The Veterinary Journal 205 (2015) 104–106

Contents lists available at ScienceDirect

The Veterinary Journal

journal homepage: www.elsevier.com/locate/tvjl

Short Communication

Agreement between veterinary patient data collected from different sources

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ARTICLE INFO

Article history:
Accepted 16 April 2015

Keywords:
Practice-based research
Veterinary consultations
Veterinary informatics
Electronic medical record
Electronic patient record

ABSTRACT

Determining the accuracy of the electronic medical record (EMR) is vital to the progress of practice-based research. The aim of this study was to determine the agreement between the EMR and other sources of signalment data. Data were gathered during direct observation of small animal consultations in eight veterinary practices. Breed, age, sex and neuter status were recorded, where available, from the EMR, owner and observer and then compared for agreement. Agreement was 'almost perfect' or 'strong' for 18/28 comparisons, although there was variation between the species. The results have implications for researchers collecting data from the EMR of first opinion practices. Future work could focus on the accuracy of other data obtained from the EMR.

Determining the accuracy of the electronic medical record (EMR) is vital to the progression of veterinary practice-based research, as many of the methods used involve collection of EMR data (Lund et al., 1999; Radford et al., 2010; O'Neill, 2013). Previous research has found that discrepancies within the EMR occur relatively commonly (Dean, 2010), suggesting that it cannot be assumed that the accuracy is high. Data accuracy is particularly crucial for signalment, as this is often of interest when looking at risk factors for disease. The aim of this study was to determine agreement between the EMR and other data sources on signalment information during direct observation of small animal consultations.

Data were gathered by direct observation of small animal consultations in eight participating practices between April 2011 and June 2012. Selection of consultations to observe was based on convenience and feasibility (e.g. room size); however each veterinary surgeon was observed at least once during the data collection period. Data were recorded using a data collection tool developed as part of a larger project (Robinson et al., 2015). Aspects of signalment recorded included breed, age, sex and neuter status. All aspects of signalment data of interest were recorded as listed in the EMR at the start of the consultation, where available for each animal. Where the owner volunteered aspects of signalment during the consultation, these were also recorded. Breed, sex and neuter status were also recorded as assessed by the observer (a researcher who was a qualified veterinary surgeon; NR), where this was possible by direct observation alone. Age as assessed by the observer was not recorded, as this was unlikely to be feasible.

To examine agreement, data from other sources (owner and observer) were compared against data from the EMR. Animals for which signalment data had been obtained from the EMR were first identified. From these, animals that also had signalment data recorded from the owner or an observer were identified. The percentage of these animals for which signalment data were identical between the two sources was then calculated. Before calculating percentage agreement for age, data from all sources were rounded to the nearest year prior to comparison, so an animal listed as 5 years 7 months would be considered to be 6 years old for the purposes of comparison. Only data for the three most frequently presented species (dog, cat and rabbit) were analysed.

Commercially available software was used to calculate agreement statistics for each comparison (IBM SPSS 21). Cohen's kappa (κ) was calculated for categorical variables such as breed. Intraclass correlation coefficient (ICC) was calculated for age, using the original age values recorded (rather than rounded values) in a two-way random model with measures of absolute agreement. Both of these agreement statistics are represented as values from 0 to 1, with 1 implying perfect agreement. For health-related studies, values >0.90 are considered 'almost perfect', 0.80–0.90 'strong' and 0.60–0.79 'moderate' (McHugh, 2012). Bias corrected and accelerated bootstrapping was used to calculate 95% confidence intervals around each value (Carpenter and Bithell, 2000). Statistical significance was initially set at 0.05, with a Bonferroni correction carried out to account for multiple comparisons (Petrie and Sabin, 2009). Ethical approval was obtained from the ethics committee at the School of

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http://dx.doi.org/10.1016/j.tvjl.2015.04.023
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Table 1
Total number of veterinary patients for which signalment data could be collected from each data source during direct observation of consultations for all animals and the three most frequently examined species.

