

1 **TITLE PAGE**

2 **Owner-reported outcome measures in veterinary care for companion animal**
3 **orthopedic patients: An international online survey of veterinarians' expectations**
4 **and practices**

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24

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32 **ABSTRACT**

33 **Objective**

34 To report veterinarians' familiarity with and perceptions of owner/observer-reported
35 outcome measures (OROMs) and their applications in routine clinical practice.

36 **Study design**

37 Cross-sectional online survey.

38 **Animals or Sample Population**

39 441 veterinarians with a caseload of companion animal orthopedic patients.

40 **Methods**

41 Respondents answered questions regarding their familiarity with and application of
42 OROMs. Respondents provided opinions on statements related to reasons for using or not
43 using OROMs in routine clinical practice, prerequisites to implement OROMs in routine
44 clinical practice, and whether they would implement OROMs in routine clinical practice
45 if adequate tools/technologies were available.

46 **Results**

47 Most (293/441, 66.4%) respondents felt familiarity with at least one OROM. Only 17.5%
48 (77 out of the 440 answering the question about the application of OROMs) applied
49 OROMs in routine clinical practice. The two main reasons for not using OROMs in
50 routine clinical practice were the lack of opportunity/feasibility and the lack sufficient
51 information/knowledge/experiences. User-friendliness, time efficiency, and
52 interpretability were considered the most important prerequisites for implementing
53 OROMs in routine clinical practice. If adequate tools/technologies were available,

54 266/439 (60.6%) respondents indicated that they would definitely implement OROMs in
55 routine clinical practice.

56 **Conclusion**

57 Although most respondents were familiar with at least one OROM, fewer than one-fifth
58 applied them in routine clinical practice. Most respondents were willing to implement
59 OROMs in routine clinical practice if adequate tools/technologies were available.

60 **Clinical Significance**

61 Our results justify further investigations to improve the application of OROMs in routine
62 clinical practice in veterinary care of companion animal orthopedic patients.

63

64 **KEYWORDS**

65 Canine, owner-reported outcome measures, observer-reported outcome measures,
66 OROM, Surveys and Questionnaires

67 **INTRODUCTION**

68 Clinical outcomes are measurable changes in health, function, and/or quality of life that
69 result from the care given to the patients.¹ Improving patient outcomes should be the
70 ultimate goal for patient care, both in humans and animals.² Owner (observer)-reported
71 outcome measures (OROMs) are validated questionnaires that provide semiquantitative
72 scores based on the subjective evaluation of companion animals' health, function, and/or
73 quality of life by their owners/carers.⁵ Outcomes from the perspective of the animal's
74 owner/carer are increasingly incorporated in evidence-based veterinary studies through
75 the use OROMs.

76

77 There are several ways in which OROMs can add value to veterinary care.^{2,3}
78 Implementing OROMs in routine veterinary clinical practice can enhance the
79 understanding of the treatment effects on clinical outcomes and quality of life (QoL) of
80 companion animal patients from the owner's perspective.² The use of OROMs can
81 facilitate the communication with owners⁴ and enhance the effectiveness of consultations
82 without increasing consultation time.⁵ Applying OROMs may also be an effective way of
83 increasing owner engagement and satisfaction.³

84

85 It is important to understand the attitudes of veterinarians regarding the application of
86 OROMs in routine clinical practice and the barriers that may have limited their use to
87 design strategies that facilitate the adoption of OROMs. The objectives of this cross-
88 sectional online survey of veterinarians with a caseload of companion animal orthopedic
89 patients were to report 1) veterinarians' familiarity with and the current application of

90 OROMs in routine clinical practice, 2) veterinarians' perceptions of the advantages and
91 disadvantages of implementing OROMs in routine clinical practice, and 3) obstacles to a
92 successful implementation of OROMs in routine clinical practice.

