TRIPOD Checklist: Prediction Model Development and Validation

Section	Item		Checklist description	Reported on Page Number/Line Number	Reported on Section/Paragraph
Title and abstract					
Title	1	D;V	Identify the study as developing and/or validating a multivariable prediction model, the target population, and the outcome to be predicted.	page 1 / line 1-3	Title
Abstract	2	D;V	Provide a summary of objectives, study design, setting, participants, sample size, predictors, outcome, statistical analysis, results, and conclusions.	page 1 / line26-32 page 2 / line 1-21	Abstract
Introduction					
Background and objectives	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.	page 2 / line 26-29 page 3 / line 1-30 page 4 / line 1-15	Introduction/Paragraph 1-4
	3b	D;V	Specify the objectives, including whether the study describes the development or validation of the model or both.	page 4 / line 16-18	Introduction/Paragraph 5
Methods					
Source of data	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, ifapplicable.	page 4 / line 26-29	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.	page 4 / line 28-29 page 5 / line 10	Methods/Paragraph 1 Methods/Paragraph 5
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.	page 4 / line 26-29	Methods/Paragraph 1
	5b	D;V	Describe eligibility criteria for participants.	page 5 / line 1-8	Methods/Paragraph 2-3
	5c	D;V	Give details of treatments received, if relevant.	page 5 / line 9-15	Methods/Paragraph 4
Outcome	6a	D;V	Clearly define the outcome that is predicted by the prediction model, including how and when assessed.	page 6 / line 15-30 page 7 / line 1-3	Methods/Paragraph 6-7
	6b	D;V	Report any actions to blind assessment of the outcome to be predicted.	page 7 / line 8-10	Methods/Paragraph 7
Predictors	7a	D;V	Clearly define all predictors used in developing or validating the multivariable prediction model, including how and when they were measured.	page 5 / line 19-21 page 6 / line 1-30 page 7 / line 1-16	Methods/Paragraph 5-8
	7b	D;V	Report any actions to blind assessment of predictors for the outcome and other predictors.	page 7 / line 8-10	Methods/Paragraph 7
Sample size	8	D;V	Explain how the study size was arrived at.	page 5 / line 19-20	Methods/Paragraph 5

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.	page 7 / line 17-20	Methods/Paragraph 8
Statistical analysis methods	10a	D	Describe how predictors were handled in the analyses.	page 8 / line 26-30	Methods/Paragraph 12
	10b	D	Specify type of model, all model-building procedures (including any predictor selection), and method for internal validation.	page 7 / line 29-30 page 8 / line 1	Methods/Paragraph 10
	10c	V	For validation, describe how the predictions were calculated.	page 9 / line 2-4	Methods/Paragraph 12
	10d	D;V	Specify all measures used to assess model performance and, if relevant, to compare multiple models.	page 8 / line 1-11	Methods/Paragraph 10
	10e	V	Describe any model updating (e.g., recalibration) arising from the validation, if done.	N/A	N/A
Risk groups	11	D;V	Provide details on how risk groups were created, if done.	N/A	N/A
Development vs. validation	12	V	For validation, identify any differences from the development data in setting, eligibility criteria, outcome, and predictors.	N/A	N/A
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.	page 5 / line 17	Methods/Figure 1
	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.	page 9 / line 11-27 page 11 / line 3-9	Result/Paragraph 1-2
	13c	V	For validation, show a comparison with the development data of the distribution of important variables (demographics, predictors and outcome).	page 11 / line 1	Result/Table 2
Model development	14a	D	Specify the number of participants and outcome events in each analysis.	page 9 / line 11-27 page 11 / line 3-9	Result/Paragraph 1-2
	14b	D	If done, report the unadjusted association between each candidate predictor and outcome.	N/A	N/A
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).	page 11 / line 12-15	Result/Paragraph 3
	15b	D	Explain how to the use the prediction model.	N/A	N/A
Model performance	16	D;V	Report performance measures (with CIs) for the prediction model.	page 11 / line 16-17 page 12 / line 1-14	Result/Paragraph 4
Model-updating	17	V	If done, report the results from any model updating (i.e., model specification, model performance).	N/A	N/A
Discussion					
Limitations	18	D;V	Discuss any limitations of the study (such as nonrepresentative sample, few events per predictor, missing data).	page 19 / line 19-30	Discussion/Paragraph 7

Interpretation	19a	V	For validation, discuss the results with reference to performance in the development data, and any other validation data.	age 16 / line 19-30 page 17 / line 1-26 page 18 / line 18-30	Discussion/Paragraph 3 Discussion/Paragraph 5
	19b	D;V	Give an overall interpretation of the results, considering objectives, limitations, and results from similar studies, and other relevant evidence.	page 17 / line 15-20	Discussion/Paragraph 3
Implications	20	D;V	Discuss the potential clinical use of the model and implications for future research.	page 19 / line 12-18	Discussion/Paragraph 6
Other information					
Supplementary information	21	D;V	Provide information about the availability of supplementary resources, such as study protocol, Web calculator, and data sets.	N/A	N/A
Funding	22	D;V	Give the source of funding and the role of the funders for the present study.	N/A	N/A

* 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.