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# Risk Prediction Models for Postoperative Nausea and Vomiting in Adults Undergoing Thyroid Surgery: A Protocol for a Systematic Review and Critical Appraisal

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## ADMINISTRATIVE INFORMATION

**Support -** No funding.

**Review Stage at time of this submission -** The review has not yet started.

**Conflicts of interest -** The authors report no conflicts of interest in this work. None of the authors has financial or non-financial relationships with the products, organisations, or studies to be evaluated. Should an author be involved in a study eligible for this review, assessment of that study will be assigned to reviewers without such a relationship. The authors declare that there is no conflict of interest.

**INPLASY registration number:** INPLASY2026100046

**Amendments -** This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 1 October 2026 and was last updated on 16 November 2026.

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## INTRODUCTION

**Review question / Objective** Population: Patients aged ≥18 years undergoing thyroid surgery, including lobectomy, subtotal/near-total thyroidectomy, total thyroidectomy, and cervical lymph node dissection, irrespective of benign or malignant diagnosis.
Index: Any type of multivariable prediction model (prognostic model) intended to predict the risk of PONV after thyroid surgery, whether or not it has been validated.
Comparator: Not applicable.
Outcome: Postoperative nausea and vomiting (PONV), comprising nausea, vomiting, or retching, occurring within 24 h after surgery, including early PONV (0–6 h) and late PONV (6–24 h).
Timing: (1) Time of model use: at preoperative assessment or after emergence from anesthesia in the PACU. (2) Time window of the outcome: within 24 h after surgery, including the period in the PACU.
Setting: Post-anesthesia care units (PACUs) and wards in hospitals at all levels.
Objectives: (1) to compare in detail the available prediction models for PONV after thyroid surgery; (2) to summarise their key characteristics; (3) to critically appraise the methodological quality of the included studies using PROBAST+AI; and (4) to provide evidence-based recommendations for selecting prediction models in clinical practice and for future research.

**Rationale** PONV is a common and distressing complication of thyroid surgery. It is associated with potentially serious consequences, including wound dehiscence, postoperative bleeding, cervical haematoma with airway obstruction, aspiration, dehydration, and electrolyte disturbance, as well as prolonged hospital stay and increased healthcare costs. Without prophylaxis, PONV occurs in approximately 30%–40% of general surgical patients, whereas the incidence reaches 60%–84% in patients undergoing thyroid surgery. Widely used generic tools such as the simplified Apfel risk score and the Koivuranta score were derived in mixed surgical populations and do not account for the specific features of thyroid surgery (neck hyperextension, surgical handling of the neck, and intraoperative vagal stimulation). Several thyroid-surgery-specific models have recently been published, but they differ substantially in predictors, sample size, modelling method, validation strategy, performance measures, and outcome definitions. Existing systematic reviews have addressed machine-learning PONV models in the general surgical population (Patel and Dexter, 21 studies, appraised with TRIPOD+AI) or perioperative artificial-intelligence prediction models overall (Ramanujam et al., 22 studies, appraised with PROBAST+AI); however, to our knowledge, no systematic review and critical appraisal of PONV risk prediction models specifically in patients undergoing thyroid surgery has been published. This review will address that evidence gap.

**Condition being studied** Postoperative nausea and vomiting (PONV) in adults undergoing thyroid surgery. PONV is defined as nausea and/or vomiting, including retching, occurring within 24 hours of the end of surgery and including the period spent in the post-anesthesia care unit (PACU). Nausea is the subjective sensation of the urge to vomit; vomiting is the forceful expulsion of gastric contents through the mouth; retching refers to labored, spasmodic, rhythmic contractions of the respiratory muscles without expulsion of gastric contents. PONV within 24 hours is commonly divided into an early window (0–6 h postoperatively, usually spent in the PACU) and a late window (6–24 h postoperatively). Thyroid surgery comprises lobectomy, subtotal or near-total thyroidectomy, total thyroidectomy, and cervical lymph node dissection, performed for benign nodules, thyroid cancer, or other indications.

