risk factors for suicide in veterinary surgeons and veterinary medicine students. The present review identified only five questionnaire studies of suicidal thoughts and behaviour of veterinary populations and two interview studies. None of these were conducted in the UK. Studies of general mental health, depression and alcohol abuse within veterinary populations were also lacking, and again relatively few studies of these issues have been investigated in samples in the UK. Finally, another topic associated with wellbeing in the veterinary profession that has received relatively little research attention is approaches to and methods of coping. Methods of coping with stress and burnout were described in five studies of varying quality and data on general coping styles and skills were reported in three survey studies. Survey studies of sources of support associated with suicidal behaviour and depression were also reported in a study of veterinary surgeons in New Zealand [51].

Chapter 4: Discussion

The dearth of survey studies of wellbeing in the veterinary profession is one factor that may account for the varying quality of these studies. Of the 75 individual survey studies, quality scores ranged from 2/12 to 12/12 as assessed by the scale developed by the author and colleagues (Appendix 5) and just 21 were rated as relatively high quality reports.

Amongst other factors, the design of survey studies and the measures used to assess wellbeing affect the strength of research in this area. Ideally, studies of mental health difficulties should use clinical diagnostic tools to assess the true prevalence of these issues in the veterinary profession. In the present review, none of the studies identified used clinical diagnostic tools. Measures of wellbeing varied greatly from open-ended interview questions about the occupational causes of stress[124], to multi-item validated measures of anxiety[92] and general mental health[57]. Furthermore, different measures were used to collect data on the same issues of wellbeing. This makes comparisons of the results of different studies problematic.

The vast majority of survey studies of wellbeing in the veterinary profession involved cross-sectional analysis. This study design allows the factors associated with wellbeing to be identified but limits the conclusions about causality that can be drawn. For example, one study found that thoughts of suicide were more common in small animal veterinarians than other types of veterinary work[51]. Whilst these data may help identify small animal veterinarians as a population at risk of suicide, it is not clear whether occupational factors associated with being a small animal veterinarian lead to

thoughts of suicide, whether those more vulnerable to having thoughts of suicide are more attracted to small animal medicine, or whether there is some other factor that can account for the relationship between these two variables.

In contrast, prospective study designs may allow causal factors associated with suicidal behaviour to be identified. An understanding of the causal relationships between variables is particularly important when considering potentially beneficial suicide prevention strategies. A related issue of study design is that very few of the studies in the review directly measured associations between suicidal behaviour and other issues of wellbeing and occupation. Given that suicide in the general population is associated with various mental health difficulties[125], and that mental health is often associated with occupational issues, the indirect conclusion of a relationship between these factors in the veterinary profession might be drawn based on separate studies that find evidence of elevated rates of suicidal behaviour and elevated mental health difficulties. However, firm conclusions about the direct effects of occupational issues and wellbeing on suicidal behaviour in veterinary surgeons are difficult to draw based on the studies presented in the current review.

A final limitation of the design of studies included in the review is that comparative statistics about the wellbeing of veterinary surgeons and students are rarely reported. Only a few studies compared the prevalence of mental health difficulties in the veterinary profession with those reported in general population samples, and even less compared the wellbeing of the veterinary profession with other occupations of interest.

4.3 Limitations of the systematic review methodology

In addition to the limitations of the studies included in the review, it is important to discuss the limitations of the systematic review methodology in relation to validity and reliability, and therefore generalisability. The highly comprehensive search strategy that involved various electronic and non-electronic methods and relatively broad inclusion criteria enhances validity to the extent that the studies retrieved are likely to be a relatively unbiased representation of the research field. However, the fact that the review inclusion criteria were relatively non-specific (due to it being more of an exploratory review) poses potential problems for the inter-reviewer reliability of decisions about the selection of studies for inclusion in the review.

In order to assess inter-reviewer reliability, agreement between the decisions of the reviewers was compared using kappa statistics. Each reference and its abstract was reviewed by reviewer 5 (the author) in addition to one other randomly selected member of the review team in order to deicide whether it should be included in the next stage of the review process. Based on established criteria[78], levels of agreement between reviewer 5 and each of the other four reviewers were moderate at the abstract screening level. There appeared to be no significant differences between reviewers in their agreement with reviewer 5. Given that any disagreements between reviewers were resolved by the decisions of an independent reviewer, good levels of reliability are maintained. At the full-text level, the reliability of decisions between reviewer 5 and each of the three members of the research team was assessed. Kappa statistics were calculated based on whether reviewers identified studies as presenting data or

not (as defined by the inclusion criteria, see appendix 7). Overall agreement between reviewer 5 and the other reviewers was found to be 'substantial' according to established criteria[78]. Furthermore, agreement between reviewer 5 and each of the reviewers individually was also substantial. In conclusion, it is unlikely that biases in the selection of studies included in the review are problematic for the generalisability of the review findings.

Just as it is important that the systematic review process is conducted in a way that minimises threats to reliability and validity, it is key that sources of bias within the studies themselves are avoided. The development and use of a quality rating scale to assess the risk of bias for each of the observational studies of suicide prevalence and for the overall quality of the survey studies enables more valid generalisations of the study's findings to be made. It provides a standardised way of highlighting the relative merits of each study, such that conclusions and therefore generalisations are drawn from those studies where the risk of bias is minimal. For this reason only the findings of suicide prevalence studies of minimum risk of bias were reported and of survey studies of relatively high quality. Unfortunately it was beyond the scope of the present review to test the validity and reliability of this measure. Guidelines on the important methodological features to consider when assessing the validity and reliability of observational studies are widely published and aided the development of the present measure[126,75,73]. Despite this, tests of the inter-reviewer reliability and external validity of the tool would help further development such that it could be used as a reliable means of assessing the quality of other observational studies.

