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SYSTEMATIC REVIEWS

Reporting quality of survival analyses in medical journals still needs improvement. A minimal requirements proposal

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Abstract

Objectives: We reviewed publications with two main objectives: to describe how survival analyses are reported across medical journal specialties and to evaluate changes in reporting across periods and journal specialties.

Study Design and Setting: Systematic review of clinical research articles published in 1991 and 2007, in 13 high-impact medical journals.

Results: The number of articles performing survival analysis published in 1991 (104) and 2007 (240) doubled (17% vs. 33.5%; $P = 0.000$), although not uniformly across specialties. The percentage of studies using regression models and the number of patients included also increased. The presentation of results improved, although only the reporting of precision of effect estimates reached satisfactory levels (53.1% in 1991 vs. 94.2% in 2007; $P = 0.000$). Quality of reporting also varied across specialties; for example, cardiology articles were less likely than oncology ones to discuss sample size estimation (odds ratio = 0.12; 95% confidence interval: 0.05, 0.30). We also detected an interaction effect between period and specialty regarding the likelihood of reporting precision of curves and precision of effect estimates.

Conclusion: The application of survival analysis to medical research data is increasing, whereas improvement in reporting quality is slow. We propose a list of minimum requirements for improved application and description of survival analysis.

Keywords: Methods; Quality reporting; Editorial guidelines; Review; Statistics; Survival analysis

1. Introduction

Survival analysis comprise a set of statistical techniques designed to study a variable defined as the time elapsed between a fixed time (e.g., time of diagnosis) and the event of interest (e.g., death), as well as associations between this time-to-event variable and potential explanatory variables. These techniques take into account the partial information provided by censored observations, that is, individuals who have not experienced the event of interest during the study's follow-up period (e.g., individuals alive at the end of the study) [1,2]. Handling this type of information is what characterizes this family of statistical analyses.

Although the earliest analysis about human survival processes could be traced back to the 17th century [3], key developments over nonparametric theory were incorporated in the second half of the last century and, since then, they have been extensively used in medical research to answer a variety of questions from treatment evaluation to risk as well as identification and assessment of prognostic factors. However, a review of the cancer literature [4] concluded that the description of key methodological features of these techniques and the reporting of survival analyses results were deficient. To give a couple of examples, the authors of the review found that almost half of the articles failed to describe the study's follow-up period, and nearly two-thirds of them (62%) did not define the event of interest clearly and explicitly. Furthermore, their analyses found

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What is new?

Key findings

- The use of survival analysis in medical research articles is increasing, both in absolute numbers and proportionally. However, although there are differences across specialties, the quality of the reporting of survival analysis has not improved substantially since a similar review on this topic was published in 1991.

What this adds to what was known?

- Based on the hurdles we encountered to complete our data extraction form, our review findings, and the guidelines suggested by Altman et al., we compiled a checklist of minimum requirements for accurate reporting of survival analysis.

What is the implication and what should change now?

- Journal editors should incorporate a concise but obligatory list of methodological and reporting requirements as the suggested one for all articles using survival analysis.
- Improvement in quality of execution and reporting of survival analysis would facilitate evaluation of validity of results and application to clinical practice.

that only 15% of the articles that used the Kaplan−Meier method and barely one-third (34%) of those fitting regression models provided any type of assessment of the uncertainty of their estimates. This cancer literature review was published in 1995 and, according to our knowledge, no other similar review has been entered into MEDLINE since.

For the preliminary investigation leading to the current project, we reviewed clinical trials published during 2007 in two cardiology journals, *Circulation* and *Journal of the American College of Cardiology*, which used survival analysis as part of their methodology. Despite the fact that we restricted ourselves to examination of clinical trials, a highly structured research design, our results were only slightly better than those of the review by Altman et al. [4] mentioned previously. For instance, 40% of the clinical trials we reviewed did not report the follow-up period, and 45% of the trials using the Kaplan−Meier estimator failed to specify the level of uncertainty of their estimates.

A few years ago, the research team led by Altman published a series of articles [1,5−7] in a journal of wide circulation with the goal of introducing and explaining the basic concepts of survival analysis, including the key elements needed for interpreting the results. Although being well aware of the excellent available textbooks devoted specifically to survival analysis [8,9], this series may be regarded as a first approach to a set of practical guidelines on how to perform and describe survival analyses procedures and the results derived from them. It should also be considered a high-impact series as it has been cited 194 times, according to the Web of Knowledge (accessed on February 6, 2012), and it is very likely that the influence of such work has spread well beyond what the actual number of citations indicates.

Therefore, we thought that a systematic review of how clinical articles describe the utilization of survival analysis tools and how their results are presented was highly appropriate at this time. To go beyond a mere description of the literature, we added a couple of dimensions to the review. First, for comparison purposes, we collected articles from journals of other medical specialties in addition to oncology; and second, to evaluate how description of these statistics evolved over time, we reviewed articles published at two different periods: the period analyzed by Altman et al. [4], that is, 1991, and then, 4 years after the publication of the series published by Altman and his team, that is, 2007.

2. Methods

2.1. Study design

We systematically reviewed all primary data articles describing research on humans that were published on the third trimester of the years 1991 and 2007 in the following 13 journals (including three Spanish journals): *New England Journal of Medicine*, *The Lancet*, *Journal of the American Medical Association*, *Annals of Internal Medicine*, *Medicina Clínica*, *Circulation*, *Journal of the American College of Cardiology*, *Revista Española de Cardiología*, *Journal of the American Society of Nephrology*, *Kidney International*, *Nefrología*, *Journal of the National Cancer Institute*, and *Journal of Clinical Oncology*.

These journals were chosen because they had the highest impact factor within their specialty, according to the Web of Knowledge, and a high clinical research focus. We also included the top Spanish journal for each specialty. We chose these two time points for data collection because the first one (1991) corresponds to the period examined by the article that was the first and only, as far as we know, wake-up call regarding the inadequate description of these statistical techniques in the clinical literature [4]. The second time point (2007) allows for full assessment of the potential impact of educational material such as the aforementioned series [1,5−7], along with corresponding changes in editorial, funding policies and requirements, as well as the enhanced availability and straightforwardness