



**Fig. 1.** Distribution of the Preoperative Score to Predict Postoperative Mortality (POSPOM) values in the validation cohort ( $n = 2,789,932$ ) in relation to the observed in-hospital mortality rate (solid line) at each POSPOM value. Gray line is the predicted probability according to Supplemental Digital Content 3 of the article by Le Manach *et al.*<sup>1</sup>

**Teus H. Kappen, M.D., Ph.D., Jonathan P. Wanderer, M.D., M.Phil., Linda M. Peelen, Ph.D., Karel G. M. Moons, Ph.D., Jesse M. Ehrenfeld, M.D., M.P.H.** Vanderbilt University Medical Center, Nashville, Tennessee (T.H.K.). teus.kappen@vanderbilt.edu

## Reference

1. Le Manach Y, Collins G, Rodseth R, Le Bihan-Benjamin C, Biccard B, Riou B, Devereaux PJ, Landais P: Preoperative score to predict postoperative mortality (POSPOM): Derivation and validation. *ANESTHESIOLOGY* 2016; 124:570–9

(Accepted for publication June 16, 2016.)

## In Reply:

We thank Kappen *et al.* for their interest in our article describing the development of the Preoperative Score to Predict Postoperative Mortality (POSPOM).<sup>1</sup> The inconsistencies are consequences of an unfortunate error in the text (in the validation cohort, a POSPOM score equal to 30 was associated to a predicted in-hospital mortality of 7.40%, and not 5.65%). All tables and figures have been verified and corrected. An erratum has been issued and appears in this issue.<sup>2</sup>

In our validation cohort of 2,789,932 patients, only 22,136 (0.79%) had a predicted risk of in-hospital

mortality greater than 10%. As a consequence, we intentionally presented a truncated calibration plot focusing on the probability range that includes more than 99% of patients. The reporting of calibration for prediction models remains difficult, as underlined by the comment by Kappen *et al.* Graphical analysis of the calibration plot remains the preferred approach.<sup>3,4</sup> However, most patients were at very low risk of in-hospital mortality. This resulted in a heavily left-skewed distribution, making the histogram of predicted probabilities uninformative. Because the calibration plot included more than 99% of patients, we believe that it is correct to state that in the validation cohort, POSPOM “has good calibration with only a small underestimation of in-hospital mortality in the validation cohort for predicted probabilities ranging from 1 to 10%.” However, we agree with the authors that a closer inspection of those patients with high probabilities of in-hospital mortality is required.

As noted by Kappen *et al.*, POSPOM overestimates the risk of in-hospital mortality in patients with a risk greater than 10%. The observed in-hospital mortality in these patients was 13.3%, and the average predicted risk in these patients was 17.1%, as presented in the figure provided by Kappen *et al.*

From a clinical point of view, we believe that any preoperative risk of in-hospital mortality greater than 10% (*i.e.*, 20 times the average risk in our population) reflects very high-risk procedures. The role of a general preoperative assessment tool (*e.g.*, POSPOM) is not to distinguish between patients with a postoperative mortality risk of 23 and 62%, especially as these cases are uncommon (409 patients presented a POSPOM greater than or equal to 40 in the validation cohort, namely, 0.01% of the population). Rather, it aims to identify clinical situations that would require further preoperative investigations to determine an appropriate care strategy.

Beyond the discussion about the appropriateness of the calibration of POSPOM in our validation cohort,<sup>3</sup> we believe that an evaluation of the performance of POSPOM in a completely different cohort (*i.e.*, true external validation) is the necessary next step before implementation of this prediction model.

### Research Support

Supported by Hamilton Anesthesia Associates and the Canadian Network and Centre for Trials Internationally, Hamilton, Ontario, Canada (to Dr. Le Manach). Supported by grant No. G1100513 from the UK Medical Research Council (London, United Kingdom; to Dr. Collins). Supported by a CIHR Scholarship (Canada-HOPE Scholarship, Toronto, Ontario, Canada), the College of Medicine of South Africa (Phyllis Kocker/Bradlow Award, Cape Town, South Africa), and the University of KwaZulu-Natal (Competitive Research Grant, Durban, South Africa; to Dr. Rodseth). Supported by Career Investigator Award of Heart and Stroke Foundation of Ontario, Canada (to Dr. Devereaux).

### Competing Interests

The authors declare no competing interests.

**Yannick Le Manach, M.D., Ph.D., Reitze Rodseth, M.B.Ch.B., Ph.D., Christine Le Bihan-Benjamin, M.D., M.Sc., Bruce Biccard, M.B.Ch.B., Ph.D., Bruno Riou, M.D., Ph.D., P. J. Devereaux, M.D., Ph.D., Paul Landais, M.D., Ph.D., Gary Collins, Ph.D.** McMaster University and the Perioperative Research Group, Population Health Research Institute, Hamilton, Ontario, Canada (Y.L.M.). yannick.lemanach@phri.ca

### References

1. Le Manach Y, Collins G, Rodseth R, Le Bihan-Benjamin C, Biccard B, Riou B, Devereaux PJ, Landais P: Preoperative Score to Predict Postoperative Mortality (POSPOM): Derivation and validation. *ANESTHESIOLOGY* 2016; 124:570–9
2. Preoperative Score to Predict Postoperative Mortality (POSPOM): Derivation and Validation: Erratum. *ANESTHESIOLOGY* 2016; 125: 817.
3. Collins GS, Reitsma JB, Altman DG, Moons KG: Transparent reporting of a multivariable prediction model for Individual Prognosis Or Diagnosis (TRIPOD). *Ann Intern Med* 2015; 162:735–6
4. Moons KG, Altman DG, Reitsma JB, Ioannidis JP, Macaskill P, Steyerberg EW, Vickers AJ, Ransohoff DF, Collins GS: Transparent reporting of a multivariable prediction model for Individual Prognosis or Diagnosis (TRIPOD): Explanation and elaboration. *Ann Intern Med* 2015; 162:W1–73

(Accepted for publication June 16, 2016.)

### ERRATUM

#### Preoperative Score to Predict Postoperative Mortality (POSPOM): Derivation and Validation: Erratum

In the March 2016 issue, the article beginning on page 570 included errors in the last paragraph of the Results section. The published paragraph and the corrected paragraph are included below, with the corrections in red.

#### Last paragraph of the Results section (published version):

In the validation cohort, POSPOM score equal to 30 (*i.e.*, predicted in-hospital mortality = 5.65%) was associated with an observed in-hospital mortality of 6.74% (95% CI, 6.40 to 7.08%). The distribution of POSPOM and the associated observed in-hospital mortality in the validation cohort are shown in figure 3. POSPOM values less than or equal to 20 were associated with a probability of in-hospital mortality less than or equal to 0.32% (*i.e.*, less than the in-hospital mortality observed in the full population—the average risk); a POSPOM value of 25 equates to a probability of in-hospital mortality of 1.37% (*i.e.*, about three times the average risk), and POSPOM values of 30 and 40 equate to probabilities of in-hospital mortality of, respectively, 5.65 and 20.51% (*i.e.*, 10 and 40 times the average risk).