The risk of bias for observational studies of the methods of suicide was not assessed specifically. Prior to commencement of the review, it was unknown how many of the few observational studies would provide data on the methods of suicide. In addition, little information was available in the research literature to inform the author of the methodological aspects that would be particularly important in devises a scale to assess the quality and risk of bias in such studies. As a result, generalisations from the data on the methods of suicide used by veterinary surgeons are not possible, although it is hoped that the collation of these studies will propel future research in this area.

4.4 Suggestions for future research

Based on the findings of the present review, several suggestions can be made about the direction of future research on suicide and issues of wellbeing in the veterinary profession.

4.4.1 Observational studies of suicide prevalence

At the time that the present search strategy was conducted (May 2008) just one observational study of suicide in the veterinary profession had been published that reviewed rates of suicide beyond the year 2000[49]. The authors are aware of another study, published since the review strategy was performed, that has updated data on the prevalence of suicide by occupation in England and Wales to include the years 2001-2005[17] and a further study that reports the prevalence of suicide by occupation in New Zealand between 1973-2004[127]. However, updates of suicide prevalence studies from the USA, Denmark, Norway, Belgium

and Scotland would be welcome given the improved access to mortality databases and recognition that veterinary surgeons are an occupational group at risk of suicide.

The review revealed that the majority of observational studies have been conducted in Western Europe, the USA and Australasia. Whilst three relatively high quality studies suggest that suicide is significantly elevated in veterinarians in the UK[46,87,83], a fourth found no cases of suicide in Danish veterinary surgeons over a seven year period[79]. Given that suicide patterns vary across the world and in different cultures, it would be interesting to see whether veterinary work is associated with increased rates of suicide in other countries and cultures such as Eastern Europe and Asia.

Analysis of the quality of existing observational studies of suicide in the veterinary profession has enabled the author to identify particular methodological aspects of study design that would be important to consider in future studies in the area. Firstly, where mortality data is also available on the methods of suicide this should be extracted and analysed along with data on the prevalence of suicide by occupation. Few studies in the present review provided data on the methods of suicide although there was preliminary evidence to suggest that poisoning, potentially by drugs obtained at work, was a salient method of suicide in this occupational group. Data on the methods of suicide is invaluable for understanding whether availability of method might contribute to risk of suicide in specific occupations, as well as having the potential to influence preventive measures for suicide in the veterinary profession.

Secondly, comparisons not only with the general population but with other occupational groups may also provide information of the extent to which veterinary surgeons in particular are at risk of suicide. For example, if no significant differences were found in the rates of suicide between veterinarians and various other healthcare professions, one might draw the conclusion that there is a more general risk factor common to these groups that influences suicide rates. Conversely, if veterinarians were found to have a rate of suicide significantly greater than other high risk occupations, the conclusion might be reached that there are specific aspects of veterinary medicine that explain the elevated suicide rate. A relatively high quality study of suicide risk of veterinary surgeons in England and Wales found that the proportion of suicide deaths in veterinary surgeons was greater than the proportion in medical practitioners[46]. Other studies, limited by small numbers and other methodological issues of quality have failed to find differences in the suicide rates of veterinary surgeons, dentists and doctors[83,87].

In general, future research on the rates of suicide in the veterinary profession should be of higher quality in order to improve the generalisability of findings. Aspects of quality and risk of bias that were particularly lacking in the present studies reviewed are: consideration of open verdicts in identifying cases of suicide, retrieving suicide data from national mortality databases rather than unofficial or regional sources, matching the comparison group for age and gender, conducting analyses from a sufficiently large population, collecting data that allows more reliable analyses such as RR and SMR, reporting absolute data on mortality in the comparison population and the statistical significance of differences between the study and comparison population, comparing risk of

suicide with other occupational groups and identifying the limitations of the research.

One final aspect that should be considered when conducting observational studies of suicide in the veterinary profession is the assessment of quality and risk of bias. The author presents a measure for assessing the quality of observational studies of occupational suicide that could potentially be developed and validated before being used as a means for authors to establish the relative quality and risk of bias of their own studies. Furthermore, the measure could also be adapted to assess the quality of observational studies of suicide prevalence in other populations. Establishment of a standard tool for assessing quality has the potential to improve the generalisability of findings from observational studies.

4.4.2 Survey studies of suicide and wellbeing

Relatively few survey studies have directly investigated the prevalence of, and factors associated with, suicidal behaviour and depression in the veterinary profession. None of the studies retrieved when the search strategy was performed (May 2008) investigated suicidal behaviour or depression in the UK veterinary profession. However, a questionnaire-based survey of the factors associated with suicidal thoughts and behaviour of UK veterinary surgeons was published recently in several journals[128,129,130,131]. This study reported that 21.3% of respondents had thought about suicide within the past 12 months and that this was significantly associated with anxiety. Depression was also more frequently reported by members of the veterinary profession than the general

population. Replication of this study in international veterinary populations would be valuable.

Other topics of interest that have not currently been widely studied are the general mental health of veterinary surgeons and veterinary medicine students as well as the coping methods and styles used to deal with mental health difficulties that arise. Important contributions to the research literature could also be made by survey studies that study the relationships between various occupational factors, mental health difficulties and suicidal behaviour as this may help identify individuals at particular risk and inform potentially beneficial suicide prevention measures.

As is the case for future observational studies of suicide prevalence, surveys of suicidal behaviour in the veterinary profession would benefit by including a control group such as members of the general population, in addition to members of another occupational group at high risk of suicide in order to determine how specific various risk factors are.

Finally, other important factors that should be considered by researchers investigating the wellbeing of the veterinary profession in the future are the measures used to assess the problem and the outcome variables to assess their impact. Rarely have clinical diagnostic measures been used to assess the prevalence of mental health difficulties in the veterinary profession; more common are multi-item measures of self-reported symptoms. There is also a lack of consistency in the measures and outcome variables reported in this research field and use of more standardised and widely used measures could

improve both the generalisability of findings, as well as the ease with which comparisons between populations are made.

