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**REPLY FROM  
AUTHORS: A NEW  
SHARED VISION ON  
SURVIVAL ANALYSIS:  
GOOD NEWS FROM  
BALTIMORE**



**Reply to the Editor:**

We read with interest the letter from Van den Eynde and colleagues.<sup>1</sup> We must admit that it is quite difficult to reply to such a beautiful explanation of the main concept of our article. Recently, an increasing number of groups have used competing risk regression analysis to determine the influence of competing events such as mortality. As mentioned in our study, the new model combines this approach with modulated renewal analysis. This combination allows control of competing events and estimates the cause-specific probability of the event of interest at a particular time while allowing for repeated events during follow-up.<sup>2</sup>

Van den Eynde and colleagues<sup>1</sup> have clearly pointed out the most important advantages of this modeling technique when compared with classic Kaplan-Meier survival estimates and Cox regression analysis. Limiting the analysis to the first occurring event at follow-up results in failure to account for subsequent events and for the interactions of these with competing variables, particularly important when several events happen during the follow-up period.<sup>3</sup> Kaplan-Meier and Cox regression models assume independence when there can be multiple causes for the event (so informative censoring is needed to avoid biased estimated of risk).

As noted by some of the reviewers of our article during the peer-review process, modulated renewal is a statistical method that was brilliantly described by Kalbfleisch and Prentice.<sup>4</sup> The terminology derives from industrial analyses (with modulated renewal characterized by the terms *good as new*, *better than new*, and *worse than new*). Although some groups (such as the group from the University of Alabama) have been pioneers in its use, modulated renewal analysis has not been widely applied in the context of



**FIGURE 1.** An evolution of survival analysis is coming: Good news for the cardiac surgery community.

cardiac surgery research. Therefore, the combination of modulated renewal and competing risk regression analysis can be considered a novelty in our field.

It is with great enthusiasm that we welcome the words of Van den Eynde and colleagues.<sup>1</sup> A great deal of effort will be needed in the coming years to promote the evolution of statistical analysis to keep pace with increasing use of big data and the growth of medical technology.<sup>5</sup> Good news from Baltimore! A new shared vision on survival analysis is coming (Figure 1).

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