93 **MATERIALS AND METHODS**

94 **Survey**

95 This cross-sectional online survey was conducted from February to March 2020. An
96 invitation e-mail was distributed to 7,000 individuals registered under 1) a mailing list of
97 AO VET, 2) members of the European College of Veterinary Surgeons, 3) members of
98 the European Society of Veterinary Orthopaedics and Traumatology, 4) members of the
99 European College of Veterinary Sports Medicine and Rehabilitation, and 5) members
100 with interest in dogs and cats of the International Veterinary Information Service (IVIS).
101 AO VET is a global network of surgeons, scientists, and other professionals highly
102 specialized in the field of veterinary surgery of the musculoskeletal system. The
103 questionnaire was also advertised 1) via AO VET online media (Facebook and Veterinary
104 Insights), 2) in the e-mail discussion forums of the British Veterinary Orthopaedic
105 Association, 3) in the e-mail discussion of Ortholistserv, a forum for American College of
106 Veterinary Surgeons and European College of Veterinary Surgeons Diplomates, 4) in the
107 news blog (NEWStat) of the American Animal Hospital Association, and 5) on the IVIS
108 webpage as a banner.

109

110 The invitation e-mail explained the purpose of the survey, provided contact details, and
111 contained a secure web link to the questionnaire. Two reminders were sent. This study
112 was conducted in compliance with the Declaration of Helsinki. The study protocol of this
113 survey was approved by the Ethics & Welfare Committee in the Department of
114 Veterinary Medicine, University of Cambridge (Reference Number: CR409). At the
115 beginning of the survey, participants were informed that their participation was voluntary

116 and anonymous and that by completing the survey they would allow their responses to be
117 processed and analyzed. The participants indicated their consent to participate in the
118 survey by clicking the web link to the questionnaire. No medical information was
119 collected. Data were collected and analyzed anonymously. No written consent was
120 obtained. No remuneration or reward was offered for participation.

121

122 **Participants**

123 Eligible participants were those who indicated that they were veterinarians with a clinical
124 caseload of companion animal orthopedic patients.

125

126 **Questionnaire**

127 *Development*

128 The self-administered questionnaire was developed by a multidisciplinary team of
129 veterinarians, clinical research scientists, and statisticians by taking references from
130 similar surveys conducted in the field of human medicine.⁶ A pilot survey was conducted
131 with ten veterinarians. Written feedback was obtained. There were no major changes to
132 the questionnaire after the pilot survey apart from appropriate rewording and rephrasing.

133

134 *Structure*

135 The questionnaire is attached as Supplement I. The questionnaire had eleven questions on
136 demographics, region of residence according to the AO regions, clinical experience,
137 professional qualifications, current workplace, specialty, and caseload of companion
138 animals.

139

140 Three questions were related to the participant's familiarity with and current application
141 of OROMs. Two types of applications of OROMs were distinguished in this survey: the
142 application of OROMs for research purposes referred to applying OROMs as part of
143 veterinary clinical studies (including any interventional or observational studies); the
144 application in routine clinical practice referred to applying OROMs not for any research
145 purposes but as part of everyday veterinary work or standard veterinary care offered to
146 patients who were not subjects in any kind of veterinary clinical studies. Ten disease-
147 specific or generic OROMs that have been featured in current literature in companion
148 animal orthopedics⁷⁻⁹ were listed in the questionnaire. Disease-specific OROMs included
149 Liverpool Osteoarthritis in Dogs (LOAD),¹⁰ Canine Brief Pain Inventory (CBPI),¹¹
150 Helsinki Chronic Pain Index (HCPI),¹² Canine Orthopedic Index (COI),¹³ Finnish Canine
151 Stifle Index (FCSI),¹⁴ and Bologna Healing Stifle Injury Index (BHSII).¹⁵ Generic
152 OROMs included VetMetrica Health-Related Quality of Life Instrument (HRQL),¹⁶
153 Glasgow University Veterinary School Questionnaire (GUVQuest),¹⁷ Texas A&M Client
154 Questionnaire,¹⁸ and Short Form Composite Measure Pain Score (CMPS-SF).¹⁹

155

156 Participants provided their opinions on ten statements regarding reasons for applying
157 OROMs, if they answered that they applied OROMs in routine clinical practice
158 (including those applying OROMs both in routine clinical practice and for research
159 purposes). Participants provided their opinions on six statements regarding reasons for
160 not applying OROMs in routine clinical practice if they answered that they did not apply
161 OROMs at all or applied only for research purposes.

162

163 Furthermore, participants provided their opinions on 1) five statements regarding what
164 would be the most important aspects to apply OROMs in routine clinical practice, and 2)
165 six statements regarding reasons why OROMs were not applied more often in routine
166 clinical practice. Participants were asked whether they would apply OROMs in routine
167 clinical practice if tools or technologies were available to overcome the barriers.