4.4.3 Systematic Reviews

Several reviews of occupational variation in suicide rates have been conducted that contain data on the risk for those in the veterinary profession[12,13,132]. However to date, this is the first systematic review specifically of suicide and related issues of wellbeing in the veterinary profession. Several suggestions for future reviews can be made based on the strengths and limitations of the current review. Firstly, it is important that future reviews adopt a systematic methodology. As previously stated, every measure must be taken in the review process to ensure reliability and validity, so that the findings of the review might be generalised to the population(s) from which they are drawn[126]. This includes searching multiple electronic databases, supplementing these with additional methods to retrieve references that are not held electronically, defining the inclusion criteria and ensuring that at least two independent reviewers are involved in identifying which studies meet these criteria. Despite performing an initial search of the literature before developing the search strategy, the present authors were unsure about the quantity and nature of the studies that would be retrieved. For this reason, the inclusion criteria were relatively minimal so that a summary of all related research literature could be produced.

Future systematic reviews in the area might be more specific about the types of studies, behaviours, and veterinary populations that they review in order to gain a more detailed and specific understanding of these studies. Examples include a

review of suicidal behaviour in students of veterinary medicine, or of the factors associated with occupational stress in veterinary surgeons.

Finally, future reviews of observational studies as well as survey studies should include an assessment of the relative quality of studies retrieved. Where possible, the validity of these scales should be tested and reported.

4.4.4 Alternative research designs

The limitations of the studies included in the present review also identify alternative research methods that might be considered in future investigations of suicide and related issues of wellbeing in the veterinary profession. One major limitation of many of the survey studies is that they are cross-sectional in design and therefore measure behaviour at a single point in time. Whilst significant associations between different variables can help identify the potential risk factors for suicidal behaviour in the population being studied, only longitudinal studies can confirm that they are truly risk factors. Also, cross-sectional studies do not tap into the causal pathways underlying the phenomena. The use of prospective, retrospective and psychological autopsy studies may complement cross-sectional research by uncovering the direction and specific means by which these risk factors influence behaviour.

Prospective study designs involve measuring a variable of interest and then tracking it over time. For example, a prospective study of veterinary student training might involve measuring stress levels upon entry to the course, and then repeating these measures throughout the course up until graduation.

Assuming that other potentially confounding variables such as life events were controlled for, this design could help identify the impact that various stages of veterinary training has on student wellbeing.

Retrospective interview-based studies of veterinarians who have thought about or attempted to take their life may shed more light on the sequence of events that influence suicidal behaviour in this group. For example, the presence or absence of self-harming behaviour prior to veterinary training may have implications for understanding whether factors such as personality may contribute to risk of suicidal behaviour in veterinary surgeons. Whilst retrospective study designs have obvious limitations associated with memory bias, they allow the researcher to understand how previous events may influence current behaviour. In addition, interview studies enable the participant to report their experiences of suicidal behaviour and the factors they associate with it, in their own words.

Psychological autopsy studies are another invaluable method of investigating suicidal behaviour and have been applied to various populations at risk of suicide [23]. In particular, psychological autopsy studies of other occupational groups at risk of suicide have provided useful information on the factors associated with suicide such as the influence of access to means, psychiatric history and occupational difficulties [20,24]. However, this research approach has not yet been adopted to understand the contributory factors to suicide in the veterinary profession. Given that the present review has highlighted the epidemiological evidence for an elevated rate of suicide in the veterinary profession and identified various potentially contributory factors, the

psychological autopsy approach is likely to be a particularly fruitful line of further research.

4.5 Prevention of suicide in the veterinary profession

In addition to furthering theoretical knowledge of occupational suicide, research into the prevalence and contributory factors associated with suicide in the veterinary profession enables potentially beneficial suicide prevention strategies to be developed. As previously described, prevention of suicide in high risk occupational groups is a priority of the UK government[30]. Furthermore, research into the factors associated with suicidal behaviour in other occupational groups has helped develop potentially useful strategies for suicide prevention. A series of research studies investigating factors associated with suicide in the farming community identified strategies to alleviate important risk factors. These include development of specific rural programmes to help farmers lacking social support, improved knowledge of and attitudes to mental health difficulties, and dissemination of advice relevant to a range of stressful situations through both farming magazines and more general media sources. Assimilation alone of research to suggest the rate of suicide is elevated in certain occupational groups, aids prevention so far as it provides an evidence base for the need for preventive measures to be supported and developed.

All but one of the 19 observational studies in the present review found the risk of suicide to be significantly elevated in the veterinary profession, as compared to the general population. Studies of particularly high quality have shown that in the UK, the risk of suicide in the veterinary profession is likely to be at least four

times that of the general population. Furthermore, survey studies of suicidal behaviour confirm that suicidal thoughts and behaviour are prominent in the veterinary profession[51]. Therefore there is urgent need for measures to be taken to address the contributory factors associated with this risk. In the UK at least, there is also means by which the outcomes of research can be directly applied to members of the veterinary profession. The Veterinary Support Working Party group (a collection of members of national veterinary associations who share an interest in developing effective methods of promoting wellbeing within the profession) aims to apply the findings of research to develop effective strategies for preventing suicide in the veterinary profession.

Potentially salient contributory factors to the suicide rate that were identified from the review include mental health difficulties; occupational factors such as access to means of suicide, job satisfaction, working hours, difficulty maintaining work-life balance, euthanasia and personality variables such as self-esteem and locus of control. Given the lack of evidence for a single cause of elevated suicide in the profession, the authors support a holistic approach to the prevention of suicide in the veterinary profession. Suicide prevention strategies developed for high risk groups, particular those in the healthcare professions, may also be useful when considering the possible methods by which suicide in the veterinary profession might be reduced.

