

Peer Review

Review of: "How does chronic pain impact the lives of dogs: an investigation of factors that are associated with pain using the Animal Welfare Assessment Grid"

Brunna Gomes Re¹

1. Independent researcher

The authors applied the Animal Welfare Assessment Grid (AWAG) to evaluate how chronic pain affects the lives of dogs. They compared 76 assessments from 46 dogs with chronic musculoskeletal conditions to 143 assessments from healthy dogs. Results showed significant differences not only in physical scores but also in psychological, environmental, and procedural domains. Logistic regression identified fear and anxiety frequency, reaction to stressors, engagement with enrichment, and social interactions as key independent predictors of chronic pain. This work advances the field by highlighting that multidimensional welfare metrics can serve as early indicators of chronic pain, allowing more holistic management that goes beyond physical symptoms.

Major issues

- **Cross-sectional design limitations**

The cross-sectional design limits causal inference; welfare and behavioral differences could reflect the consequences rather than precursors of chronic pain.

How longitudinal data would help: Repeated AWAG evaluations in the same animals over time could determine whether behavioral or welfare indicators precede clinical deterioration. For example, following dogs every 3–6 months could verify whether rising anxiety or decreased enrichment engagement predicts pain onset or worsening.

- **Impact of limitations & recommendations:**

The study's design and single-center sampling may inflate associations and limit generalizability. To mitigate this:

- (i) conduct **prospective cohorts** with repeated AWAG measures;
- (ii) pursue **multi-center recruitment** to include different case mixes and management conditions;
- (iii) **pre-register** the analysis plan to minimize data-driven bias;
- (iv) perform **sensitivity analyses** excluding dogs under active analgesic therapy and adjusting for confounders (age, breed, orthopedic history, activity level); and
- (v) handle missing data transparently (e.g., multiple imputation).

- **External validation and generalizability**

Results are limited to a single institution. Validation in different clinical contexts, breeds, and populations is needed to confirm that the AWAG model performs consistently across varied environments.

- **Regression transparency and robustness**

The regression model lacks sufficient methodological detail.

Suggested statistical improvements:

- Use **penalized regression methods** (LASSO or ridge) to handle multicollinearity and variable selection.
- Report **variance inflation factors (VIFs)** and **goodness-of-fit measures** (AIC, BIC).
- Follow **TRIPOD** guidelines: list all predictors a priori, indicate coding (continuous vs. categorical), test for **non-linear relationships** (restricted cubic splines), and describe any **interaction terms** (e.g., enrichment × age).
- Present **AUC with 95% CI**, **Brier score**, **calibration intercept/slope**, and a **calibration plot**.
- Include **decision-curve analysis** to assess clinical utility.
- Perform **bootstrap internal validation** (≥1,000 resamples) and, if possible, **external validation** with a separate dataset.
- Provide a **complete coefficients table** (β , SE, OR with 95% CI) and an example showing how to calculate an individual predicted probability.
- Conduct **sensitivity analyses** adjusting for confounders and testing alternative codings (continuous vs. categorized AWAG domains).
- **Interpretation of behavioral indicators**

Some behavioral markers (e.g., reduced social interaction) might result from pain rather than predict

it. The discussion should clarify the directionality and causal interpretation of these associations.

- **Calibration and sensitivity analysis**

The paper reports model discrimination but omits calibration statistics. Including ROC curves, calibration plots, and thresholds would improve interpretability.

Minor issues

Define key AWAG terms (“reaction to stressors,” “enrichment engagement”) to enhance clarity for readers less familiar with the scoring system.

Add an illustrative example showing how AWAG scores are computed for one individual dog.

Improve figure legends with units, scale ranges, and assay details where relevant.

Expand the limitations section to acknowledge potential effects of ongoing pain management therapies.

Conduct minor grammatical and stylistic revisions for conciseness and readability.

Final note: This structured peer review aims to strengthen methodological transparency and interpretive clarity. The study provides valuable insight into the use of multidimensional welfare assessment as an early diagnostic and monitoring tool for chronic pain in dogs.

Declarations

Potential competing interests: No potential competing interests to declare.