168

169 **Statistical analyses**

170 The response rate (including completed and partially completed questionnaires) and the
171 margin of error at 95% confidence level (expressing the amount of random sampling
172 error, calculated using the overall proportion of users of OROMs as the outcome of
173 interest) were computed. Percentages for all categorical variables (excluding missing
174 responses) were calculated. Multivariable logistic regression analyses were conducted to
175 evaluate the influences of the region, specialty, current position, clinical experience, and
176 workplace on a) the familiarity with disease-specific OROMs, b) the familiarity with
177 generic OROMs, and c) the application of OROMs in routine clinical practice and/or
178 research. Because the experience of having applied OROMs, even for research purposes
179 only, might influence the veterinarians' opinions, Chi-square tests were performed to
180 compare the following data between those who did not apply OROMs at all and those
181 who applied OROMs in routine clinical practice and/or research: 1) the proportions of
182 opinions on statements regarding why OROMs were not applied more often in routine
183 clinical practice, and 2) the proportions of respondents who indicated that they would

184 definitely implement OROMs in routine clinical practice if tools or technologies were
185 available to overcome barriers. The significance level was set at $P < 0.05$.

186 **RESULTS**

187 **Participants**

188 Four hundred sixty-four respondents completed the survey. One respondent was not a
189 graduate of veterinary school, and 16 did not have a clinical caseload of companion
190 animal orthopedic patients. The remaining 441 (95.0%) respondents were considered
191 eligible for the final analyses. The overall response rate was 6.3% (441/7,000). The
192 maximum margin of error for the results of the survey was 4%.

193

194 Over half of the respondents (232/441, 52.7%) were from Europe (Table 1). Respondents
195 worked predominantly in the fields of orthopedics, traumatology, spine surgery, and soft
196 tissue surgery (176/435, 40.5%). Numbers (percentages) of respondents having clinical
197 experience of 1–10 years, 11–20 years, and ≥ 21 years were 116/441 (26.3%), 159/441
198 (36.1%), and 166/441 (37.6%), respectively. Most respondents (288/441, 65.3%) were
199 veterinarians without surgical specialist training; 124 (28.1%) were surgical specialists in
200 training; 29 (6.6%) were registered surgical specialists.

201

202 **Familiarity of respondents with OROMs**

203 Most (293/441, 66.4%) respondents felt a familiarity with at least one OROM. Disease-
204 specific OROMs were more well-known (261/441, 59.2%) than generic OROMs
205 (141/441, 32.0%). LOAD (180/441, 40.8%) and CBPI (164/441, 37.2%) were the two
206 most well-known disease-specific OROMs, followed by HCPI (107/441, 24.3%), COI
207 (66/441, 15%), FCSI (12/441, 2.7%), and BHSII (4/441, 0.9%). The most well-known
208 generic OROM was GUVQuest (100/441, 22.7%), followed by CMPS-SF (58/441,

209 13.2%). Texas AM Client Questionnaire (28/441, 6.3%) and VetMetrica HRQL (5/441,
210 1.1%) were less well-known.

211

212 The proportion of respondents who were familiar with OROMs was highest in North
213 America (67/81, 82.7%), in respondents working in the fields of orthopedics,
214 traumatology, and spinal surgery (47/56, 83.9%), among surgical specialists in training
215 (25/29, 86.2%), among respondents with 11–20 years of clinical experience (114/159,
216 71.7%), and among respondents working at university referral hospitals (54/66, 81.8%;
217 Supplement II, Table S1). Multivariable analyses confirmed the influences of the region,
218 specialty, current position, clinical experience, and workplace on the familiarity with
219 disease-specific or generic OROMs (Table 2).

220

221 **Application of OROMs**

222 Four hundred forty respondents answered the question about the application of OROMs.
223 Seventy-seven (17.5%) respondents applied OROMs in routine clinical practice: 58
224 applied them in routine clinical practice only (18 regularly and 40 irregularly), and 19
225 applied them in routine clinical practice and for research purposes. Sixty-five (14.8%)
226 respondents applied OROMs for research purposes only. The overall proportion of
227 respondents applying OROMs was 32.3% (142/440). The four most widely applied
228 OROMs were LOAD (81/142, 57.0%), CBPI (61/142, 43%), HCPI (22/142, 15.5%), and
229 COI (14/142, 9.9%). Proportions of respondents applying OROMs varied across regions,
230 specialties, and workplaces but not across current positions and clinical experiences
231 (Table 2 and Supplement II, Table S1).