One method of preventing suicide that has been used in national suicide prevention strategies is raising awareness of suicidal thoughts and behaviour in a way that reduces the stigma attached to the phenomenon. Particularly in populations where there is a reluctance to seek help for emotional difficulties,

reduced taboo associated with suicidal thoughts increases the chance that individuals at risk approach others for support. The present review found evidence that veterinary surgeons tend to use informal sources of support for emotional difficulties. Increased awareness of suicide may enable colleagues and family members to recognise signs of suicidal ideation and provide this much needed support.

Support helplines such as the Samaritans are invaluable forms of 24-hour confidential support. They provide those who are in crisis to talk to some one anonymously. Similar services exist for the medical profession specifically and the Vet Helpline now provides a confidential listening and advice service for members of the veterinary profession. Formal evaluation, continuous improvement and publication of this service are essential in supporting vulnerable veterinarians.

Evidence from the present review about the methods of suicide used by members of the veterinary profession is limited, although preliminary findings suggest that poisoning is the most common method used, at least in non-US populations. Further research is needed to establish whether this is influenced by occupational access to means of suicide. If suicide is found to be linked to easy access to means of suicide in the veterinary profession, restriction of access to these drugs (particularly in those at risk) may be an effective strategy for suicide prevention.

Surveys of mental health difficulties suggest that veterinary medicine students suffer from both anxiety and depression and that these may be related to academic concerns and the stressfulness of testing system in veterinary

medicine. In order to ensure that students do not suffer in silence, access to and psychological and counselling services should be provided for this vulnerable group. Increased awareness of the relatively high prevalence of mental health difficulties may also encourage those who are suffering to seek help. This may be particularly important in veterinary medicine students given the highly competitive nature of the course.

4.6 Conclusions

Suicide is a leading cause of death internationally. Higher rates are found in certain occupational groups such as the health professions and the farming community. This had lead researchers to investigate whether the rate of suicide may also be elevated in the veterinary profession, given that they share many demographic and occupational characteristics. The present systematic review assimilated and summarised all available research on the prevalence of suicide in the veterinary profession as well as research into the factors associated with suicidal behaviour such as mental illness, occupational difficulties and psychological characteristics.

The primary conclusion of observational studies included in the present review, was that the proportion of deaths from suicide in the veterinary profession is at least four times that of the general population. In the UK, the prevalence of suicide in the veterinary profession may also be higher than other healthcare professionals such as doctors. Several limitations of the lower-quality studies of suicide prevalence have been identified and their implications for future research discussed. In particular, more attention should be paid to the methods

of suicide used by veterinary surgeons so that the extent to which access to means of suicide might contribute to the elevated suicide rate can be established.

Survey studies of suicidal behaviour and associated issues of wellbeing have investigated the prevalence of suicidal ideation, mental illnesses such as anxiety and depression, occupational difficulties and psychological characteristics of veterinary surgeons and students of veterinary medicine. These studies also identify the demographic and occupational factors associated with the phenomena and occasionally, the sources and methods by which members of the veterinary profession cope with them.

Appendix 1: Data extraction form-epidemiological studies

Systematic Review: Suicide and related mental health problems in the veterinary profession

Data Extraction Form: Epidemiological studies of suicide rates

Section	Title	Description	Question numbers	Comments
A	Paper details	Summary of the research report	1-16	
B1	Background	Type of data reported	17-25	
B2	Demographic information	Study inclusion criteria Study sample analysed	26-31 32-37	
B3	Results PMR/SMR reported	Main sample Sub-group analysis	38-47 48-59	
B4	Results Relative Risk reported	Main sample Sub-group analysis	60-66 67-74	
B5	Results Absolute rate reported	Main sample Sub-group analysis	75-80 81-87	
B6	Results Other statistical analysis	Results of statistic tests not described above	88-90	
B7	Methods of Suicide	Main sample Sub-group analysis	91-94 95-100	
B8	Other data	Other data related to suicide rate reported	101-103	
B9	Explanations	Explanations offered for results found	104-106	

Part A: Paper details

1	Reviewer ID	1 (Sue) ☐ 2 (Richard) ☐ 3 (Keith) ☐ 5 (Belinda) ☐
2	Paper ID number	VR
3	1st Author (surname, initials)	
4	Title of paper	
5	Year of publication	
6	Journal	
7	Is the journal peer-reviewed?[1]	Yes ☐ No ☐
8	Country research conducted in	Country: Not stated ☐
9	Language research published in	Language: Not stated ☐
10	Main aims (as reported in paper where given)	
11	Main conclusions (as reported in paper where given)	
12	Funding source of research	Funding: Not stated ☐
13	Type of research reported (see table 1) *Tick all that apply*	Suicide rates ☐ Suicide survey ☐ Other survey e.g. stress ☐ Review ☐ Models/theories ☐ Other (specify) ☐
14	How does the research meet the review's inclusion criteria? *Select one*	Reports primary data ☐ Discusses causes, methods of prevention or models ☐ Both ☐ Neither ☐

15	Which mental health issues does the paper discuss? *Select all that apply*	Suicidal behaviour ☐ Depression ☐ Anxiety ☐ Eating Disorders ☐ Stress ☐ Burnout ☐ Psychological well-being ☐ Other(s) please list: ☐
16	Miscellaneous comments on Part A	

Part B: Papers reporting data on rates of suicide based on mortality databases

B1: Background

17	Type of analysis *Select one*	Causes of mortality in veterinarians ☐ Suicide rates by occupation/education ☐ Suicide rates in veterinarians ☐ Other (specify) ☐
18	Database used to identify cases *Select one*	National ☐ Veterinary Association ☐ Obituary Listings ☐ Other (specify) ☐ Unclear ☐ Not specified ☐
19	Name of database	
20	Index (and version numbers) used to classify suicide	ICD ( ) ☐ DSM ( ) ☐ Other (specify) ☐ Unclear ☐ Not stated ☐
21	Causes of death (and codes) included in classification of suicide	Causes: Codes: Not stated ☐

