

Theory of medical scoring systems and a practical method to evaluate Asian elephant (*Elephas maximus*) foot health in European zoos

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Abstract

Several established models in human and veterinary medicine exist to evaluate an individual health or disease status. Many of these seem unsuitable for further epidemiological research aimed at discovering underlying influential factors. As a case example for score development and choice, the present study analyses different approaches to scoring the foot health of Asian elephants (*Elephas maximus*) living in European facilities. Sum scores with varying degree of detail, and without or with a weighting method, were compared using descriptive statistics, ie kurtosis, skewness, Shannon entropy, total redundancy, their maximum and their actual ranges. With increasing score complexity, a higher level of differentiation was reached. In parallel, the distribution of score frequencies in the population shifted systematically: with the least complex scoring model the pattern indicated a severely unhealthy population with an opposite skew to a hypothetically healthy population, whereas the most complex scoring model indicated a mildly affected population with a skew corresponding to that expected for a healthy population. We propose the latter, in the form of the Particularised Severity Score (ParSev), which accounts for every nail and pad individually and weights the sub-scores by squaring, as the most relevant score for further investigations, either in assessing changes within an elephant population over time, or correlating foot health in epidemiological studies to potentially influencing factors. Our results emphasise the relevance of choosing appropriate scoring models for welfare-associated evaluations, due to implications for the applicability as well as the perceived welfare status of the test population.

Keywords: animal welfare, Asian elephant, epidemiology, foot health, scoring system, weighting factor