

External validation, impact assessment and clinical utilization of clinical prediction models: a prospective cohort study



Banafsheh Arshi¹, PhD MD; Laura Elizabeth Cowley², PhD, Eline Rijnhart¹, Msc, Kelly Reeve³, PhD, Luc J. Smits¹, PhD; Laure Wynants^{1,4,5*}, PhD

¹ Department of Epidemiology, CAPHRI School for Public Health and Primary Care, Faculty of Health, Medicine and Life Sciences, Maastricht University, Maastricht, the Netherlands; ² Population Data Science, Swansea University Medical School, Wales, United Kingdom; ³ Department of Epidemiology, Biostatistics and Prevention Institute, Department of Biostatistics, University of Zurich, Hirschengraben 84, CH-8 001 Zurich, Switzerland; ⁴ Department of Development and Regeneration, KU Leuven, Leuven, Belgium; ⁵ Leuven Unit for Health Technology Assessment Research (LUHTAR), KU Leuven, Leuven, Belgium

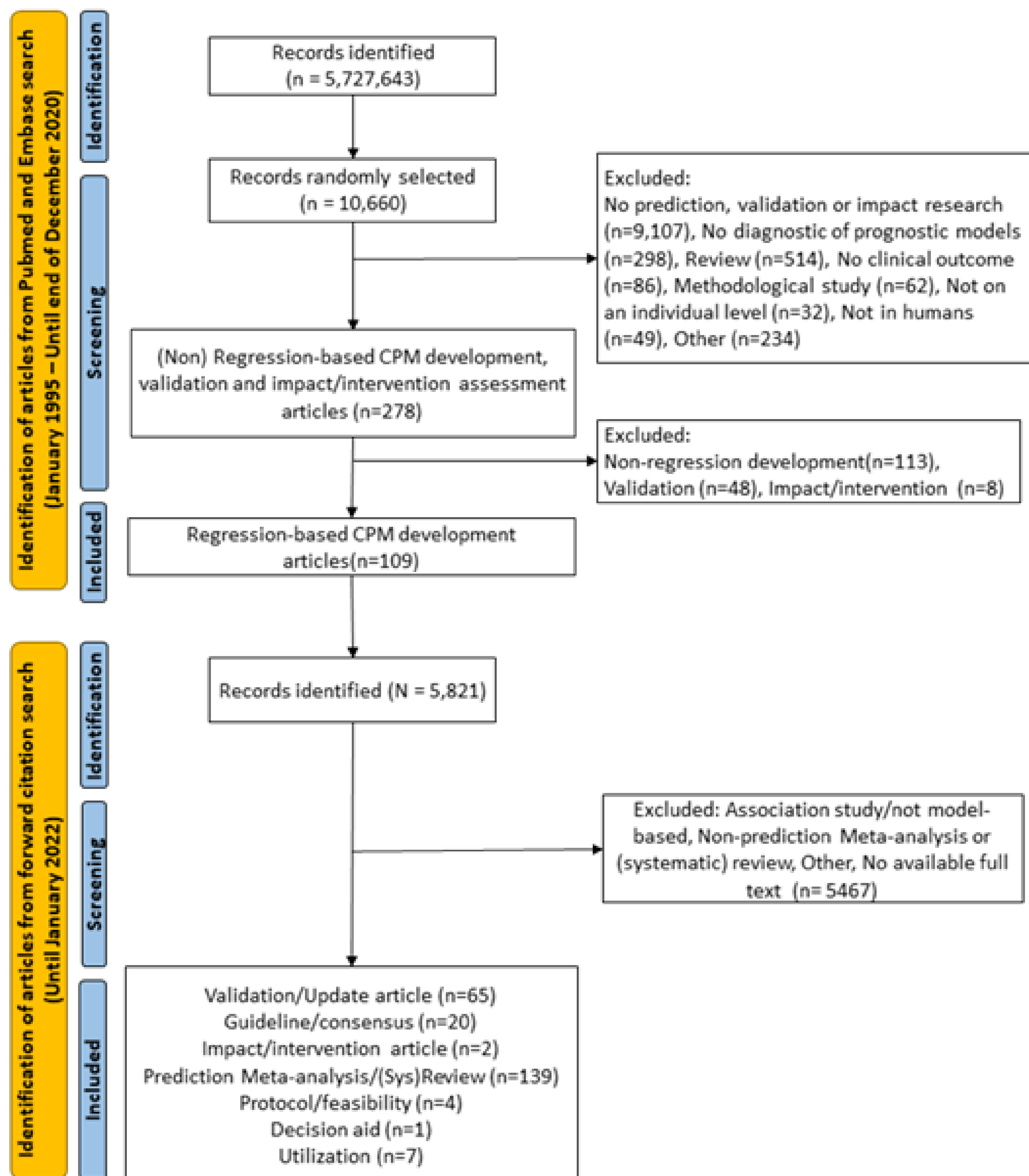
Despite evidence of their utilization in clinical settings, few clinical prediction models have been externally validated, and published impact assessment is very rare.

BACKGROUND

Despite the surge in development of clinical prediction models (CPMs), their rate of adoption in clinical practice is unknown. External validation and impact assessment are crucial steps in determining whether a model is suitable for use in clinical practice.

METHODS

We followed a random sample of 109 regression-based CPMs by performing a forward citation search for external validation, impact assessment and implementation studies. We estimated five- and ten-year probabilities of external validation, impact assessment and implementation of CPMs using Kaplan-Meier analysis. We also conducted a survey of the authors of the CPM development articles, to determine whether the CPMs are utilized in a clinical setting.

