Prescription of perioperative analgesics by UK small animal veterinary surgeons in 2013

J. R. Hunt, T. G. Knowles, B. D. X. Lascelles, J. C. Murrell

Data from a survey conducted in 1996–1997 suggested a low level of perioperative analgesic administration to cats and dogs in the UK. In order to evaluate current practice and attitudes with regards to perioperative analgesic prescription, a cross-sectional survey of UK practising small animal veterinary surgeons was undertaken in spring 2013. Four thousand one hundred paper questionnaires were distributed and the survey was made available online. Seven hundred and twenty valid responses were received and analysed. All respondents had access to at least one non-steroidal anti-inflammatory drug (NSAID) and one opioid within their practice. Respondents considered analgesic efficacy, and degree of intraoperative pain, the most important factors governing their selection of NSAID and opioid analgesics. Perioperative NSAIDs were administered by approximately 98 per cent of respondents to dogs and cats undergoing neutering. Multimodal (opioid+NSAID) analgesia was prescribed by the majority of respondents. Neutering was considered more painful in dogs than in cats, and lower rates of opioid and postdischarge NSAID prescription were reported for cats. Orthopaedic, abdominal and dental surgeries were considered equally painful in dogs and cats. Local analgesic techniques were not commonly used. Analgesic prescription has increased since previous surveys, which should translate to improved animal welfare.

Introduction
In 1999, the results of a survey, conducted between 1996 and 1997, of the attitudes of UK veterinary surgeons to perioperative analgesia in dogs (Capner and others 1999) and cats and small mammals (Lascelles and others 1999) were published. That survey described reduced rates of analgesic use in cats compared with dogs and very low levels of employment of multimodal analgesic strategies. It identified that female veterinary surgeons, and more recently graduated veterinary surgeons, were more likely to use and prescribe analgesic drugs. At that time, there were limited non-steroidal anti-inflammatory drugs (NSAIDs) (carprofen) available with an indication for preanaesthetic administration to cats and small mammals (Lascelles and others 1999). Now three opioid analgesics (buprenorphine, butorphanol and pethidine) licensed for use in dogs and/or cats. Local analgesic techniques were not commonly used. Analgesic prescription has increased since previous surveys, which should translate to improved animal welfare.

Materials and methods
A cross-sectional survey of veterinary surgeons, engaged in small animal practice in the UK during April and May 2013, was conducted.

A written questionnaire, divided into eight parts (see online supplementary appendix 1), was used. Data about the respondent were collected anonymously in Part I. Part II listed a range of analgesic drugs, and respondents were asked to identify those that were available for perioperative use within the practice. Part III comprised questions regarding the analgesics that the respondent used in dogs. These questions investigated the prescription of perioperative NSAIDs and opioids for routine surgery, and the prescription of postoperative NSAIDs and opioids, use of local and adjunctive analgesics, and specific questions on the analgesic strategy and duration of analgesic treatment that would be typically used for eight different painful procedures.
surgical and medical conditions. Part IV requested that veterinary surgeons assign scores on a numerical rating scale (NRS) corresponding to the degree of pain that they considered each of the eight procedures described in the previous question would elicit, if analgesic drugs were not administered. Parts V and VI mirrored the questions contained in Parts III and IV, but were applied to cats. Part VII asked respondents to indicate whether pain assessment tools were used perioperatively within the practice, and which practice personnel were responsible for perioperative pain assessment in animals. Part VIII asked respondents to indicate whether they believed their knowledge in the area of perioperative analgesia in small animals to be adequate and to indicate their preferred method of updating their knowledge. Parts of the questionnaire were deliberately designed to replicate questions contained within a previous survey (Capner and others 1999; Lasseles and others 1999), in order for direct comparisons to be made.

Four thousand questionnaires were distributed by post via a commercial mailing company (Vetfile, UK) to veterinary surgeons engaged in small animal practice, randomly selected from the company’s database. Freepost envelopes to return the survey to the investigators were enclosed. One hundred of the questionnaires were distributed at the Association of Veterinary Anaesthetists (AVA) Spring Meeting in April 2013. The survey was made available online. Before distribution of the questionnaires, a letter informing veterinary surgeons about the purpose of the study was published in the Veterinary Record and Veterinary Times; a link to the online survey was provided (Murrell and others 2015).

