Human Orthopaedic Articles Convey Information Differently than Veterinary Orthopaedic Articles: A Prospective, Cross-Sectional Analysis

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Abstract

The objective of this analysis was to compare the length and number of active voice sentences in human orthopaedic articles to veterinary orthopaedic articles. The goal is to provide authors and reviewers with objective, evidence-based guidelines to critically evaluate those two aspects of style of veterinary manuscripts during the writing phase of research and the review process. We used word counts and the percent of active voice sentences of the introduction sections and discussion sections in 15 randomly chosen veterinary orthopaedic clinical trial articles and 15 randomly chosen human orthopaedic clinical trial articles. Veterinary introduction sections were on average 193 words longer than human introduction sections ($p = 0.001$). Veterinary discussion sections were on average 370 words longer than human discussion sections. Veterinary introduction sections had on average 14.4 percent fewer active voice sentences than human introduction sections ($p = 0.003$). Veterinary discussion sections had on average 8.3 percent fewer active voice sentences than human discussion sections. Our conclusion is that human articles are written in a different style from veterinary clinical trial articles, which could be written with fewer words and more active sentences.

Keywords
- writing
- surgery
- orthopaedics

Introduction

Short, direct, scientific articles can increase reader confidence and encourage interdisciplinary collaboration.[1,2] Readers may cite short articles more often than longer written articles.[2] Reviewers may read more carefully, be less distracted, and write a more focused review for shorter manuscripts.

Two attributes may help make scientific writing short and direct. The first attribute is manuscript length. Length is important because longer introduction and discussion sections have more ideas for readers to process, and that comes at the expense of clarity.[3,4] We measured the length of sections objectively with word counts.

The second attribute is the active voice, which improves clarity by making points directly.[4–6] For example, "The dogs walked over the force plate," is more quickly understood than the passive voice, "The force plate was walked over by the dogs." Neuroimaging has shown that human brains require more activation to understand passive voice sentences than active voice sentences.[7] If veterinary authors compared word counts and percent of active voice sentences in orthopaedic manuscripts to those in published veterinary orthopaedic articles and human orthopaedic articles, then they could

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objectively assess if their manuscripts are more-or-shorter and direct relative to other articles.

The first aim is to establish baseline word counts for the introduction and discussion sections in veterinary orthopaedic articles, and then compare word counts between veterinary and human orthopaedic articles. The second aim is similar to the first aim, but for active voice sentences. First, we establish the baseline percent of active voice sentences in the introduction and discussion sections for veterinary orthopaedic articles, and then compare those percents between veterinary and human orthopaedic articles.

Materials and Methods

Study Design and Case Selection

This was a two-group, cross-sectional analysis using veterinary orthopaedic articles from *Veterinary Comparative Orthopaedics and Traumatology* and *Veterinary Surgery*, and human orthopaedic papers from the *Journal of Bone and Joint Surgery*.

To select veterinary articles, we generated lists from the *Veterinary Comparative Orthopaedics and Traumatology* and *Veterinary Surgery* websites by searching on "orthopedic," "orthopaedic," "randomised," and "randomised," and then refined the lists to prospective randomized clinical trials. We alternated between the lists, working down them, flipping a coin to randomly select publications for analysis. To select human orthopaedic papers, we generated a list from the *Journal of Bone and Joint Surgery* following the same randomized procedure. We removed citation numbers, headings, figures, and tables from the introduction and discussion sections before the text analysis.

Outcome Measures

The co-primary outcomes were the word counts of the introduction sections and the percent of passive voice sentences in the introduction sections. They were the only outcomes that were prespecified for statistical testing, to guard against picking and choosing statistically significant results. The secondary outcomes were the word counts of the discussion sections and the percent of passive voice sentences in the discussion sections. We measured outcomes using Microsoft Word Editor Insights.

Sample Size and the Early Stopping Rule

We calculated the sample size using the approach recommended by the National Institutes of Health, arriving at 60 articles in total.[8] Processing articles for analysis is tedious and time consuming, so we used the clinical trial technique of early stopping rules to end the accrual of articles early if there was a dramatic difference between the veterinary and human writing styles halfway through the study.

We used the O'Brien and Fleming method to determine the stopping rule, stopping the data collection early if both *p*-values for the co-primary outcomes were less than 0.0054.[9,10] If either *p*-value was equal to or greater than 0.0054, then the data collection would continue to 60 articles.