22	Main analysis (section to complete) *Select all that apply*	PMR (B3) ☐ SMR (B3) ☐ Relative Risk (B4) ☐ Absolute Rate (B5) ☐ Other (B6) Specify: ☐ Unclear ☐ Not stated ☐
23	Does the paper also report data on the methods used?	Yes (complete B7) ☐ No ☐
24	Does the paper report any other relevant data (other than rates and methods)?	Yes (complete B8) ☐ No ☐
25	Which demographic information is described?	Study inclusion criteria (complete B2.1) ☐ Actual sample included in analysis (complete B2.2) ☐ Both (complete B2.1 and B2.2) ☐ Unclear (complete B2.2) ☐ Sample not described ☐

B2: Demographic information

B2.1: Study inclusion criteria

Only complete for the demographics that describe the study's inclusion criteria

26	Gender	Male ☐ Female ☐ Both ☐ Not stated ☐
27	Age range(s)	Not stated ☐
28	Time period(s)	Not stated ☐
29	Veterinarian or student	Qualified veterinarian ☐ Student ☐ Both ☐ Other (specify) ☐ Not stated ☐
30	Is the veterinarian currently practicing?	Yes ☐

		No	☐
		N/A (e.g. student)	☐
		Not stated	☐
31	Field of clinical work	Small animal	☐
		Farm animal	☐
		Equine	☐
		Exotic	☐
		Laboratory animals	☐
		Meat hygiene	☐
		Other (specify)	☐
		Not stated	☐

B2.2: Sample included in analysis

Only complete if demographic information describes the sample included in main analysis

32	Gender	Male	☐
		Female	☐
		Both	☐
		Not stated	☐
33	Age range(s)		
		Not stated	☐
34	Time period(s)		
		Not stated	☐
35	Veterinarian or student	Qualified veterinarian	☐
		Student	☐
		Both	☐
		Other (specify)	☐
		Not stated	☐
36	Are the veterinarians currently practicing?	Yes	☐
		No	☐
		Mixed	☐
		N/A (e.g. student)	☐
		Not stated	☐
37	Field of clinical work	Small animal	☐
		Farm animal	☐
		Equine	☐
		Exotic	☐
		Laboratory animals	☐
		Meat hygiene	☐

		Other (specify) ☐ Not stated ☐

B3: Study results
Please complete B3.1/B4.1/B5.1 to report the results from the main/overall sample analysed (e.g. all veterinarians) and use B3.2/B4.2/B5.2 to report the results of any subgroups analysed (e.g. small animal veterinarians)

B3 – PMR/SMR reported
B4 – Relative Risk reported
B5 – Absolute rate reported
B6 – Other statistical analysis reported

B3.1 PMR/SMR reported: **Main sample**

38	Brief description of sample	
39	Observed deaths from suicide	Not stated ☐
40	Expected deaths from suicide	Not stated ☐
41	Observed deaths from all causes	Not stated ☐
42	PMR/SMR value	Not stated ☐
43	PMR/SMR confidence interval (95%)	Not stated ☐
44	PMR significance level	p < Not stated ☐
45	Chi-Square Value	Not stated ☐
46	Chi-Square significance level	p< Not stated ☐
47	PMR/SMR Sub-group analyses reported? *If yes please complete B3.2*	Yes ☐ No ☐

B3.2 PMR/SMR reported: **Sub-group sample**
Copy and complete for each sub-group analysed

48	Name of subgroup as reported	
49	Description of subgroup	

50	Observed deaths from suicide	Not stated ☐
51	Expected deaths from suicide	Not stated ☐
52	Observed deaths from all causes	Not stated ☐
53	PMR/SMR	Not stated ☐
54	PMR/SMR confidence interval	Not stated ☐
55	PMR/SMR significance level	Not stated ☐
56	Chi-Square Value	Not stated ☐
57	Chi-Square significance level	p< Not stated ☐
58	Other statistical analysis reported?	Yes (complete below) ☐ No ☐
59	Results of other statistical analyses	

B4.1 Relative Risk reported: **Main sample**

60	Brief description of sample	
61	RR for veterinarians	Not stated ☐
62	Confidence interval (95%)	Not stated ☐
63	Significance level	p< Not stated ☐
64	Reference group description	
65	Reference group mean estimate of RR	Not stated ☐
66	Reference group mean confidence interval (95%)	Not stated ☐

B4.2 Relative Risk reported: **sub-group sample**

Copy and complete for each sub-group analysed

67	Name of sub-group as reported	
68	Description of sub-group	
69	RR	Not stated ☐
70	Confidence interval (95%)	Not stated ☐
71	Significance level	Not stated ☐
72	Reference group description	Not stated ☐
73	Reference group mean estimate of RR	Not stated ☐
74	Reference group mean confidence interval (95%)	Not stated ☐

B5.1 Absolute rate reported: **Main sample**

75	Brief description of sample	
76	Rate based on total population of X individuals e.g. 100,000	Not stated ☐
77	Number of suicides by veterinarians	Not stated ☐
78	Suicide rate	Not stated ☐
79	Confidence interval (95%)	Not stated ☐
80	Significance level	Not stated ☐

B5.2 Absolute rate: **Subgroup sample**

Copy and complete for each sub-group analysed

81	Name of sub-group as reported	
82	Description of sub-group	
83	Based on total population of…e.g. 100,000	Not stated ☐
84	Number of suicides by veterinarians	Not stated ☐

85	Suicide rate	Not stated ☐
86	Confidence interval (95%)	Not stated ☐
87	Significance level	Not stated ☐

B6: Other statistical analysis of suicide prevalence

88	Name of statistical test	
89	Description of sample analysed	
90	Results of analysis	

B7: Methods of suicide

B7.1 Main sample analysis (as described in 2.2)
Copy and complete for each method of suicide reported