## METHODS

**Participant or population** Adults aged 18 years or older undergoing thyroid surgery — lobectomy, subtotal or near-total thyroidectomy, total thyroidectomy, and cervical lymph node dissection — irrespective of the underlying diagnosis (benign nodule, hyperthyroidism, thyroid cancer, or other). Patients with different diagnoses and procedures will be considered as a single population, for two reasons: regardless of indication, thyroid surgery involves the same anatomical region and a broadly consistent anaesthetic pathway (general anaesthesia, neck hyperextension, intraoperative vagal stimulation), so the pathophysiological mechanisms underlying PONV are homogeneous; and restricting the review to a single diagnosis or procedure would yield too few prediction-model studies. We will record surgical procedure, duration of surgery, and anaesthetic technique separately and explore them in subgroup analyses—eligible setting: PACUs and wards in hospitals at all levels.

**Intervention** Not applicable as an intervention. Multivariable prognostic prediction models developed to predict the risk of postoperative nausea and vomiting (PONV) after thyroid surgery,

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regardless of whether the models have undergone internal or external validation.

**Comparator** Not applicable. This is a systematic review of prognostic prediction models, and no comparative intervention is required.

**Study designs to be included** Prediction model development and/or validation studies (prognostic model studies) of any design, including retrospective cohort studies, prospective cohort studies, and case-control studies. Because the objective concerns the performance and methodological quality of prediction models rather than intervention effects, we do not restrict study design; we will record and report different designs and validation approaches (internal vs. external) separately rather than pooling them.

**Eligibility criteria** Eligibility criteria were formulated using the PICOTS (Population, Index, Comparator, Outcome, Timing, Setting) framework,a refinement of the classic PICO framework that additionally incorporates temporal and clinical setting considerations.
Population: Patients aged ≥18 years undergoing thyroid surgery, including lobectomy, subtotal/near-total thyroidectomy, total thyroidectomy, and cervical lymph node dissection, irrespective of benign or malignant diagnosis.
Index: Any type of multivariable prediction model (prognostic model) intended to predict the risk of PONV after thyroid surgery, whether or not it has been validated.
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Timing: (1) Time of model use: at preoperative assessment or after emergence from anesthesia in the PACU. (2) Time window of the outcome: within 24 h after surgery, including the period in the PACU.
Setting: Post-anesthesia care units (PACUs) and wards in hospitals at all levels.
Exclusion criteria:
Studies will be excluded if they: (1) do not report data for patients undergoing thyroid surgery separately, for example studies in mixed surgical populations from which thyroid surgery subgroup data cannot be extracted; (2) do not develop or evaluate a multivariable prediction model for PONV, including studies that report only associations between risk factors or perform only univariable or descriptive analyses; (3) provide insufficient data or are available only as abstracts without full text; (4) do not include PONV within 24 h after surgery as an outcome, for example studies assessing only postoperative pain or only post-discharge nausea and vomiting, or from which outcome data for PONV within 24 h after surgery cannot be extracted; (5) are published in languages other than Chinese or English; or (6) report duplicate publications or substantially overlapping datasets, in which case the study with the most complete data and the most rigorous reporting will be retained.

**Information sources** We will conduct a comprehensive search of six electronic databases: PubMed, Web of Science Core Collection, the Cochrane Library, Embase, the China National Knowledge Infrastructure (CNKI), and the Wanfang Data knowledge service platform. To further capture potentially relevant studies, we will also hand-search the reference lists of the included studies. The search will cover the period from database inception to September 2026.

**Main outcome(s)** PONV occurring within 24 hours after surgery, including the PACU period, defined as nausea and/or vomiting (including retching) as reported by the included studies. Because there is no universally accepted standard definition, no single definition is imposed: studies using PONV, postoperative vomiting, or postoperative nausea as the predicted outcome are all eligible, and the definition and measurement method used in each study will be described in the data tables. Where reported, early PONV (0–6 h) and late PONV (6–24 h) will be recorded separately.Postoperative nausea and vomiting (PONV), comprising nausea, vomiting, or retching, occurring within 24 h after surgery, including early PONV (0–6 h) and late PONV (6–24 h).