232

233 The two statements related to facilitating communication between veterinarians and
234 owners and to monitoring treatment responses attracted more than a 90% agreement rate
235 (95.1% [73/76] and 93.4% [71/76], respectively, either strongly agreed or agreed) as the
236 reasons for applying OROMs in routine clinical practice (Table 3). Only 18.4% (14/76)
237 of respondents agreed that they were required by regulatory authorities to document QoL
238 data.

239

240 Lack of opportunity/feasibility (232/356, 65.2%) and lack of sufficient
241 information/knowledge/experience (234/360, 65.0%) had the highest agreement rates as
242 the reasons for not applying OROMs in routine clinical practice. Less than 10% (35/356,
243 9.8%) of respondents agreed that they did not believe in the usefulness of OROMs for
244 companion animal orthopedic patients.

245

246 **Prerequisites for and obstacles to implementing OROMs in routine clinical practice**

247 User-friendliness (418/435, 96.1%), time efficiency (401/432, 92.8%), interpretation and
248 clinical relevance of results (399/430, 92.8%) were considered very important or
249 important by over 90% of respondents (Table 4). Costs and compatibility to existing
250 software tools were also considered very important or important by 75.6% (327/432) and
251 80.7% (346/429) of respondents, respectively.

252

253 The statement related to the time-consuming and burdensome aspects of OROMs for
254 owners got an agreement rate of 51.4% (223/434) among the six statements related to

255 reasons why OROMs were not applied more often in routine clinical practice (Table 5).
256 Agreement rates for the other statements ranged from 28.1% to 42.4%. The experience of
257 having applied OROMs in routine clinical practice and/or for research purposes was
258 associated with a more definite opinion, either agree or disagree, as reflected by the lower
259 rates of neutral opinion (neither agree nor disagree) in these respondents (Table 5).
260
261 Two hundred sixty-six respondents (60.6% out of the 439 respondents who answered this
262 question) would definitely implement OROMs in routine clinical practice if tools or
263 technologies were available to overcome barriers; 159 (36.2%) responded with "maybe",
264 and 5 (1.1%) responded with "maybe not"; 9 (2.1%) could not decide. The proportion of
265 respondents who would definitely implement OROMs in routine clinical practice was
266 59.5% (172/289) among those who did not apply OROMs at all and 66.7% (94/141)
267 among those who applied OROMs in routine clinical practice and/or research ($P=0.152$).

268 **DISCUSSION**

269 This is the first international survey to report veterinarians' familiarity with, current
270 application of, and perceptions of applying OROMs in routine clinical practice for
271 companion animal orthopedic patients. A few disease-specific OROMs were found to be
272 more well-known and more frequently applied than others, possibly because they were
273 the most featured OROMs in the current literature^{7,9,20} or there have been reports on their
274 validity, reliability, and responsiveness.⁷

275

276 The low percentage of respondents applying OROMs in routine clinical practice
277 supported the anecdotal observation that OROMs had not been routinely applied in the
278 everyday practice of veterinary medicine.² In contrast, a routine collection of patient-
279 reported outcome measures (PROMs), the equivalent of OROMs in human medicine, has
280 been implemented in several healthcare systems to improve the quality of care from the
281 patients' perspective.^{21,22} For instance, PROMs are part of the Health Outcomes Survey in
282 Medicare managed care in the US,²³ and the National Health Service PROMs program in
283 England routinely collects generic and disease-specific PROMs since 2009 to track the
284 outcomes of patients undergoing four elective surgeries.²⁴ Applying PROMs in routine
285 clinical practice has been shown to help tailor treatment plans to meet the patients'
286 preferences and needs, improve patient outcomes, and facilitate patient-clinician
287 communication,^{21,22} with minimal or no clinical workflow delays.²⁵

288

289 Increasing the application of OROMs in routine clinical practice requires more than
290 developing validated and time-efficient OROMs. Our results may help identify areas for

