Annex

**Appendix 1** PubMed search strategy

| Search number | Query |
|---|---|
| **13** | #3 AND #6 AND #9 AND #12 |
| **12** | #10 OR #11 |
| **11** | "Predictive variabl*"[TIAB] OR "Risk factors"[TIAB] OR "Util*"[TIAB] OR "value*"[tiab] OR "tool*"[tiab] OR "index"[tiab] OR "indices"[tiab] OR "assess*"[tiab] OR "risk prediction"[TIAB] OR "risk score"[TIAB] OR "risk calculation"[TIAB] OR "risk assessment"[TIAB] |
| **10** | "Risk"[Mesh] |
| **9** | #7 OR #8 |
| **8** | "Data mining*"[TIAB] OR "Forecasting*"[TIAB] OR "Explanatory modelling"[TIAB] OR "Neural Networks*"[TIAB] OR "Support Vector Machine"[TIAB] OR "Naïve Bayesian classifier"[TIAB] OR "Logistic regression"[TIAB] OR "heuristic approach*"[TIAB] OR "Statistical approach*"[TIAB] OR "c-statistic*"[tiab] OR "ROC"[tiab] OR "nomogram"[tiab] OR "indicat*"[tiab] OR "calibration"[tiab] OR "area under the curve"[tiab] OR "area under the receiver operator characteristic curve"[tiab] OR "Predictive Value of Tests"[TIAB] |
| **7** | "Regression Analysis"[Mesh] OR "Algorithms"[Mesh] OR |

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| | "Nomograms"[mesh] OR "Prognosis"[Mesh:NoExp] OR "Support Vector Machine"[Mesh] OR "Area Under Curve"[Mesh] |
| **6** | #4 OR #5 |
| **5** | "Rehosp*"[TIAB] OR "Discharge"[TIAB] OR "Unplanned readmission*"[TIAB] OR "Readmission*"[tiab] OR "Re-admission*"[tiab] OR "Readmit*"[tiab] OR "Repeat*"[tiab] OR "Admission*"[tiab] |
| **4** | "Patient Readmission"[Mesh] OR "Hospitalization*"[Mesh] OR Hospital*"[Mesh] |
| **3** | #1 OR #2 |
| **2** | "Pulmonary Emphysema*"[TIAB] OR "Chronic Pulmonary disease*"[TIAB] OR "COPD*"[TIAB] |
| **1** | "Pulmonary Disease, Chronic Obstructive"[Mesh] |

**Appendix 2** CHARMS 2014 Relevant items to extract from individual studies in a systematic review of prediction models[32].

| Domain | Key items | Reported |
|---|---|---|
| **Source of data** | Source of data (e.g., cohort, case-control, randomized trial participants, or registry data) | |
| **Participants** | Participant eligibility and recruitment method (e.g., consecutive participants, location, number of centers, setting, inclusion and exclusion criteria) | |
| | Participant description | |
| | Details of treatments received, if relevant | |
| | Study dates | |
| **Outcome(s) to be predicted** | Definition and method for measurement of outcome | |
| | Was the same outcome definition (and method for measurement) used in all patients? | |
| | Type of outcome (e.g., single or combined endpoints) | |
| | Was the outcome assessed without knowledge of the candidate predictors (i.e., blinded)? | |
| | Were candidate predictors part of the outcome (e.g., in panel or consensus diagnosis)? | |
| | Time of outcome occurrence or summary of duration of follow-up | |
| **Candidate predictors (or index tests)** | Number and type of predictors (e.g., demographics, patient history, physical examination, additional testing, disease characteristics) | |
| | Definition and method for measurement of candidate predictors | |
| | Timing of predictor measurement (e.g., at patient presentation, at diagnosis, at treatment initiation) | |