Data	Source	All (*n* = 1901)[a]	Dog (*n* = 1235)[a]	Cat (*n* = 525)[a]	Rabbit (*n* = 90)[a]
		n (%)	*n* (%)	*n* (%)	*n* (%)
Breed	EMR	1790 (94.2)	1213 (98.2)	510 (97.1)	67 (74.4)
	Owner	53 (2.8)	36 (2.9)	5 (1.0)	12 (13.3)
	Observer	1828 (96.2)	1228 (99.4)	520 (99.0)	80 (88.9)
Age	EMR	1775 (93.4)	1173 (95.0)	486 (92.6)	79 (87.8)
	Owner	418 (22.0)	260 (21.1)	125 (23.8)	23 (25.6)
Sex	EMR	1812 (95.3)	1186 (96.0)	500 (95.2)	80 (88.9)
	Owner	336 (17.7)	227 (18.4)	67 (12.8)	26 (28.9)
	Observer	612 (32.2)	420 (34.0)	153 (29.1)	26 (28.9)
Neuter status	EMR	1811 (95.3)	1185 (96.0)	500 (95.2)	80 (88.9)
	Owner	329 (17.5)	214 (17.3)	65 (12.4)	25 (27.8)
	Observer	606 (31.9)	415 (33.6)	152 (29.0)	26 (28.9)

EMR, electronic medical record.
[a] Numbers in brackets represent the total number of animals presented during the study.

Table 2
Veterinary patients for which the electronic medical record (EMR) agreed with other data sources (where available) for each aspect of signalment in the three most frequently examined species. For κ and intraclass correlation (ICC), the point estimate is given along with the 95% confidence interval (CI).

Data	Sources	Species	*n*	Agree (%)	Disagree (%)	κ/ICC (95% CI)	*P*
Breed	EMR/owner	All	46	33 (71.7)	13 (28.3)	0.663 (0.513–0.818)[b]	<0.001[c]
		Dog	34	26 (76.5)	8 (23.5)	0.746 (0.571–0.894)[b]	<0.001[c]
		Cat	5	5 (100.0)	0 (0.0)	1.000 (1.000–1.000)[a]	<0.001[c]
		Rabbit	7	1 (14.3)	6 (85.7)	0.125 (0.000–0.222)	0.008
	EMR/observer	All	1780	1716 (96.4)	64 (5.4)	0.962 (0.952–0.972)[a]	<0.001[c]
		Dog	1213	1184 (97.6)	29 (2.4)	0.976 (0.966–0.986)[a]	<0.001[c]
		Cat	502	477 (95.0)	25 (5.0)	0.885 (0.836–0.926)[a]	<0.001[c]
		Rabbit	65	54 (83.1)	11 (16.9)	0.765 (0.648–0.889)[b]	<0.001[c]
Age	EMR/owner	All	381	305 (80.1)	76 (19.9)	0.973 (0.967–0.978)[a]	<0.001[c]
		Dog	248	205 (82.7)	43 (17.3)	0.991 (0.988–0.993)[a]	<0.001[c]
		Cat	106	79 (74.5)	27 (25.5)	0.938 (0.909–0.957)[a]	<0.001[c]
		Rabbit	18	12 (66.7)	6 (33.3)	0.984 (0.957–0.994)[a]	<0.001[c]
Sex	EMR/owner	All	307	291 (94.8)	16 (5.2)	0.891 (0.832–0.943)[a]	<0.001[c]
		Dog	216	212 (98.1)	4 (1.9)	0.960 (0.908–0.991)[a]	<0.001[c]
		Cat	54	50 (92.6)	4 (7.4)	0.850 (0.685–0.963)[a]	<0.001[c]
		Rabbit	24	21 (87.5)	3 (12.5)	0.750 (0.538–0.917)[b]	<0.001[c]
	EMR/observer	All	573	561 (97.9)	12 (2.1)	0.907 (0.848–0.960)[a]	<0.001[c]
		Dog	401	396 (98.8)	5 (1.2)	0.933 (0.852–0.986)[a]	<0.001[c]
		Cat	138	135 (97.8)	3 (2.2)	0.920 (0.791–1.000)[a]	<0.001[c]
		Rabbit	22	19 (86.4)	3 (13.6)	0.713 (0.396–1.000)[b]	<0.001[c]
Neuter status	EMR/owner	All	301	266 (88.4)	35 (11.6)	0.765 (0.668–0.852)[b]	<0.001[c]
		Dog	214	189 (88.3)	25 (11.7)	0.766 (0.668–0.857)[b]	<0.001[c]
		Cat	52	46 (88.5)	6 (11.5)	0.771 (0.620–0.921)[b]	<0.001[c]
		Rabbit	23	23 (100.0)	0 (0.0)	1.000 (1.000-1.000)[a]	<0.001[c]
	EMR/observer	All	571	520 (91.1)	51 (8.9)	0.817 (0.772–0.854)[a]	<0.001[c]
		Dog	400	373 (93.3)	27 (6.8)	0.862 (0.811–0.903)[a]	<0.001[c]
		Cat	137	114 (83.2)	23 (16.8)	0.613 (0.478–0.750)[b]	<0.001[c]
		Rabbit	22	22 (100.0)	0 (0.0)	1.000 (1.000–1.000)[a]	<0.001[c]