291 improvement in raising awareness of, and application of, OROMs in routine clinical
292 practice. Over 90% of the respondents who applied OROMs in routine clinical practice
293 felt that OROMs facilitate the communication with owners and help monitor the
294 responses to treatments. Over 70% of respondents who did not apply OROMs in routine
295 clinical practice disagreed with the statement that OROMs are not useful. These indicated
296 that the usefulness of OROMs may not be a major concern. The two main reasons for not
297 using OROMs were the lack of opportunity/feasibility and the lack of sufficient
298 information/knowledge/experience. Over half of the respondents, even among those who
299 had applied OROMs, agreed that filling out OROMs was time-consuming and
300 burdensome for owners. Although most available OROMs have been designed to be
301 completed in 5 to 10 minutes, respondents could still have concerns that owners might
302 feel delayed in the regular consultations and burdened by being asked to complete an
303 OROM. User-friendliness, time efficiency, and interpretability were considered the three
304 most important prerequisites for implementing OROMs in routine clinical practice.

305

306 These barriers identified in the survey are mostly "soft" barriers that can be tackled with
307 technical innovations and further education. These may include replacing paper-based
308 forms with digitized OROMs; the development of user-friendly digital platforms (such as
309 centralized databases and cloud applications) that can be integrated into the existing
310 electronic medical record systems and facilitate the delivery, storage, processing, access,
311 and visualization of OROMs; adequate training to the owners and veterinarians on
312 understanding OROMs and their purpose; and better education of veterinarians on how to
313 communicate the results to owners and how to use OROMs to engage owners in the

314 consultation.³ An example of educating veterinarians on how to use OROMs can be
315 found in the study by Mwacalimba et al., where the veterinarians were provided with a
316 one-page guidance document that explained the purpose of the QoL assessment and
317 provided talking points for introducing and explaining the assessment results to owners.⁵
318 These improved the usability of the QoL assessment and resulted in favorable acceptance
319 from the veterinarians.

320

321 It is encouraging that most respondents would definitely apply OROMs in routine clinical
322 practice if technologies or tools were available to overcome barriers. A favorable
323 environment may be created for broader use of OROMs in routine clinical practice as
324 experience with OROMs expands and matures. First, it encourages developers to develop
325 more valid, reliable, sensitive, and interpretable OROMs for more conditions and
326 purposes. Second, it guides institutional changes of policies for using OROMs to improve
327 healthcare quality. Finally, it promotes among veterinarians the concept of value-based
328 care, in which the value of care lies in the outcomes that matter to patients.

329

330 The main limitation of this survey was the low response rate (6.3%). However, we may
331 have underestimated the response rate because it was calculated using the total number of
332 invitations sent rather than the number of eligible invitees.²⁶ Nonetheless, it was still
333 unlikely that the response rate could have reached 60%, a frequently quoted measure of
334 survey quality.²⁶ The low response rate may give rise to nonresponse bias. First, the
335 invitations were sent to mailing lists of several organizations with a high number of
336 specialists. Specialists might have been overrepresented in the final analyses. Second,

337 veterinarians interested in OROMs were more likely to have responded as the survey was
338 voluntary. These two factors may have led to overestimation of the levels of familiarity
339 with and application of OROMs. Nevertheless, the relatively small margin of error
340 indicated confidence in the results being representative of the full population. Another
341 study limitation is the small number of users of OROMs. In contrast to non-users, who
342 may be over-optimistic, experienced users may be more cautious concerning the
343 usefulness and burden of OROMs. The analyses of the experienced users might highlight
344 the most important challenges in applying OROMs in routine clinical practice.

345

346 In conclusion, although most respondents were familiar with at least one OROM, fewer
347 than one-fifth applied them in routine clinical practice. Most respondents were willing to
348 implement OROMs in routine clinical practice if adequate tools and technologies were
349 available to overcome the barriers. Our results justify further investigations to improve
350 the application of OROMs in routine clinical practice of veterinary care of companion
351 animal orthopedic patients.