**Data management** Records will be imported into EndNote X9 and de-duplicated using its built-in functions. Two reviewers will independently screen records in two stages (title/abstract, then full text) against the prespecified eligibility criteria; records of uncertain or potential relevance (including conference abstracts) will be retained for full-text assessment. Two reviewers will independently extract data into a standardized Excel form based on the CHARMS checklist, covering 11 domains (source of data; participants; outcome to be predicted; candidate predictors; sample size; missing data; model development; model performance; model evaluation; results; and interpretation). Extraction will also record participants' diagnostic category, surgical procedure, anesthetic technique, and PONV measurement method, and extracted data will be cross-checked against the full texts. We will

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resolve disagreements through discussion; a third reviewer will adjudicate if we do not reach consensus. We will record full-text exclusions with reasons and document the selection process in a PRISMA 2020 flow diagram.

**Quality assessment / Risk of bias analysis** We will use PROBAST+AI to rigorously assess the risk of bias and applicability of the included prediction model studies. PROBAST+AI is an updated version of PROBAST and applies to prediction models developed using either traditional regression methods or artificial intelligence (including machine learning) methods. It comprises two independent parts, model development and model evaluation. In the model development part, 16 signaling questions assess concern about quality and applicability; in the model evaluation part, 18 signaling questions assess risk of bias and applicability. Both parts cover four domains: participants and data sources, predictors, outcome, and analysis; applicability is assessed for three of these domains: participants and data sources, predictors, and outcome. Risk of bias is rated as “low”, “unclear”, or “high” for each domain and overall. Two researchers will perform the assessments independently, and a third researcher will adjudicate disagreements. The results of the risk of bias and applicability assessments will be summarized in tabular form.

**Strategy of data synthesis** Because of substantial clinical and methodological heterogeneity among prediction model studies- for example, differences in the predictors included, the modeling approaches, and the outcome definitions- this review will be primarily a narrative synthesis and will not pool effect estimates. This decision reflects the heterogeneity of the available evidence; nevertheless, the review will follow established methodological standards for systematic reviews of prediction models in all stages, including searching, screening, data extraction, and risk of bias assessment. In addition, we will describe subgroups by surgical procedure, anesthetic technique, duration of surgery, outcome definition, and observation window to explore potential sources of heterogeneity. The basic characteristics, predictors, and performance metrics of the included models will be presented in standardized tables, primarily in two core tables:
(1) A table of the basic characteristics of the included studies, comprising authors, year, country, study design, sample size, incidence of PONV, surgical procedure, definition of the predicted outcome, number of candidate predictors, modeling method, and method of model validation.
(2) A summary table of the characteristics and performance of the prediction models, comprising the predictors ultimately included, the model presentation format, discrimination (AUC or C-statistic with 95% confidence intervals), calibration metrics, Brier score, results of decision curve analysis, and internal and external validation results.

**Subgroup analysis** Descriptive subgroups will be described by: (1) surgical procedure ; (2) anesthetic technique; (3) duration of surgery; (4) outcome definition (PONV vs postoperative vomiting vs postoperative nausea); and (5) observation window (early 0–6 h vs late 6–24 h). These subgroups are presented descriptively to explore potential sources of heterogeneity; we do not plan formal interaction tests or meta-regression because we will not perform a meta-analysis.

**Sensitivity analysis** Not applicable.

**Language restriction** Only English and Chinese publications.

**Country(ies) involved** China.

**Keywords** thyroid surgery; postoperative nausea and vomiting; risk prediction model; systematic review; PROBAST+AI.

**Contributions of each author**
Author 1 - Fangfang Li - Conceptualization; Methodology; Writing – original draft. Contribution: The author designed the study, developed the methodology, and drafted the manuscript. Fangfang Li and Mengran Li contributed equally to this work. Yuyan Tan is the corresponding author and guarantor of this protocol.
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