91	Method	
92	Frequency of use as means of suicide (units)	
93	Other data related to method reported	
94	Comments	

B7.2 Sub-group analysis
Copy and complete for each method in each sub-group

95	Name of sub-group	
96	Description of sub-group	
97	Method	
98	Frequency of use as means of suicide	
99	Other data related to method reported	
100	Comments	

B8: Other data

101	Description of data analysis	

102	Results of data analysis	
103	Comments on data analysis	

B9: Explanations for suicide rates

104	Explanations *Record here any explanations the authors offer for the suicide rate reported*	
105	Other *Record here any other ideas the authors report in relation to the suicide rate reported*	
106	Comments on B9	

Appendix 2: Data extraction form-surveys of mental health problems and suicidal behaviour

Systematic Review: Suicide and related mental health problems in the veterinary profession

Data Extraction Form: Surveys of mental health problems and suicidal behaviour

Section	Title	Description	Question numbers	Comments
A	Paper details	Summary of the research report	1-16	
C1	Study background	Description of the type of survey conducted	108-114	
C2	Recruitment	Recruitment methods for questionnaire and interview studies	115-124	
C3	Sample characteristics *(compulsory)*	Demographic information about the sample included in analysis	125-134	
C4	Data on mental health issues	Results of data collected on mental health issues	135-153	
C5	Data on suicidal behaviour	Results of data collected on suicidal behaviour	154-167	
C6	Other types of data	Results of data collected that do not fit above categories	168-174	
C7	Limitations of research	Description of research limitations and areas for further research	175-181	

Part A: Paper details

1	Reviewer ID	1 (Sue) ☐ 2 (Richard) ☐ 3 (Keith) ☐ 5 (Belinda) ☐
2	Paper ID number	VR
3	1st Author (surname, initials)	
4	Title of paper	
5	Year of publication	
6	Journal	
7	Is the journal peer-reviewed?[1]	Yes ☐ No ☐
8	Country research conducted in	Country: Not stated ☐
9	Language research published in	Language: Not stated ☐
10	Main aims (as reported in paper where given)	
11	Main conclusions (as reported in paper where given)	
12	Funding source of research	Funding: Not stated ☐
13	Type of research reported (see table 1) *Tick all that apply*	Suicide rates ☐ Suicide survey ☐ Other survey e.g. stress ☐ Review ☐ Models/theories ☐ Other (specify) ☐
14	How does the research meet the review's inclusion criteria? *Select one*	Reports primary data ☐ Discusses causes, methods of prevention or models ☐ Both ☐ Neither ☐

15	Which mental health issues does the paper discuss? *Select all that apply*	Suicidal behaviour ☐ Depression ☐ Anxiety ☐ Eating Disorders ☐ Stress ☐ Burnout ☐ Psychological well-being ☐ Other(s) please list: ☐
16	Miscellaneous comments on Part A	

Part C: Papers reporting surveys (including interviews)

107	How many studies does the paper report that present data on mental health issues and/or suicidal behaviour in the veterinary profession?	

*****Copy and complete the rest of the questions for each study reported that presents data on issues related to stress and mental health issues in the veterinary profession*****

C1: Study background

108	Study name/number (assign a number if no name/number given)	
109	Type of research *Tick one*	Questionnaire ☐ Interview ☐ Both ☐ Other ☐ Specify
110	Mental health problems or suicide data? *Tick one*	Mental health problems (including substance misuse) ☐ **-Complete section C2, C3, C4, C6, C7** Suicidal behaviour ☐ **-Complete section C2, C3, C5, C6, C7** Both ☐ **-Complete sections C2, C3, C4, C5, C6, C7** Neither ☐
111	Other data collected *Tick all that apply*	Occupational issues/challenges ☐ (e.g. performing euthanasia, job satisfaction) Stress (work-related or other) ☐ Mental health problems (including substance misuse) ☐ Suicidal behaviour ☐

		Other (not stated) ☐ Specify:	
112	Aim(s) of survey	Aim(s): Same as Q10 ☐	
113	Main conclusion(s) of survey	Conclusions(s): Same as Q11 ☐	
114	Any other comments on study background		

C2.1 Questionnaire recruitment

COMPLETE FOR QUESTIONNAIRE STUDIES ONLY			
115	Sample to whom questionnaires distributed	Not stated ☐	
116	Media in which questionnaire distributed *Tick all that apply*	Electronic (email) ☐ Electronic (web link) ☐ Paper copy (post) ☐ Paper copy (other) ☐ Specify Other ☐ Specify Unclear ☐ Not stated ☐	
117	Number of questionnaires distributed	Not stated ☐	
118	Number of questionnaires returned	Not stated ☐	
119	Number of questionnaires completed	Not stated ☐	
120	Response rate	Not stated ☐	
121	Any other comments on questionnaire recruitment e.g. whether recruitment was random or not		

C2.2 Interview recruitment

COMPLETE FOR INTERVIEW STUDIES ONLY			
122	Sample approached for participation in interview	Not stated ☐	

123	Type of interview conducted	Structured ☐ Semi-structured ☐ Unstructured ☐ Not stated ☐
124	Any other comments on interview recruitment	

C3: Sample characteristics

DEMOGRAPHIC INFORMATION OF PARTICIPANTS INCLUDED IN ANALYSIS		
125	Number	Not stated ☐
126	Gender (% male)	Not stated ☐
127	Mean age	Not stated ☐
128	Age range(s)	Not stated ☐
129	% Qualified veterinarians	Not stated ☐
130	% Veterinary students	Not stated ☐
131	Is the type of veterinary employment of the sample reported?	Yes ☐ No ☐ Not applicable ☐
132	Which areas of veterinary medicine area participants employed in? *Tick all that apply*	Small animal ☐ Large animal ☐ Mixed practice ☐ Non-clinical work ☐ Other (specify) ☐ Not stated ☐ Not applicable ☐
133	Modal ethnic background	Not stated ☐
134	Other comments on participant demographics	