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420

421

422 Table 1 Demographics and characteristics of the respondents

Characteristics	N=441
Sex	441
Men	114 (25.9)
Women	325 (73.7)
Prefer not to say	2 (0.5)
Clinical experience	441
1–5 years	30 (6.8)
6–10 years	86 (19.5)
11–15 years	82 (18.6)
16–20 years	77 (17.5)
21–25 years	62 (14.1)
25–30 years	42 (9.5)
>30 years	62 (14.1)
Region	440
Africa	4 (0.9)
Asia Pacific	47 (10.7)
Europe	232 (52.7)
Latin America	67 (15.2)
Middle East	9 (2.0)
North America	81 (18.4)
Qualification(s) ^a	441
Veterinary surgeon	302 (68.5)
ECVS/ACVS resident	29 (6.6)
ECVS/ACVS specialist	112 (25.4)
Other type of registered surgical specialist	41 (9.3)
Other	41 (9.3)
Workplace	441
Private practice	197 (44.7)
Private referral hospital	142 (32.2)
University referral hospital	66 (15.0)
Both university and non-university referral hospital	27 (6.1)
Other	9 (2.0)
Surgical specialty	435
Orthopedics and traumatology	86 (19.8)
Orthopedics, traumatology, and spinal surgery	56 (12.9)
Orthopedics, traumatology, spinal surgery, and soft tissue surgery	176 (40.5)
Surgery and other areas of clinical veterinary medicine	101 (23.2)
Specialized in one or more subareas of orthopedics and traumatology	16 (3.7)
Percentage of case-load of companion animal orthopedic cases	441
Up to 20%	92 (20.9)
21–40%	67 (15.2)
41–60%	82 (18.6)
61–80%	65 (14.7)
81–100%	135 (30.6)

No. of new appointments of canine orthopedic patients per week	434
1–5	104 (24.0)
6–10	122 (28.1)
11–15	79 (18.2)
15–20	53 (12.2)
20–30	45 (10.4)
>30	31 (7.1)

423 Results are presented as number (%). Abbreviations: ACVS, American College of Veterinary
424 Surgeons; ECVS, European College of Veterinary Surgeons.

425 ^a Answer options are not mutually exclusive. Percentages do not add up to 100%.

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Table 2 Influence of region, specialty, current position, clinical experience, and workplace on the familiarity with disease-specific owner-reported outcome measures (OROMs), the familiarity with generic OROMs, and the current application of OROMs

Variables	Familiarity with disease-specific OROMs		Familiarity with generic OROMs		Current application of OROMs in routine clinical practice/research	
	OR (95% CI)	<i>P</i>	OR (95% CI)	<i>P</i>	OR (95% CI)	<i>P</i>
Region^a						
Europe	Reference		Reference		Reference	
Asia Pacific	0.62 (0.30;1.29)	0.201	1.54 (0.77;3.11)	0.226	0.63 (0.29;1.36)	0.242
Latin America	0.15 (0.07;0.31)	<0.001	0.61 (0.29;1.25)	0.176	0.31 (0.14;0.71)	0.006
North America	1.26 (0.64;2.47)	0.507	3.95 (2.18;7.15)	<0.001	1.11 (0.62;1.99)	0.727
Surgical specialty						
Orthopedics and traumatology	Reference		Reference		Reference	
Orthopedics, traumatology, and spinal surgery	1.47 (0.61;3.53)	0.388	0.34 (0.15;0.76)	0.008	0.86 (0.42;1.76)	0.679
Orthopedics, traumatology, spinal surgery, and soft tissue surgery	0.7 (0.37;1.33)	0.279	0.77 (0.43;1.36)	0.366	0.41 (0.23;0.73)	0.003
Surgery and other areas of clinical veterinary medicine	0.29 (0.14;0.61)	0.001	0.67 (0.33;1.36)	0.263	0.32 (0.15;0.68)	0.003
Orthopedics and traumatology with further specialization	0.37 (0.10;1.35)	0.132	0.3 (0.07;1.25)	0.099	0.41 (0.11;1.52)	0.183
Current position						
Registered surgical specialist	Reference		Reference		Reference	
Veterinarian but not a registered surgical specialist	0.48 (0.26;0.86)	0.014	1.33 (0.77;2.29)	0.307	0.81 (0.48;1.37)	0.429
Surgical specialist in training	1.09 (0.31;3.80)	0.896	1.19 (0.45;3.17)	0.730	1.47 (0.57;3.75)	0.424
Clinical experience						
≥21 years	Reference		Reference		Reference	
1–10 years	3.03 (1.60;5.73)	<0.001	0.88 (0.48;1.60)	0.675	0.93 (0.51;1.70)	0.813
11–20 years	2.33 (1.36;4.00)	0.002	1.08 (0.65;1.80)	0.755	0.81 (0.49;1.36)	0.428
Workplace^a						
Private practice	Reference		Reference		Reference	
Private referral hospital	0.93 (0.53;1.65)	0.815	1.78 (1.02;3.09)	0.041	1.11 (0.64;1.94)	0.703
University referral hospital	2.16 (0.97;4.80)	0.059	1.37 (0.68;2.74)	0.377	2.23 (1.13;4.40)	0.020