Data from completed questionnaires were entered into a spreadsheet (Microsoft Excel, 2003). Data from questionnaires that were partially completed were entered into the spreadsheet if the respondent had provided details on date of graduation or gender. Data from the online questionnaire were exported into a spreadsheet file (Microsoft Excel, 2003), which was then used to populate the main spreadsheet.

Statistical analysis
Descriptive statistics were used to evaluate the demographic data, which was compared with reported data for the UK veterinary profession, and to document the number of respondents with access to analgesics within their practices. Data unsuitable for parametric statistical tests, such as the importance assigned to different factors that influenced prescribing of analgesics and pain scores assigned by respondents, were analysed using Kruskall-Wallis tests and, posthoc, Dunn’s multiple comparison test. Differences in prescribing between proportions of male and female respondents, for dogs compared with cats, and AVA members and non-members were analysed using Fisher’s exact test or chi-squared tests as appropriate. A general linear model, and posthoc Bonferroni testing, was used to evaluate the effect of increasing time since graduation on responses. Spearman’s correlation was used to evaluate the relationship between the interval since graduation and pain scores assigned by respondents. Interaction between the factors ‘time since graduation’, ‘gender’ and ‘AVA membership’ was evaluated using logistic regression. No interaction was identified between factors; therefore, these main effects are individually reported.

Proportions of responses from different categories of respondents are presented as percentages, interval since graduation is presented as mean±SD (years). Non-normally distributed data (eg pain scores and importance of considerations for prescription of analgesic drugs) are summarised using the median (interquartile range).

Results
Demographic data
Of the 4100 written questionnaires distributed, 665 were returned. Data from four questionnaires were excluded from analysis. Response rate to the written questionnaire was therefore 16.2 per cent, and completion rate was 16.1 per cent. The online questionnaire produced 59 usable responses; therefore, the data presented are derived from 720 respondents. The breakdown of responses by demographics is shown in Table 1.

Mean interval since graduation of female respondents (15.1±9.5 years) was less than that of male respondents (21.±11.5 years; P≤0.0001). The distribution of interval since graduation of survey respondents (Fig 1) appeared to mirror the distribution of age groups among practising UK veterinary surgeons (www.rcvs.org.uk/publications/rcvs-facts-2013/?destination=%2FPublications%2F). Four hundred and sixty-four (65.2 per cent of 711 respondents who supplied an answer) indicated that they worked in a practice that participated in the RCVS Practice Standards Scheme; 25 (5.4 per cent) indicated the practice was Tier 1, 279 (60.1 per cent) Tier 2 and 103 (22.2 per cent) Tier 3. Fifty-seven respondents did not indicate at which tier the practice was registered.

The proportions of respondents with access to specific analgesic drugs in their practice are shown in Table 2. All respondents indicated that at least one opioid and one NSAID analgesic were available. Five hundred and eighty-nine (81.8 per cent) respondents indicated that at least one full μ opioid agonist was available in their practice.

The ranked order of importance of factors in the choice of perioperative NSAID and opioid drugs by respondents is shown in Figs 2 and 3 for dogs and Figs 4 and 5 for cats. Respondents determined importance of factors by assigning a value using an NRS, which ranged from 0 to 3; 0 indicating not at all important and 3 indicating of highest importance. Analgesic efficacy was the most highly ranked consideration regarding NSAID prescription in dogs and cats (5 (3–5) P≤0.0001); analgesic efficacy and degree of intraoperative pain were the most highly ranked considerations regarding opioid prescription in dogs and cats (5 (3–5) P≤0.0001).

Administration of analgesics for routine surgeries
Routine surgeries were defined as those performed for neutering and lump removal. Approximately ninety-eight per cent of all respondents administered perioperative (preoperative or intraoperative) NSAIDs to dogs and cats for routine surgeries. In dogs, the proportion of male and female NSAID prescribers was similar (P=0.51). In cats, a lower proportion (94.4 per cent) of male veterinary surgeons prescribed NSAIDs, compared with female veterinary surgeons (99.4 per cent; P≤0.0001).

