Predicting Postpartum Haemorrhage: A Systematic Review of Prognostic Models

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Background: Postpartum Haemorrhage (PPH) remains the leading cause of maternal mortality and morbidity worldwide, and the rate is increasing. Using a reliable prognostic model could identify those at risk, support management and treatment, and improve maternal outcomes.

Aims: To systematically identify and appraise existing prognostic models for PPH and ascertain their suitability for clinical use.

Methods: MEDLINE, CINAHL, Embase, and the Cochrane Library were searched using combinations of terms and synonyms including 'postpartum haemorrhage', 'prognostic model', and 'risk factors'. Observational or experimental studies describing a prognostic model for risk of PPH, published in English were included. The checklist for critical appraisal and data extraction for systematic reviews of prediction modelling studies (CHARMS) informed data extraction and risk of bias was assessed using the prediction model risk of bias assessment tool (PROBAST).

Results: 1,612 records were screened; 16 studies met the inclusion criteria reporting the development of prognostic models from 8 different countries. Models were developed for women who experienced vaginal birth (n=7), caesarean birth (n=2), any mode of birth (n=2), hypertensive disorders (n=1) and abnormal placentation (n=4). Three studies used internal validation to evaluate model performance, and only two validated performance in an external dataset. All of the models had high risk of bias, in terms of validity and applicability, according to the PROBAST criteria (Table 1).

Discussion: Evaluation of model performance and clinical impact was limited, as most of the models were not externally validated. No existing prognostic models for PPH are ready for clinical application. Future research is needed to externally validate existing models and potentially develop a new model that is reliable and applicable to clinical practice.

Table 1: Assessment of risk of bias and applicability of the studies according to the PROBAST criteria. (+) indicate low risk of bias, (-) indicate high risk of bias and (?) indicate unclear risk of bias.

Study	Risk of Bias				Applicability			Overall	
	Participants	Predictors	Outcome	Analysis	Participants	Predictors	Outcome	Risk of bias	Applicability
Chen et al., 2011	+	+	+	-	+	-	-	-	-
Helman et al., 2015	-	+	+	-	+	+	+	-	+
Koopmans et al., 2014	+	+	+	-	+	+	+	-	+
Prata et al., 2011	+	-	+	-	+	-	+	-	-
Biguzzi et al., 2012	+	-	+	-	+	+	+	-	+
Peyvandi et al., 2012	+	-	+	-	+	-	+	-	+
Niepraschk-von Dollen et al., 2016	+	+	+	-	+	+	+	-	+
Rubio-Alvarez et al., 2018	+	+	+	-	+	+	+	-	+
Tsu, 1994	-	?	-	-	+	?	+	-	?
Sittiparn & Siwadune, 2017	+	+	+	-	+	+	+	-	+
Suta et al., 2015	+	-	-	-	+	-	+	-	-
Dunkerton et al., 2017	+	+	-	-	+	+	+	-	+
Lee et al., 2018	+	-	-	-	-	+	+	-	-
Sei et al., 2018	+	-	+	-	+	-	+	-	-
Shinohara et al., 2018	+	-	-	-	-	-	+	-	-
Wu et al., 2019	+	+	-	-	-	?	+	-	-

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