Statistical Analysis

We assessed the data for spurious observations using boxplots, and we used the Wilk–Shapiro test to test the outcomes for normality. In addition, the percent data were checked to satisfy the "npq" normal approximation. Welch's *t*-test was used to statistically test introduction section word count and introduction percent active voice between veterinary and human groups of articles. To declare one group statistically shorter and more direct than another group, both *p*-values had to be below 0.0054 at the interim analysis. We presented the data using Cohen's effect size and summaries as: average (standard error).

Results

At the 30-article interim data analysis, both the introduction word-count *p*-value ($p = 0.001$) and the percent active voice ($p = 0.003$) were less than 0.0054. That satisfied the stopping rule, so we terminated data collection.

We analyzed 15 veterinary articles (from 2005 to 2021) and 15 human orthopaedic articles (from 2004 to 2021). For the veterinary articles, one studied anesthesia, one studied gloving, and three assessed pain control. The rest studied intervention effects on the spine or joints. One studied felines, another used felines and canines, and the rest used canines or canine cadavers. For the human articles, one studied anesthesia, one assessed opioid use, one telemedicine, and one web-based rehabilitation. The rest studied intervention effects on the spine or joints. All studied live patients.

There were no spurious observations, and all the outcomes and groups had approximately normal distributions. The average introduction word count for veterinary articles was 522 (37.5), and for human articles it was 329 (23.7). Cohen's effect size was 1.6. As mentioned above, the population mean introduction word counts were statistically different ($p = 0.001$, using 0.0054 as the cutoff, with 23.7 degrees of freedom). The average discussion word count for veterinary articles was 1,262 (83.6), and for human articles it was 892 (60.0). Cohen's effect size was 1.3.

The average introduction percent of active voice sentences for veterinary articles was 63.5% (3.41%), and for human articles it was 77.9% (2.69%). Cohen's effect size was 1.3. As mentioned above, the population mean introduction percent of active voice sentences was statistically different ($p = 0.003$, using 0.0054 as the cutoff, with 26.5 degrees of freedom). The average discussion percent of active voice sentences for veterinary articles was 62.3% (1.69%), and for human articles it was 70.6% (2.75%). Cohen's effect size was 0.9.

Discussion

Human orthopaedic introductions were shorter and more direct than veterinary orthopaedic introductions. Veterinary introductions and discussions combined were on average 563 words longer, that is, over a page longer than human orthopaedic introductions and conclusions combined. We

informally assessed causes for the difference in word count. It appeared that the veterinary articles provided more background and ancillary information than provided in human articles. Both introductions and discussions in veterinary articles had elements similar to review papers, rather than focused explanations of the gaps in literature and narrow discussions of the results. Veterinary articles sometimes have more redundancies. For example, the human introductions stated aims, but veterinary introductions often stated both aims and general hypotheses. When hypotheses are required, they should provide specific, statistically testable outcomes.

The veterinary introductions had 22.6% fewer active voice sentences than the human introductions, and most veterinary introductions had fewer active sentences than most human articles. For perspective, one human article introduction had 100% active sentences. However, sometimes authors prefer the passive voice to emphasize the object of a sentence rather than the subject. For example, the passive sentence, "The force plate was walked over by the dogs," emphasizes the force plate. Still, authors could emphasize the force plate actively with, "The force plate was used to assess ground reaction forces. Dogs walked over it five times." An active voice is easier to understand for readers whose first language is not English.[10]

We acknowledge that there are attributes of style, such as noun clustering, organization, and repetition, but they can be hard to assess and quantify.[5]

This research focused on the introduction and discussion sections because they offer more opportunity for shorter writing than materials and methods sections and results sections. Informally, the materials and methods sections and results sections of the human and veterinary articles appeared to have the same structures and terse reporting style. In other words, the human articles did not shorten their introductions by leaking introduction information into the materials and methods sections.

Different study designs and research topics might by necessity have considerably different introduction and discussion lengths. For example, medical articles involving public policy can have very long discussion sections. That is why we focused on a specific kind of design, orthopaedic randomized clinical trials, to control variation.

The community of veterinary orthopaedic clinical trial authors is relatively small compared with human authors. Some veterinary authors co-authored more than one veterinary article. There is no way to assess the correlated-author effect on outcomes without designing a study to do so. No author appeared as lead author more than once. A limitation of this research was that we investigated the use of American English in a single human journal and two veterinary journals, so the conclusions in this article are best used as considerations for style, rather than as broad practice standards. Also, VCOT instructs authors to use UK English.

The objective of this analysis was to encourage authors and reviewers to evaluate more critically the aspects of clarity and brevity in scientific writing. In general, the writing style of veterinary publications in the field of orthopaedic surgery could or should be amended by giving less background information and by using more active voice sentences.

Conflict of Interest
None declared.

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