Perioperative opioids were prescribed by 90.5 per cent of all respondents to dogs undergoing routine surgery; a lower proportion of respondents prescribed opioids to cats (81.8 per cent; P≤0.0001) Within each species, similar proportions of male and female respondents prescribed opioids.

A higher proportion of respondents prescribed postoperative NSAIDs, for continuing analgesia following discharge from the clinic, to dogs undergoing routine surgery; compared with cats (dogs 75.1 per cent; cats 33.4 per cent, P≤0.0001). In dogs, a higher proportion of female veterinary surgeons (78.4 per cent) prescribed postoperative NSAID analgesia for routine surgeries than male veterinary surgeons (68.4 per cent P=0.004); this difference was not apparent in prescriptions of postoperative NSAIDs to cats.

Time since qualifying as a veterinary surgeon was not a significant factor in prescription of perioperative or postoperative NSAIDs to dogs undergoing routine surgery, but prescribers of perioperative opioids to dogs had a shorter time since graduation

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<tr>
<th>TABLE 1: Number and categorisation of respondents</th>
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<th>Overall</th>
<th>Male</th>
<th>Female</th>
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<tr>
<td>Survey respondents</td>
<td>720 (100%)</td>
<td>239 (33.2%)</td>
<td>478 (66.4%)</td>
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<tr>
<td>AVA members</td>
<td>30 (4.2%)</td>
<td>11 (36.7%)</td>
<td>19 (63.3%)</td>
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<tr>
<td>Length of time since graduation (years)</td>
<td>15±10.9</td>
<td>21±11.3</td>
<td>13±9.5</td>
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<td>AVA, Association of Veterinary Anaesthetists</td>
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A higher proportion of A V A members prescribed postoperative opioid administration to dogs and cats for routine surgeries, but non-members of the A V A with regard to perioperative NSAID or ≤ (P adj) adjunctive analgesics compared with non-A V A members analgesia. A higher proportion of A V A members prescribed 21 per cent of respondents had administered ketamine CRIs for morphine/lidocaine/ketamine mixture by CRI (Table 3). In cats, constant rate infusions (CRIs) and 23 per cent had administered In dogs, 30 per cent of respondents had administered ketamine Adjunctive constant rate infusion analgesia

Local analgesia and constant rate infusion analgesia

The majority of respondents did not use local analgesic techniques routinely (Table 3). Members of the A V A were more likely to use local anaesthetic techniques (P=0.001). In general, prescribers of local analgesic techniques had a shorter time since graduation (P=0.001). In cats, there was a significant difference in time since graduation between prescribers and non-prescribers of perioperative NSAIDs (15.5±10.6, 31.0±14.3 years; P≤0.0001) and perioperative opioids (15.5±10.5, 18.2±12.3 years; P=0.017).

There were no significant differences between members and non-members of the A V A with regard to perioperative NSAID or opioid administration to dogs and cats for routine surgeries, but a higher proportion of A V A members prescribed postoperative NSAIDs to dogs (AVA 92.6 per cent, non-AVA 74.3 per cent; P=0.03) and cats (AVA 77.8 per cent, non-AVA 31.5 per cent; P≤0.0001).

**Adjunctive constant rate infusion analgesia**

In dogs, 30 per cent of respondents had administered ketamine constant rate infusions (CRIs) and 25 per cent had administered morphine/lidocaine/ketamine mixture by CRI (Table 3). In cats, 21 per cent of respondents had administered ketamine CRIs for analgesia. A higher proportion of A V A members prescribed adjunctive analgesics compared with non-A V A members (P≤0.0001). Prescribers of CRIs of ketamine, lidocaine and morphine/lidocaine/ketamine in dogs had a significantly shorter interval since graduation than non-prescribers, but this was not different in cats.

**Analgesia and pain scores by procedure**

Respondents indicated their typical perioperative analgesic strategy for a range of surgeries in dogs (see online supplementary Table S1) and cats (see online supplementary Table S2) and indicated the degree of pain that they considered would be associated with each surgery if no analgesia was provided (see online supplementary Table S3 and Fig 6).

