


# An Introduction to Competing Risks in Epidemiology [Response to Letter]

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## Dear editor

We thank Professor Muñoz for the thoughtful and detailed comments on our article, “An Introduction to Competing Risks in Epidemiology”. We have carefully reviewed each point raised and have provided detailed responses accordingly.<sup>1</sup>

The aim of our article<sup>2</sup> was to provide researchers, particularly those new to the field, a clear and accessible overview of the basic principles and challenges of competing risks. While advanced extensions such as time-varying approaches are indeed valuable analytical tools, an in-depth discussion of such advanced methods was beyond the scope of this introductory article. For this reason, we focused in this article on core concepts, with a plan to address time-varying approaches and related advanced methods in a dedicated follow-up article.

We agree that proportionality is not intrinsic to either the cause-specific hazard or subdistribution hazard models, and that violations of the proportional hazards assumption are common in competing risk analyses. For this reason, we emphasized in our article the importance of carefully assessing and discussing the implications when the assumption is not met. We also highlighted alternative approaches, such as cumulative incidence functions and composite endpoints, that remain interpretable under non-proportional hazards. We further agree that analytical approaches allowing relative hazards to vary over time are advantageous when proportionality does not hold.

The purpose of noting that the subdistribution hazard model retains individuals who experience competing events in the risk set was to guide readers who may be unfamiliar with this unconventional feature of the model. We agree that, under the “immunity/cure” interpretation, individuals who have experienced a competing event are appropriately kept in the risk set, even though they can no longer experience the event of interest. Our article already reflects this interpretation by explaining that the subdistribution hazard model directly targets the cumulative incidence function, and therefore requires this specific risk-set structure.

We thank Professor Muñoz for the comment on the direct 1-to-1 relation between the hazard rate and the cumulative risk. Our statement about the direct 1-to-1 relation appears prior to introducing the cause-specific hazard and subdistribution hazard frameworks, as part of a general discussion on how competing risks alter the usual hazard-to-risk relationship seen in Kaplan–Meier analyses or standard survival models. Later in the article, once the subdistribution hazard approach is introduced, we explicitly describe its direct relation with the cumulative incidence function. For these reasons, we believe that the current structure effectively supports readers’ step-by-step understanding of the key concepts and methodological challenges associated with competing risks.

The *VTE and risk of MACE* example in our article was deliberately selected to illustrate how competing risks can lead to meaningful departures from proportionality, thereby producing discrepancies between the cause-specific and subdistribution hazard ratio estimates. This example served as a pedagogical demonstration of how competing risk may yield divergent interpretations across models. We also acknowledge that, under non-proportional hazards, the reported hazard ratios should be interpreted as average estimates across the follow-up period.

We appreciate the observation on Figure 4 in our article, which illustrates left censoring. We agree that the suggested modifications could help readers better understand the connection between the illustrative figure and the accompanying text. However, this figure was designed as a schematic illustration aimed at distinguishing among right-, left-, and interval-censoring through a simplified graphical representation.

We hope this review article offers early-career researchers clear guidance on the fundamental principles and challenges of competing risks and encourages them to think critically when selecting appropriate strategies for conducting valid and meaningful analyses in the presence of competing events.

## Disclosure

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## Reference

1. Muñoz A, Ng DK. An introduction to competing risks in epidemiology [Letter]. *Clin Epidemiol.* 2026;18:1–2. doi:10.2147/CLEP.S606572
2. Sørensen HT, Horváth-Puhó E, Peacock JL. An introduction to competing risks in epidemiology. *Clin Epidemiol.* 2026;18:574928. doi:10.2147/CLEP.S574928

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