Repeated measures analysis with measurements on ambiguous scales

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This research addresses the robustness of a repeated measures analysis of a growth process when: (1) the measurements are scored on an ambiguously defined interval scale with unambiguously defined end points, (2) the number of observations over time is small, and (3) the initial part of the process is not observable. This study was prompted by research on burn wounds. Skin regrowth is an important clinical parameter, which is conventionally expressed as the percentage of new skin on a wound (0 - 100%) In practice, it is troublesome to quantify this clinical parameter rigorously, even in animal models. Firstly, the actual areas of new skin are commonly assessed only visually and suffer a large degree of error. Secondly, the regrowth is assessed discretely, at wound dressing changes. Additionally, the regrowth cannot be assessed at all in the early stages of wound healing due to the treatment protocol. However, the 100% regrowth is generally reached and observable. In this paper, we study a general growth process of this kind by computationally comparing the performances of two estimators: the first ambiguous measurement, and the time to the first observed unambiguous end point. The analysis is done under a one-factor completely randomized design. The analysis is illustrated with data from a porcine burn model. This research could be of interest to statisticians working on applications in medical, agricultural and general biophysical research.