Consistent with the results for the general approach to analgesia for routine surgeries, there was a high level of prescription of perioperative opioids and NSAIDs and postoperative NSAIDs.

Respondents who prescribed opioid and NSAID analgesics concomitantly (multimodal analgesia) for the specified conditions were more recently graduated than those who did not. Members of the A V A were more likely to prescribe multimodal techniques incorporating three or more different analgesic strategies, including the use of local anaesthetic techniques, for all the named procedures. However, an increased proportion of non-A V A members (59.5 per cent) reported the perioperative prescription of tramadol for dogs undergoing orthopaedic surgery, compared with A V A members (24.1 per cent; P≤0.0001). For each procedure, only a very small proportion of respondents indicated that they would not prescribe perioperative analgesics.

Median and interquartile pain scores assigned by respondents are shown in online supplementary Table S3; mean pain scores are illustrated in Fig 6. The pain scores assigned to most procedures varied between individual respondents. Comparison of procedures between dogs and cats identified no interspecies differences in pain scores assigned to orthopaedic or abdominal surgery, dental extractions or pancreatitis. Ovariohysterectomy (dogs 7 (6–8), cats 6 (5–7), P≤0.0001) and castration (dogs 5 (4–6), cats 5 (3–6), P=0.03) were considered more painful in dogs than in cats. Pain scores assigned by prescribers of perioperative opioids and NSAIDs and postoperative NSAIDs were not invariably higher than pain scores assigned by non-prescribers (see online supplementary Table S3). Time since graduation did not correlate with pain scores assigned for any of the procedures (r=-0.06 to 0.09).

Pain assessment tools were routinely used by 17 per cent of respondents in dogs and cats. Higher proportions of A V A members used pain assessment tools (dogs 89.3 per cent, cats 64.3 per cent) compared with non-members (14.9 per cent and 15.1 per cent, respectively, P<0.0001 in both cases). There was no association with the proportion of respondents using pain assessment tools and gender, or interval since graduation. A higher proportion of pain assessment tool users compared with non-users prescribed perioperative opioids to dogs (90.0 per cent v 89.0 per cent; P=0.018) and cats (90.0 per cent v 80.0 per cent; P=0.009) undergoing routine surgery and postoperative NSAIDs to cats (47.5 per cent v 30.2 per cent; P≤0.0001).

Comparison of the proportion of analgesic prescribers for comparable surgical procedures between the present survey and

![FIG 1: Frequency histogram showing number of respondents (y-axis) by time since graduation (x-axis).](image)

(15.8±12.0 years), compared with non-prescribers (19.7 ±11.4 years; P=0.011). In cats, there was a significant difference in time since graduation between prescribers and non-prescribers of perioperative NSAIDs (15.5±10.6, 31.0±14.3 years; P≤0.0001) and perioperative opioids (15.5±10.5, 18.2±12.3 years; P=0.017).

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<th>Table 2: Proportion of respondents indicating that named analgesics are available within the practice</th>
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<td><strong>Opioids</strong></td>
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<td><strong>NSAIDs</strong></td>
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<td><strong>Local anaesthetics</strong></td>
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<td><strong>Adjunctive analgesics</strong></td>
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**NSAIDs, non-steroidal anti-inflammatory drugs**

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the previous UK survey (Capner and others 1999, Lascelles and others 1999) indicated a significantly higher proportion of respondents in the present survey prescribed analgesics (P<0.0001).

Both veterinary surgeons and nurses were reported to be responsible for perioperative pain assessment by 85 per cent of respondents; veterinary surgeons alone were reported by 11 per cent and nursing staff alone were reported by four per cent of respondents in the present survey prescribed analgesics to be provided routinely for surgery and 61 per cent would expect animals to be sent home with analgesics. The results of the previous UK survey (Capner and others 1999, Lascelles and others 1999) indicated that 77.7 per cent of owners would expect analgesics to be provided routinely for surgery and 61 per cent would expect animals to be sent home with analgesics.