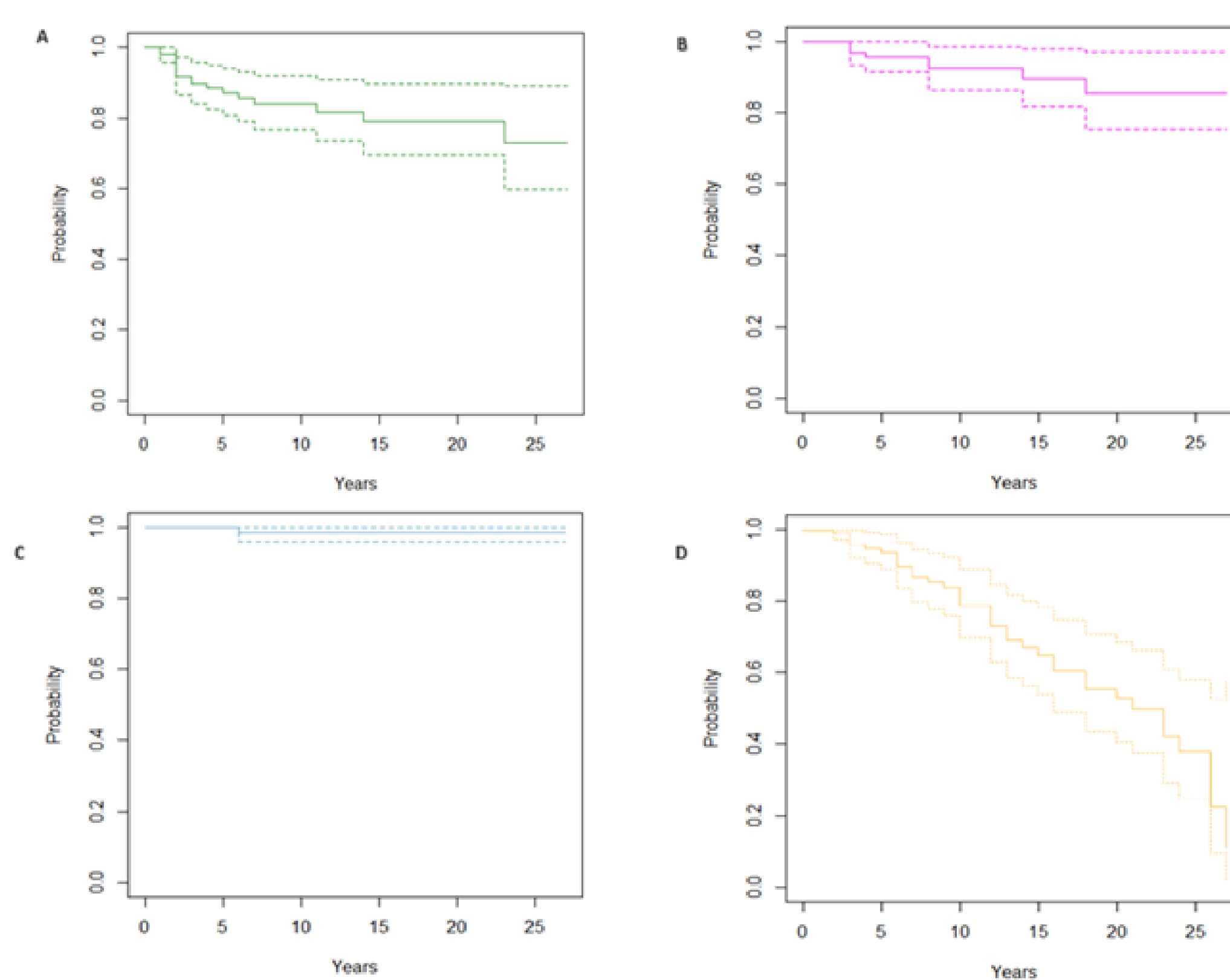


RESULTS

Among the 109 CPMs, 18 (17%) were externally validated after development. The five- and ten-year probabilities of validation for a CPM were 0.13 and 0.16, respectively. Only one CPM had undergone impact assessment (ten-year probability: 0.01). Among the 34 (31%) CPM articles with a response to our questionnaire, 17 (50%) had been used in clinical practice. Among these, 4 (24%) had been externally validated after development, 2 (12%) were recommended for use in a guideline/consensus article and none had undergone impact assessment.

RESULTS CONTINUED

Kaplan-Meier plot for the time to first external validation (A), guideline/consensus (B), impact/intervention (C), and inclusion in a review after CPM development publication (D) (N=109)



Characteristics and fate of CPM development articles, by use in clinical practice (based on questionnaire responses from development authors, N=34)

	Used in clinical practice (N=17)	Not used in clinical practice (N=17)
Characteristics		
Type of model, n (%)		
Prognostic	13 (76)	8 (47)
Diagnostic	4 (24)	9 (53)
Sample size, median	515	441
Number of Events, median	76	76
Calibration information reported, n (%)	5 (29)	4 (24)
C-statistic reported reported, n (%)	13 (76)	15 (88)
Final model presented	5 (29)	6 (35)
Fate		
External validation after development, n (%)	4 (24)	2 (12)
Impact assessment/intervention study after development, n (%)	0 (0)	0 (0)
CPM development articles mentioned in guideline/consensus statement after development, n (%)	4 (24)	1 (6)
CPM development articles included in (Systematic) reviews/meta-analyses, n (%)	5 (29)	6 (35)

CONCLUSIONS

About one in six clinical prediction models is externally validated after initial publication, but impact assessment is very rare. While half of survey responders reported CPM use in clinical settings, the majority of these had no published external validation study and none had a published impact assessment study. Efforts are needed to increase the conduct and publication of validations and impact assessments to advance the field of clinical prediction research and ensure patient safety.

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