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| | Were predictors assessed blinded for outcome, and for each other (if relevant)? |
| | Handling of predictors in the modelling (e.g., continuous, linear, non-linear transformations or categorised) |
| **Sample size** | Number of participants and number of outcomes/events |
| | Number of outcomes/events in relation to the number of candidate predictors (Events Per Variable) |
| **Missing data** | Number of participants with any missing value (include predictors and outcomes) |
| | Number of participants with missing data for each |
| | Handling of missing data (e.g., complete-case analysis, imputation, or other methods) |
| **Model development** | Modelling method (e.g., logistic, survival, neural network, or machine learning techniques) |
| | Modelling assumptions satisfied |
| | Method for selection of predictors for inclusion in multivariable modelling (e.g., all candidate predictors, pre-selection based on unadjusted association with the |
| | Method for selection of predictors during multivariable modelling (e.g., full model approach, backward or forward selection) and criteria used (e.g., p-value, Akaike Information Criterion) |
| | Shrinkage of predictor weights or regression coefficients (e.g., no shrinkage, uniform shrinkage, penalized |
| **Model** | Calibration (calibration plot, calibration slope, Hosmer-Lemeshow test) and Discrimination |

| | | |
|---|---|---|
| **performance** | Classification measures (e.g., sensitivity, specificity, predictive values, net reclassification improvement) and whether a-priori cut points were used | |
| **Model Evaluation** | Method used for testing model performance: development dataset only (random split of data, resampling methods e.g. bootstrap or cross-validation, none) or separate external validation (e.g. temporal, geographical, different setting, different investigators) | |
| | In case of poor validation, whether model was adjusted or updated (e.g., intercept recalibrated, predictor effects adjusted, or new predictors added) | |
| **Results** | Final and other multivariable models (e.g., basic, extended, simplified) presented, including predictor weights or regression coefficients, intercept, baseline survival, model performance measures (with standard errors or confidence intervals) | |
| | Any alternative presentation of the final prediction models, e.g., sum score, nomogram, score chart, predictions for specific risk subgroups with performance | |
| | Comparison of the distribution of predictors (including | |
| **Interpretation and discussion** | Interpretation of presented models (confirmatory, i.e., model useful for practice versus exploratory, i.e., more research needed) | |

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| | Comparison with other studies, discussion of generalizability, strengths and limitations. |

**Appendix 3** PROBAST: Assessment of Risk of Bias and Concerns Regarding Applicability[34]

| **1. Participants** | **2. Predictors** | **3. Outcome** | **4. Analysis** |
|---|---|---|---|
| **Signaling questions** | | | |
| **1.1.** Were appropriate data sources used, e.g., cohort, RCT, or nested case-control study data? | **2.1.** Were predictors defined and assessed in a similar way for all participants? | **3.1.** Was the outcome determined appropriately? | **4.1.** Were there a reasonable number of participants with the outcome? |
| **1.2.** Were all inclusions and exclusions of participants appropriate? | **2.2.** Were predictor assessments made without knowledge of outcome data? | **3.2.** Was a prespecified or standard outcome definition used? | **4.2.** Were continuous and categorical predictors handled appropriately? |
| | **2.3.** Are all predictors available at the time the model is intended to be used? | **3.3.** Were predictors excluded from the outcome definition? | **4.3.** Were all enrolled participants included in the analysis? |
| | | **3.4.** Was the outcome defined and determined in a similar way for all | **4.4.** Were participants with missing data handled appropriately? |

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|---|---|---|---|
| | | participants?<br>**3.5.** Was the outcome determined without knowledge of predictor information?<br>**3.6.** Was the time interval between predictor assessment and outcome determination appropriate? | **4.5.** Was selection of predictors based on univariable analysis avoided?<br>**4.6.** Were complexities in the data (e.g., censoring, competing risks, sampling of control participants) accounted for appropriately?<br>**4.7.** Were relevant model performance measures evaluated appropriately?<br>**4.8.** Were model overfitting, underfitting, and optimism in model performance accounted for?<br>**4.9.** Do predictors and |

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| | | | their assigned weights in the final model correspond to the results from the reported multivariable analysis? |
| **ROB**<br>Selection of participants | Predictors or their assessment | Outcome or its determination | Analysis |
| **Applicability**<br>Included participants or setting does not match the review question | Definition, assessment, or timing of predictors does not match the review question | Its definition, timing, or determination does not match the review question | |

RCT = randomized controlled trial; ROB = risk of bias. Signaling questions are answered as yes, probably yes, probably no, no, or no information. ROB and concerns for applicability are rated as low, high, or unclear.