	Both university and non-university referral hospital	1.11 (0.37;3.31)	0.849	2.84 (1.04;7.76)	0.042	1.96 (0.70;5.51)	0.202
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428 Abbreviation: OROMs, owner-reported outcome measures.

429 ^a Due to low frequencies, those classified as 'Afrika' and 'Middle East' in the region or 'Other' in the workplace, were excluded from the model.

430 Table 3 Perceived advantages and limitations of applying owner-reported outcome measures (OROMs) in routine clinical practice for companion animal
 431 orthopedic patients

Variable	n	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
Reasons for applying OROMs in routine clinical practice^a						
OROMs can help to prioritize clinical problems.	76	10 (13.2)	50 (65.8)	14 (18.4)	2 (2.6)	0 (0.0)
OROMs can help to facilitate communication between the veterinarian and the dog owner/carer.	76	29 (38.2)	44 (57.9)	3 (3.9)	0 (0.0)	0 (0.0)
OROMs can screen for potential patient-related problems.	76	13 (17.1)	43 (56.6)	16 (21.1)	4 (5.3)	0 (0.0)
OROMs can identify dog carer and patient-related preferences.	76	11 (14.5)	34 (44.7)	30 (39.5)	1 (1.3)	0 (0.0)
OROMs monitor changes/responses to treatment.	76	35 (46.1)	36 (47.4)	5 (6.6)	0 (0.0)	0 (0.0)
OROMs monitor and assess the general health care status of my patients and their health care status changes.	75	14 (18.7)	38 (50.7)	18 (24.0)	5 (6.7)	0 (0.0)
OROMs can be helpful but are not substitutes to measure the clinical outcomes of my patients.	76	22 (28.9)	35 (46.1)	11 (14.5)	7 (9.2)	1 (1.3)
OROMs help to monitor the quality of healthcare provision.	76	13 (17.1)	46 (60.5)	11 (14.5)	5 (6.6)	1 (1.3)
OROMs are useful for national/international comparison and benchmarking.	76	16 (21.1)	39 (51.3)	18 (23.7)	3 (3.9)	0 (0.0)
I am required to document the owner-reported quality of life data by the government, regulatory bodies, my workplace, or for insurance reasons.	76	6 (7.9)	8 (10.5)	12 (15.8)	26 (34.2)	24 (31.6)
Reasons for not applying OROMs in routine clinical practice^b						
I do not believe in the usefulness of outcome and quality of life measurements in veterinary orthopedics.	356	12 (3.4)	23 (6.5)	67 (18.8)	158 (44.4)	96 (27.0)
I do not have sufficient information, knowledge, or experience to apply OROMs in daily routine clinical practice.	360	88 (24.4)	146 (40.6)	50 (13.9)	57 (15.8)	19 (5.3)
It is too time-consuming to implement OROMs in my daily clinical practice.	357	24 (6.7)	135 (37.8)	111 (31.1)	67 (18.8)	20 (5.6)
The resistance of owners to filling out owner-reported outcomes routinely is too high.	355	21 (5.9)	84 (23.7)	162 (45.6)	72 (20.3)	16 (4.5)
I am interested in using OROMs but I have not yet had the possibility to do so.	356	89 (25.0)	143 (40.2)	70 (19.7)	38 (10.7)	16 (4.5)
The resistance within my workplace to using OROMs is too high.	355	19 (5.4)	45 (12.7)	137 (38.6)	106 (29.9)	48 (13.5)

432 Results are presented as count (%). N is the available respondents for the analyses. Abbreviation: OROMs, owner-reported outcome measures.

