## TRIPOD Checklist: Prediction Model Development and Validation

| Section                     | Item | Checklist description                                                                 | Reported on Page Number/Line Number | Reported on Section/Paragraph |
|-----------------------------|------|----------------------------------------------------------------------------------------|-------------------------------------|-----------------------------|
| **Title and abstract**      | 1    | D;V Identify the study as developing and/or validating a multivariable prediction model, the target population, and the outcome to be predicted. | Page1 LINE1-2                       | title/Paragraph 1                  |
|                             | 2    | D;V Provide a summary of objectives, study design, setting, participants, sample size, predictors, outcome, statistical analysis, results, and conclusions. | Page2 LINE31-61                     | abstract/Paragraph 1            |
| **Introduction**            | 3a   | D;V Explain the medical context (including whether diagnostic or prognostic) and rationale for developing or validating the multivariable prediction model, including references to existing models. | Page3 LINE66-108                    | introduction/Paragraph 1     |
|                             | 3b   | D;V Specify the objectives, including whether the study describes the development or validation of the model or both. | Page4 LINE102-108                   | introduction/Paragraph 3    |
| **Methods**                 | 4a   | D;V Describe the study design or source of data (e.g., randomized trial, cohort, or registry data), separately for the development and validation data sets, if applicable. | Page4 LINE110-122                   | methods/Paragraph 1            |
|                             | 4b   | D;V Specify the key study dates, including start of accrual; end of accrual; and, if applicable, end of follow-up. | Page4 LINE115                       | methods/Paragraph 1            |
| **Participants**            | 5a   | D;V Specify key elements of the study setting (e.g., primary care, secondary care, general population) including number and location of centres. | Page4 LINE110-122                   | methods/Paragraph 1            |
|                             | 5b   | D;V Describe eligibility criteria for participants.                                      | Page4 LINE116-128                   | methods/Paragraph 1-2          |
|                             | 5c   | D;V Give details of treatments received, if relevant.                                    | Page4 LINE123-128                   | methods/Paragraph 2            |
| **Outcome**                 | 6a   | D;V Clearly define the outcome that is predicted by the prediction model, including how and when assessed. | Page5 LINE129-146                   | methods/Paragraph 3            |
|                             | 6b   | D;V Report any actions to blind assessment of the outcome to be predicted.               | Page5 LINE130-134                   | methods/Paragraph 3            |
| **Predictors**              | 7a   | D;V Clearly define all predictors used in developing or validating the multivariable prediction model, including how and when they were measured. | Page5 LINE147-165                   | methods/Paragraph 4-5           |
|                             | 7b   | D;V Report any actions to blind assessment of predictors for the outcome and other predictors. | Page5 LINE147-165                   | methods/Paragraph 4-5           |
| **Sample size**             | 8    | D;V Explain how the study size was arrived at.                                           | no                                  | no                           |
| Topic | Section | Type | Description | Actions | Related Sections |
|-------|---------|------|-------------|---------|------------------|
| Missing data | 9 | D;V | Describe how missing data were handled (e.g., complete-case analysis, single imputation, multiple imputation) with details of any imputation method. | no | no |
| Statistical analysis methods | 10a | D | Describe how predictors were handled in the analyses. | Page5/Li ne141-146 | methods/Paragraph3 |
| 10b | D | Specify type of model, all model-building procedures (including any predictor selection), and method for internal validation. | Page5/Li ne141-146 | methods/Paragraph3 |
| 10c | V | For validation, describe how the predictions were calculated. | Page5/Li ne147-156 | methods/Paragraph4 |
| 10d | D;V | Specify all measures used to assess model performance and, if relevant, to compare multiple models. | Page5/Li ne147-156 | methods/Paragraph4 |
| 10e | V | Describe any model updating (e.g., recalibration) arising from the validation, if done. | no | no |
| Risk groups | 11 | D;V | Provide details on how risk groups were created, if done. | no | no |
| Development vs. validation | 12 | V | For validation, identify any differences from the development data in setting, eligibility criteria, outcome, and predictors. | Page5/Li ne147-156 | methods/Paragraph4 |
| Results | Participants | 13a | D;V | Describe the flow of participants through the study, including the number of participants with and without the outcome and, if applicable, a summary of the follow-up time. A diagram may be helpful. | Page6/Li ne168-179 | results/Paragraph1 |
| 13b | D;V | Describe the characteristics of the participants (basic demographics, clinical features, available predictors), including the number of participants with missing data for predictors and outcome. | Page6/Li ne168-192 | results/Paragraph1-2 |
| 13c | V | For validation, show a comparison with the development data of the distribution of important variables (demographics, predictors and outcome). | Page6/Li ne183-227 | results/Paragraph2-5 |
| Model development | 14a | D | Specify the number of participants and outcome events in each analysis. | Page6/Li ne168-179 | results/Paragraph1 |
| 14b | D | If done, report the unadjusted association between each candidate predictor and outcome. | no | no |
| Model specification | 15a | D | Present the full prediction model to allow predictions for individuals (i.e., all regression coefficients, and model intercept or baseline survival at a given time point). | Page9/Li ne210-232 | results/Paragraph4-5 |
| 15b | D | Explain how to use the prediction model. | Page9/Li ne216-220 | results/Paragraph4 |
| Model performance | 16 | D;V | Report performance measures (with CIs) for the prediction model. | Page9/Li ne216-220 | results/Paragraph4 |
| Model-updating | 17 | V | If done, report the results from any model updating (i.e., model specification, model performance). | no | no |

Discussion

Limitations | 18 | D;V | Discuss any limitations of the study (such as nonrepresentative sample, few events per predictor, missing data). | Page12/Li ne302-309 | discussion/Paragraph7 |
| Interpretation | 19a | V | For validation, discuss the results with reference to performance in the development data, and any other validation data. | Page10/Li ne249-301 | Discussion on Paragraph 3-6 |
| Interpretation | 19b | D;V | Give an overall interpretation of the results, considering objectives, limitations, and results from similar studies, and other relevant evidence. | Page10/Li ne249-301 | Discussion on Paragraph 36 |
| Implications | 20 | D;V | Discuss the potential clinical use of the model and implications for future research. | Page13/Li ne311-314 | Conclusion on Paragraph 1 |

**Other information**

| Supplementary information | 21 | D;V | Provide information about the availability of supplementary resources, such as study protocol, Web calculator, and data sets. | no | no |
| Funding | 22 | D;V | Give the source of funding and the role of the funders for the present study. | Page13/Li ne316-317 | Funding/Paragraph 1 |

* Items relevant only to the development of a prediction model are denoted by D, items relating solely to a validation of a prediction model are denoted by V, and items relating to both are denoted D;V. We recommend using the TRIPOD Checklist in conjunction with the TRIPOD Explanation and Elaboration document.

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*As the checklist was provided upon initial submission, the page number/line number reported may be changed due to copyediting and may not be referable in the published version. In this case, the section/paragraph may be used as an alternative reference.