[a] κ and ICC values considered to represent almost perfect (>0.90) or strong (0.80–0.90) agreement.
[b] κ and ICC values considered to represent moderate agreement (0.60–0.79).
[c] *P* values remaining statistically significant after Bonferroni correction of the significance level to 0.0018. *P* value in this case tests only whether the estimated κ or ICC value is likely due to chance and does not give an indication of the strength of agreement.

Veterinary Medicine and Science, The University of Nottingham[1] (reference 104 091120; approved 20 November 2009).

Some or all of the signalment data of interest were available for 1901 veterinary patients, comprising 1235 dogs, 525 cats, 90 rabbits and 51 patients of other species. Data completion varied widely between data source and species (Table 1). The observer recorded the breed for the majority of animals, but only limited data were elicited from owners or collected by the observer for other aspects of signalment (Table 1).

Agreement was classed as 'almost perfect' or 'strong' for 18/28 comparisons made and 'moderate' for 9/28 comparisons (Table 2). Only 3/7 comparisons in rabbits were classed as 'almost perfect' or 'strong', compared with 5/7 comparisons each in dogs and cats. For age, 4/4 comparisons were 'almost perfect', while for sex, 6/8 comparisons were 'almost perfect' or 'strong' (Table 2). For breed, 4/8 comparisons were 'almost perfect' or 'strong'; however breed comparisons with only 'moderate' agreement were predominantly those between EMR and owner data, where very few comparisons were possible. For neuter status, only 4/8 comparisons were 'almost perfect' or 'strong'.

For large-scale research purposes, EMRs are likely to be the most practical source of signalment data. Consistency between signalment data from the different sources was 'almost perfect' or 'strong'

[1] See: http://www.nottingham.ac.uk/fabs/rgs/documents/code-of-research-conduct-and-research-ethics-approved-january-2010.pdf (accessed 27 April 2015).

for 18/28 comparisons, which was encouraging. All sources of data are likely to have some degree of inaccuracy, and this study was not able to determine which source was most accurate. 'Moderate' agreement for neuter status in some cases could be a cause for concern, particularly as signalment is often of interest as a risk factor for disease. Collecting signalment information might be more of a challenge for rabbits than other species, as the EMR was often less complete and less consistent with other sources, although this could in part be due to the small number of rabbits presented.

Possible explanations for why lower levels of agreement were found for some comparisons include poor owner recall, owner recall bias (owners volunteering information could be different from those who do not) and the small number of comparisons considered in this study. Errors could also occur during creation of the EMR, which could be influenced by the knowledge of the person entering the information, particularly for breed data. While it is obvious that date of birth, sex and breed remain constant throughout an animal's life, neuter status might not, so inconsistencies in neuter status could potentially be explained by out-of-date fields in the EMR, rather than inaccuracies in the data initially entered or poor owner recall. Some practice management systems use default values (e.g. neuter status set to 'entire' unless edited), which could also influence the accuracy of the data.

This study used a convenience sample of practices, so it is unclear whether the results are generalisable to other veterinary practices in the UK. Difficulty in determining certain veterinary patient characteristics (such neuter status) by direct observation alone was another limitation, as this was easiest for dogs and for male animals. Our study focused on signalment data and further work is needed to determine the accuracy of other data recorded in the EMR.

Our findings have implications for researchers gathering data from first opinion practices and highlight the potential limitations of the data collected. Age, breed and sex data from the EMR appear to be highly consistent with other sources; however caution might be needed when using rabbit signalment data or neuter status data from the EMR. These results could also be useful to researchers, veterinary practitioners and producers of practice management software, to enhance the accuracy of signalment information recorded in the EMR.

Conflict of interest statement

This study was supported by an unrestricted grant from Elanco Animal Health and The University of Nottingham. Elanco played no role in the study design, in the collection, analysis and interpretation of data, or in the manuscript writing or submission for publication. None of the authors has any other financial or personal relationships that could inappropriately influence or bias the content of the paper.

Acknowledgements

The authors would like to thank the sentinel practices, their clients and the veterinary patients for their involvement in the study.

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