C4: Data on mental illness in the veterinary profession

135	Which mental illnesses are studied?	Depression ☐ Anxiety ☐

		Eating disorders ☐ Alcohol or drug abuse ☐ Stress ☐ Other (specify) ☐

Copy and complete **questions 136 to 153** for each mental health problem

136	Mental health problem	
137	How is the mental health problem measured?	Clinical diagnostic measure e.g. DSM ☐ Multi-item measure of symptoms e.g. BDI ☐ Self-reported symptoms ☐ Other (specify) ☐ Unclear ☐ Not stated ☐
138	Name and description of this measure *Number of items, maximum and minimum scores etc.*	
139	Does the paper report validity and/or reliability of this measure?	Yes ☐ No ☐ Not applicable ☐
If yes go to 140, otherwise go to 141		
140	Data on validity/reliability of this measure	
141	Is the prevalence of this mental illness in the current population reported?	Yes ☐ No ☐
If yes go to 142, otherwise go to 144		
142	How is the prevalence measured?	
143	Data on prevalence of mental health problem	
144	Is data on the causes/contributory factors of the mental health problem presented?	Yes ☐ No ☐
If yes go to 145, otherwise go to 146		
145	Data on the causes/contributory factors of the mental health problem	

146	Is data on treatment/support for this problem reported?	Yes ☐ No ☐
If yes go to 147, otherwise go to 149		
147	How is treatment/support measured?	
148	Data on treatment/support for this problem	
149	Is this mental health problem compared with other samples (either within veterinary profession or with other professions)?	Yes ☐ No ☐ Unclear ☐
If yes go to 150, otherwise go to 151		
150	What are the results of comparisons with other samples?	
151	Is other data in relation to this mental health problem reported?	Yes ☐ No ☐
If yes go to 152, otherwise go to 153		
152	Description of other mental health data reported	
153	Other comments on C4	

C5: Data on suicidal behaviour

COPY FOR EACH FORM OF SUICIDAL BEHAVIOUR REPORTED		
154	Form of suicidal behaviour	
155	How is this behaviour defined?	
156	How is this behaviour measured?	
157	Is the prevalence of this behaviour reported?	Yes ☐ No ☐
If yes go to 158, otherwise go to 159		
158	Data on prevalence of this behaviour	
159	Is data on support/treatment reported?	Yes ☐ No ☐
If yes go to 160, otherwise go to 161		
160	Data on support/treatment	
161	Is suicidal behaviour between samples (either within veterinary profession or with other professions) compared?	Yes ☐ No ☐ Unclear ☐
If yes go to 162, otherwise go to 163		

162	What are the results of comparisons with other samples?	
163	Is other data on this behaviour reported?	Yes ☐ No ☐
If yes go to 164, otherwise go to 165		
164	Other data	
165	Are explanations offered for data found on suicidal behaviour?	Yes ☐ No ☐
If yes go to 166, otherwise go to 167		
166	Explanations for suicidal behaviour reported	
167	Other comments on C5	

C6: Other data

168	Does the study report any other data *that the authors relate to well being* in the veterinary profession?	Yes ☐ No ☐
If yes go to 169, otherwise go to 175		
169	Does the study report the data in relation to any of the following? *Tick **all that apply***	Working hours ☐ Workload ☐ Financial issues ☐ Client demands/expectations ☐ Work-life balance ☐ Area of work ☐ Euthanasia ☐ Professional support ☐ Job satisfaction ☐ Work-related stress ☐ Career change (either within profession or to another profession) ☐ Other data in relation to well being (specify) ☐
For each issue selected above, copy and complete the following questions		

170	How is the issue defined?	Not stated ☐
171	How is the issue measured?	Not stated ☐

172	What data is presented in relation to this issue?	Not stated ☐
173	Do the authors discuss the consequences of this issue on the wellbeing on veterinary surgeons?	
174	Other comments/information related to this issue	

C7: Limitations of research

175	Do the authors discuss limitations of the present research?	Yes ☐ No ☐
If yes go to 176, otherwise go to 177		
176	What limitations are discussed?	
177	Are there any other concerns about the research methodology?	Yes ☐ No ☐
If yes go to 178, otherwise go to 179		
178	Please describe any concerns you have about the research methodology	
179	Do the authors suggest particular areas for future research?	Yes ☐ No ☐
If yes go to 180, otherwise go to 181		
180	Which areas of future research are highlighted?	
181	Any other comments about the study?	

Table 1: Type of research reported

Type of research	Description	Example
Suicide rates	Study reports data on the prevalence of suicide in the veterinary profession based on mortality records.	Blair and Hayes (1982) Mortality Patterns among US veterinarians 1947-1977
Suicide survey	Questionnaires that reports prevalence, causes of and/or prevention methods directly for suicide in vets	Jeyaretnam et al (2000) Disease and injury among veterinarians.
Other survey	Questionnaires that reports prevalence, causes of and/or prevention methods for problems other than suicide.	Gardner and Hini (2006) Work related stress in the veterinary profession in New Zealand
Review	Systematic or Narrative Review of suicide and/or other mental health issues in the veterinary profession	Kahn and Nutter (2005)
Models/theories	Paper that discusses causes of, methods of prevention for and models of suicide and other mental health issues in the veterinary profession but that does not present any primary empirical data	Bartram and Gardner (2008) Coping with stress

Appendix 3: Letter to international experts

Dear all

As you may know, myself and colleagues at the University of Oxford are collaborating with Richard Mellanby at the University of Edinburgh to conduct an international systematic review of suicide and related mental health problems within the veterinary profession. We believe that this is an area of research you have expertise in and would therefore like to ask for your assistance.

We have combined a comprehensive electronic search strategy with hand searching and other methods to create a list of studies that will feature in the review. These studies have been independently screened by 2 members of the research team who have unanimously identified them as meeting our review inclusion criteria. In order to ensure that we have not missed any studies out, we would now like to ask you to view this list and add to it any references that you think we may have missed.