Discussion
An increased proportion of respondents employed analgesics perioperatively and postoperatively in both dogs and cats, compared with previous UK results (Capner and others 1999, Lascelles and others 1999). Similar increases in analgesic usage have been identified in sequential surveys of veterinary surgeons in Canada (Hewson and others 2006a) and South Africa (Joubert 2006). Factors which may have contributed to this increased analgesic prescription include increased availability of licensed analgesic drugs for cats and dogs, greater emphasis on analgesia in the undergraduate curriculum and in postgraduate CPD, and client expectations (Demetriou and others 2009). Results of a survey of pet owners (Demetriou and others 2009) indicated that 77.7 per cent of owners would expect analgesics to be provided routinely for surgery and 61 per cent would expect animals to be sent home with analgesics. The results of the
<table>
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<th>TABLE 3: Prescribers of local analgesic techniques (maxillary/mandibular nerve block, periodontal infiltration, skin infiltration, intratesticular infiltration, epidural, brachial plexus block, wound infiltration with local anaesthetic, wound catheter to permit repeated infiltration of local anaesthetic, and radial, ulnar, musculocutaneous, and median (RUMM) nerve block), and adjuvant analgesics by constant rate infusion (CRI) (ketamine, lidocaine, medetomidine, dexmedetomidine, morphine/lidocaine/ketamine and fentanyl/lidocaine/ketamine), to dogs and cats</th>
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<td><strong>Local analgesic techniques</strong></td>
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<tr>
<td><strong>Maxillary/mandibular infiltration</strong></td>
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<td><strong>Periodontal infiltration</strong></td>
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<td><strong>Skin infiltration</strong></td>
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<td><strong>Intratesticular</strong></td>
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<td><strong>Epidural</strong></td>
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<td><strong>Brachial plexus</strong></td>
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<td><strong>RUMM</strong></td>
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<td><strong>Constant rate infusions</strong></td>
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<td><strong>Ketamine</strong></td>
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<td><strong>Lidocaine</strong></td>
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<td><strong>Medetomidine</strong></td>
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<td><strong>Dexmedetomidine</strong></td>
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<td><strong>Morphine/Lidocaine/Ketamine</strong></td>
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<td><strong>Fentanyl/Lidocaine/Ketamine</strong></td>
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<td><strong>Availability of controlled infusion apparatus for delivering CRIs</strong></td>
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*Significant difference P<0.05

AVA, Association of Veterinary Anaesthetists
Pain scores attributed to respondents to the different conditions were subject to marked individual variation. Neutering procedures were ranked as more painful in dogs than in cats, and the reduced prescription of perioperative opioids and postoperative NSAIDs to cats is likely to be a reflection of this, which suggests continuation of bias that was documented in previous surveys (Capner and others 1999, Lascelles and others 1999), and has also been reported in surveys conducted in other countries (Williams and others 2005, Joubert 2006). Non-prescribers of perioperative NSAIDs for neutering procedures in both dogs and cats also assigned lower pain scores to neutering compared with prescribers.

A minority of respondents used pain-assessment tools. An increased proportion of respondents who used pain-scoring tools prescribed perioperative opioids to dogs and cats undergoing routine surgery. Given that use of pain-scoring tools was not influenced by sex or interval since graduation, it is likely that use of pain scales represents an additional factor which influences the decision to prescribe perioperative opioids, which may reflect an increased likelihood of detecting pain in these cases. Pain assessment was reported to be the responsibility of both veterinary surgeons and nurses by the majority of respondents; education and training in pain assessment is therefore essential for both professions.

Approximately three-quarters of respondents prescribed a combination of opioids and NSAIDs (multimodal analgesia) to dogs and cats undergoing surgical procedures, a figure that is significantly higher than the 30 per cent of respondents did this according to the previous survey (Capner and others 1999). Multimodal analgesia is well recognised to improve pain management in human beings (Buvanendran and Kron 2009, White and others 2009) and cats (Steagall and others 2009), although data are lacking in dogs (Capner and others 2006, Shih and others 2008). The use of local analgesic techniques (Hendrix and others 1996, Huuskonen and others 2013) and adjuncts (Sarran and others 2007) has the potential to contribute to multimodal analgesia.