433 ^a Only respondents who indicated that they applied OROMs in routine clinical practice or routine clinical practice and research provided opinions on these
 434 statements (N=77).

435 ^b Only respondents who indicated that they did not apply OROMs in routine clinical practice (including those who applied OROMs for research purposes only)
436 provided opinions on these statements (N=363).

437 Table 4 Important aspects for implementing owner-reported outcome measures in routine clinical
 438 practice for companion animal orthopedic patients

Variables	N = 441
User-friendliness (for hospital staff and animal owners)	435
Very important	294 (67.6)
Important	124 (28.5)
Neither important nor unimportant	14 (3.2)
Unimportant	2 (0.5)
Very unimportant	1 (0.2)
Costs	432
Very important	146 (33.8)
Important	181 (41.9)
Neither important nor unimportant	89 (20.6)
Unimportant	13 (3.0)
Very unimportant	3 (0.7)
Time efficiency	432
Very important	226 (52.3)
Important	175 (40.5)
Neither important nor unimportant	27 (6.3)
Unimportant	3 (0.7)
Very unimportant	1 (0.2)
Compatibility to existing software tools	429
Very important	163 (38.0)
Important	183 (42.7)
Neither important nor unimportant	62 (14.5)
Unimportant	16 (3.7)
Very unimportant	5 (1.2)
Interpretation and clinical relevance of results	430
Very important	255 (59.3)
Important	144 (33.5)
Neither important nor unimportant	25 (5.8)
Unimportant	4 (0.9)
Very unimportant	2 (0.5)

439 Results are presented in count (%).

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Table 5 Reasons why owner-reported outcome measures (OROMs) were not used more often in routine clinical practice for all respondents and by current application of OROMs in routine clinical practice and/or research

Variables	Current application of OROMs in routine clinical practice and/or research								<i>P</i> ^a	All participants			
	No			Yes			N	Strongly agree /Agree		Neither agree nor disagree	Disagree /Strongly disagree		
	N	Strongly agree /Agree	Neither agree nor disagree	N	Strongly agree /Agree	Neither agree nor disagree							
Data from OROMs are not objective and cannot adequately reflect our patient's situation.	293	79 (27.0)	130 (44.4)	84 (28.7)	141	43 (30.5)	43 (30.5)	55 (39.0)	0.017	434	122 (28.1)	173 (39.9)	139 (32)
Data from OROMs are prone to a placebo effect and therefore are not reliable or clinically relevant in veterinary orthopedic patients.	293	107 (36.5)	117 (39.9)	69 (23.5)	141	46 (32.6)	49 (34.8)	46 (32.6)	0.133	434	153 (35.3)	166 (38.2)	115 (26.5)
There is a lack of suitable and specific OROMs available for the assessment of routine patients in veterinary orthopedics.	293	112 (38.2)	128 (43.7)	53 (18.1)	141	49 (34.8)	36 (25.5)	56 (39.7)	<0.001	434	161 (37.1)	164 (37.8)	109 (25.1)
Veterinary surgeons lack the necessary skills to interpret and use the information given by these instruments.	294	121 (41.2)	95 (32.3)	78 (26.5)	142	52 (36.6)	34 (23.9)	56 (39.4)	0.019	436	173 (39.7)	129 (29.6)	134 (30.7)
To fill out OROMs is time-consuming and burdensome for the animal owner.	293	148 (50.5)	97 (33.1)	48 (16.4)	141	75 (53.2)	36 (25.5)	30 (21.3)	0.204	434	223 (51.4)	133 (30.6)	78 (18)
Implementing OROMs would require significant changes in the structure of the basic routine clinical practice of veterinary health	293	116 (39.6)	122 (41.6)	55 (18.8)	141	68 (48.2)	34 (24.1)	39 (27.7)	0.001	434	184 (42.4)	156 (35.9)	94 (21.7)

care providers as well as
being costly.

442 Results are presented as count (%). N is the available respondents for the analyses. Abbreviation: OROMs, owner-reported outcome measures.
443 ^a Comparisons by Chi-square test between respondents who did not apply OROMs at all and those who applied OROMs in routine clinical practice and/or
444 research.