If you think you may be interested in assisting us, please don't hesitate to get in touch.

With best wishes

Belinda

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CC:

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Professor Lin Fritschi
Dr Helen Fairnie
Dr Keren Skegg
Dr Albert Nienhaus

Appendix 4: Quality rating scale-epidemiological studies

Assessment of the risk of bias in epidemiological studies of suicide in the veterinary profession **Paper ID number: VR _____**

CRITERIA		SCORE (0/1)	Comments
1	**Definition of suicide**		
	Clear definition of the suicide used e.g. ICD codes identified	1	
	Unclear definition of suicide e.g. 'cases where death was due to suicide'	0	
2	**Source of numerator data**		
	National or official source of mortality data e.g. ONS	1	
	Regional or unofficial source of mortality data e.g. obituaries	0	
3	**Source of denominator data**		
	National or official source of population data	1	
	Regional or unofficial source of population data	0	
4	**Study duration**		
	More than 5 years	1	
	Less than or equal to 5	0	
5	**Study period**		
	Clear definition of study period e.g. 1966-2000	1	
	Study period unclear e.g. '10 year period'	0	
6	**Veterinary population data**		
	No. suicides/No. all deaths reported OR rate of suicide reported	1	
	No. suicides/No. all deaths OR rate of suicide not reported	0	
7	**Comparison population data**		
	No. suicides/No. all deaths reported OR rate of suicide reported	1	
	No. suicides/No. all deaths reported OR rate of suicide not reported	0	
8	**Number and type of comparisons made**		
	Statistical comparisons made with general population AND a specific occupational group	1	
	None or one comparison made	0	
9	**Appropriateness of comparison group (gender)**		
	Comparisons made by gender OR comparison group statistics adjusted for gender	1	
	Comparisons not made by gender OR comparison group not adjusted for gender	0	
10	**Appropriateness of comparison group (age)**		
	Comparisons made by age OR comparison group statistics adjusted for age	1	
	Comparisons not made by age OR comparison group not adjusted for age	0	
11	**Significance of comparison statistics**		
	P values or confidence intervals reported	1	
	P values or confidence intervals not reported	0	
12	**Study limitations**		
	Authors discuss possible sources of bias	1	
	Authors do not discuss possible sources of bias	0	
Total score		/12	

*nb: where insufficient information is available to make decision, mark '0'

Appendix 5: Quality rating scale-survey studies

Assessment of the risk of bias in survey studies of mental health and related occupational issues in the veterinary profession VR:

Criteria		Score (0/1)	Comments
1	**Peer review**		
	The article has been subject to peer-review	1	
	The article has not been subject to peer-review	0	
2	**Aims**		
	The aims of the study in relation to mental health and/or wellbeing are clearly stated	1	
	The aims of the study in relation to mental health and/or wellbeing are not clearly stated	0	
3	**Information on response rate**		
	The response rate is stated and/or sufficient information is provided to calculate the response rate	1	
	The response rate is not stated and insufficient information is available to calculate it	0	
4	**Response rate data**		
	Response rate is greater than or equal to 50%	1	
	Response rate is less than 50% or is not stated	0	
5	**Sample demographics (gender)**		
	Percentage of males in the sample is described	1	
	Percentage of males in the sample is not described	0	
6	**Sample demographics (age)**		
	Age distribution (mean/range/age groups) is provided	1	
	Age distribution (mean/range/age groups) is not provided	0	
7	**Validity and reliability of each measure**		
	Validity or external reliability of *at least one* measure reported	1	
	Validity or external reliability not reported for any of measures	0	
8	**Number of items in each measure**		
	More than 1 item is used to assess *at least one* issue	1	
	1 item is used to assess each issue or the number of items is not stated	0	
9	**Prevalence of problem**		
	Study reports the prevalence of *at least one* issue in the study population	1	
	Study does not report the prevalence of *at least one* issue in the study population	0	
10	**Statistical comparisons**		
	The study makes statistical comparisons with a control group e.g. medical practitioners	1	
	The study does not make statistical comparisons with a control group	0	
11	**Limitations of the methodology (authors)**		
	The authors discuss limitations of the research methodology	1	
	The authors do not discuss limitations of the research methodology	0	
12	**Limitations of the methodology (reviewers)**		
	The reviewers do not identify limitations of the research methodology	1	
	The reviewers identify limitations of the research methodology	0	
		/12	

*nb: where insufficient information is available to make decision, mark '0'

Appendix 6: Full-text inclusion criteria

Full-text inclusion criteria

Code	Category	Details
1	Include for data extraction	a. Paper is related to the following issues: stress, mental health, psychological well-being or suicidal behaviour
		AND
		b. Paper reports primary empirical data related to the above in veterinary surgeons or veterinary medicine students
2	Studies of relevance but without primary empirical data	a. Paper is related to the following issues: stress, mental health, psychological well-being or suicidal behaviour
		AND
		b. Paper discusses possible causes, methods of prevention or models of the above in veterinary surgeons or veterinary medicine students but does not present any primary empirical data.
3	Studies used to inform background to the review	a. Paper is related to the following issues: stress, mental health, psychological well-being or suicidal behaviour
		AND
		b. Paper provides useful information about the above in relation to veterinary surgeons or veterinary medicine students.
4	Exclude as irrelevant to the review	a. Paper is related to stress, mental health, psychological well-being or suicidal behaviour in veterinary surgeons or veterinary medicine students but does not fulfil criteria 1b, 2b or 3b.
		OR
		b. Paper is not related to the following issues in veterinary surgeons or veterinary medical students: stress, mental health, psychological well-being or suicidal behaviour.

Appendix 7: Abstract screening criteria

Abstract screening criteria

1 Discuss suicide, self-harm mental illness or work-related stress AND
2 Report the above in relation to those in the veterinary profession AND
3 Article is published in a journal or book, is in press or is an unpublished dissertation.

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