Despite the lack of a veterinary licensed oral or injectable formulation of tramadol in the UK and very limited clinical data to support the efficacy of oral tramadol for management of acute pain in cats and dogs (eg Davila and others 2013), it was prescribed by more than 50 per cent of respondents to dogs undergoing orthopaedic surgery and by more than 20 per cent of respondents to dogs undergoing abdominal surgery and mastectomy.

The duration of postoperative pain in dogs and cats undergoing surgery has not been extensively studied. Owners of dogs (Wagner and others 2008) and cats (Väisänen and others 2007) reported behavioural changes, which may be indicative of pain, for up to three days postneutering surgery. A decrease in mechanical nociceptive threshold at the wound, indicating peripheral sensitisation, was reported for up to 72 hours following ovariohysterectomy in dogs (Hancock and others 2005). In the current survey, approximately two-thirds of respondents prescribed postoperative NSAIDs for longer than 24 hours postsurgery for canine neutering procedures. This figure was lower in cats, with only a quarter of respondents prescribing NSAIDs for longer than 24 hours after castration. The recent survey by Farnworth and others (2014) indicated a much lower prevalence of prescription of postdischarge analgesics for feline neutering than was indicated by the responses to the present survey. However, a number of respondents to the current survey indicated that they considered a single subcutaneous dose of carprofen to provide up to 72 hours analgesia in cats, and these respondents may have also indicated that they provided NSAID analgesia for greater than 24 hours postoperatively, potentially artificially increasing the number of prescribers of postoperative NSAIDs in cats. Although the pharmacokinetics of carprofen in cats include a prolonged elimination half-life (Taylor and others 1996, Parton and others 2000), no published studies have evaluated the analgesic effect of carprofen beyond 24 hours following a single dose in cats.
The response and completion rates (16 per cent) to the written questionnaire were lower than the previously conducted survey which reported a 48 per cent return rate (Capner and others 1999, Lascelles and others 1999). The inclusion of online responses to the current survey meant that an overall response rate could not be calculated, as we were unable to determine the number of veterinary surgeons who accessed the online survey. However, despite the lower response rate, the number of surveys distributed was higher than in the 1996 survey; therefore, the number of responses (720) to the current survey represents 75 per cent of the total number of responses (958) to the previous one.

The number of practising veterinary surgeons in the UK in 2015 was 18,413 (www.rcvs.org.uk/publications/rcvs-facts-2013/destination=%2Fpublications%2F); therefore, respondents to the current survey represent 3.9 per cent of the UK total. Sending out reminder notices might have increased the response rate but was considered cost prohibitive. Responses were accepted for six weeks, shorter than the five-month period of data collection for the 1996 survey, which might have also contributed to the lower return rate. Additionally, the current survey was a 15-sided document, compared with the eight-sided survey described by Capner and others (1999), it is possible that the length of the current survey discouraged some recipients from completing it.

Despite the lower return rate, the range and distribution of interval since graduation of the survey respondents appeared appropriate, considering the age group demographics of the UK veterinary profession. Compared with the overall UK figures, male veterinary surgeons were under-represented in our survey (33 per cent of responses, compared with 44 per cent of the profession). As a consequence, where a sex-related difference in analgesic prescription was identified, the overall proportion of prescribers calculated from the survey responses may overestimate the proportion of prescribers within the profession.

Veterinary surgeons with a special interest in analgesia may have been more likely to complete the survey. Although some responses were received from veterinary surgeons who did not routinely employ analgesics, a bias may exist towards respondents more likely to prescribe analgesia, and therefore, results should be interpreted as a ‘best-case’ scenario. Despite these caveats, the results of the survey are hopefully broadly representative of current views and practice within the UK veterinary profession. The magnitude of changes observed, compared with the previous survey, is extremely unlikely to be entirely attributable to a skewed sample population, and therefore, we believe that these results reflect real increase in the provision of perioperative analgesia to animals.

In conclusion, this study suggests a marked increase in the prescription of perioperative analgesics among veterinary surgeons since 1996. Gender and time since graduation appear to be less associated with analgesic use than previously. Further work to determine the effectiveness of current analgesic strategies for the days following surgery is essential to optimise the welfare of dogs and cats undergoing surgery.

Acknowledgements

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References


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