Systematic review and meta-analysis protocol for development and validation of a prediction model for gestational hypertension in Africa

Sefineh Fenta Feleke[1] (ID), Anteneh Mengist Dessie[2],
Denekew Tenaw[2], Ali Yimer[1] (ID), Habtamu Geremew[3] (ID),
Rahel Mulatie[2] and Abayneh Kebede[4]

Abstract

Objective: Examining the development and validation of predictive models for gestational hypertension, evaluating the validity of the methodology, and investigating predictors typically employed in such models.

Design: Systematic review and meta-analysis protocol.

Methods: The Preferred Reporting Items for Systematic Reviews and Meta-Analysis Protocols (PRISMA-P) guideline will be used to carry out the study procedure. Using the key phrases "Gestational hypertension," "prediction, risk prediction," and "validation," a full systematic search will be conducted in PubMed/MEDLINE, Hinari, Cochrane Library, and Google Scholar. The methodological quality of the included studies will be evaluated using the prediction model risk of bias assessment tool. The CHARMS (checklist for critical evaluation and data extraction for systematic reviews of prediction modeling research) will be used to extract the data, and STATA 16 will be used to analyze it. The degree of study heterogeneity will be assessed using Cochrane I^2 statistics.

Discussion: A subgroup analysis will be performed to reduce the variance between primary studies. To examine the impact of individual studies on the pooled estimates, a sensitivity analysis will be performed. The funnel plot test and Egger's statistical test will be used to assess the small study effect. The presence of a modest study effect is shown by Egger's test (*p*-value 0.05), which will be handled by nonparametric trim and fill analysis using the random-effects model. The protocol has been registered in the PROSPERO-International Prospective Register of systematic reviews, with the registration number CRD42022314601.

Introduction

Gestational hypertension is defined as hypertension that develops later in pregnancy (beyond 20 weeks), without any other preeclampsia symptoms, and then returns to normal after delivery.[1] After 20 weeks of pregnancy, a woman with previously normal blood pressure develops pregnancy-induced hypertension. Gestational hypertension (without proteinuria), preeclampsia (with proteinuria), and eclampsia are the three main types of pregnancy-induced hypertension (preeclampsia with convulsions).[2]

[1]Department of Public Health, College of Health Sciences, Woldia University, Woldia, Ethiopia
[2]Department of Public Health, College of Health Sciences, Debre Tabor University, Debre Tabor, Ethiopia
[3]Department of Nursing, College of Health Sciences, Oda Bultum University, Chiro, Ethiopia
[4]Department of Mathematics, College of Natural and Computational Sciences, Debre Tabor University, Debre Tabor, Ethiopia

Corresponding author:
Sefineh Fenta Feleke, Department of Public Health, College of Health Sciences, Woldia University, PO.Box: 400, Ethiopia.
Email: fentasefineh21@gmail.com

One of the leading causes of maternal and fetal morbidity and mortality globally is pregnancy-induced hypertension. Every 3 min, a pregnant woman dies, resulting in a total of almost 9 million deaths each year.[3] Pregnancy-induced hypertension is a major cause of maternal morbidity and mortality worldwide, but the burden is borne disproportionately by low- and middle-income nations.[4]

The frequency of various types of pregnancy-induced hypertension among African mothers ranges from 9.2% for superimposed preeclampsia to 49.8% for gestational hypertension, according to a thorough study and meta-analysis.[5]

Prediction models predict the likelihood or danger of a specific result or event occurring in the future in those who are at risk of it.[6] It is critical to develop a prediction model for gestational hypertension. Given that gestational hypertension can be controlled to prevent it from progressing to more severe forms, a model that can identify women who are at risk is beneficial.

Prediction models have also been used to identify women who are at high risk of developing pregnancy-induced hypertension later in pregnancy, allowing for more frequent monitoring and low-dose aspirin prophylaxis from the start of pregnancy,[7] which has been shown to reduce the risk of severe forms of pregnancy-induced hypertension.

Disease prediction models are useful for preventing disease by keeping track of risk factors, recommending appropriate intervention or therapy options depending on the risk, and uncovering new risk factors.[8]

Healthcare professionals need prediction models to evaluate probability, enable prompt management, and enhance decision-making through tailored counseling of expectant mothers.[9]

There are several clinical prediction models of the risks of pregnancy-induced hypertension developed in developing and developed countries using different sociodemographic and clinical parameters.[10–13] However, there are a number of issues. One is a mismatch between the findings of studies using prediction models, and another is a deficiency in sufficient performance validation.[14]

This study aimed to look at the development and validation of predictive models of gestational hypertension, as well as the methodological quality and predictors that are commonly utilized in such models.

Methods

Search strategies

This study will be undertaken in Africa and will include a systematic review and meta-analysis of prognostic studies for gestational hypertension in pregnant women in 2022.

The review of prognostic studies as recommended by PROGnosis RESearch Strategy (PROGRESS) framework published before[15]; that summarize a factor's predictive value and time points for a certain health condition.

Preferred Reporting Items for Systematic Reviews and Meta-Analysis Protocols (PRISMA-P) will be used to carry out the protocol.[16] The Prospero International Prospective Register of Systematic Reviews was used to register the study protocol (CRD42022314601). "Gestational hypertension," "hypertension, pregnancy-induced" OR "Gestational hypertension," "prediction, risk prediction," and "validation" will be among the harvest phrases. They will be scoring through the databases Pubmed/MEDLINE, SCOPUS, Hinari, Google Scholar, and gray literature.

Inclusion and exclusion criteria

A clinical or healthcare-related question is formulated using the PICO (Population, Intervention, Comparator, and Outcome) framework in evidence-based practice, particularly in evidence-based medicine. The PICO framework is often utilized in systematic reviews to create literature search tactics that are thorough and devoid of bias.[17]

For the review, the PICO format will be used: P (pregnant women), I (predictive models), C (none), and O pregnant women (gestational hypertension).[14] Populations are studies that look at how to predict gestational hypertension in pregnant women; Interventions are studies that look at how to predict gestational hypertension in pregnant women with and without external validation, as well as external model validation studies with and without model updating; and Outcomes are studies that look at how to predict gestational hypertension in mothers who are at risk. We will include research that construct a prediction model for gestational hypertension and provide the anticipated probabilities, as well as studies that validate the developed prediction model, which must have at least two predictors, and the predictors had to be presented in the text of papers. Only original research will be considered; reviews and letters will be excluded. Due to a lack of sufficient information for quality evaluation or data extraction, conference summaries will also be removed. Furthermore, pregestational hypertension prediction studies will be excluded from this study. Endnote version X20.1 (Thomson Reuters, Philadelphia, PA, USA) software was used to aggregate, export, and manages all prognostic studies found in electronic databases. Duplicate studies were deleted, and full-text studies will be downloaded manually and with the help of Endnote software.

Definition of terms

Gestational hypertension was defined as elevated systolic blood pressure of at least 140 mmHg and/or diastolic blood pressure of at least 90 mmHg on at least two occasions separated by 4 h and appearing for the first time after 20 weeks of pregnancy without proteinuria.[18]

A logistic regression formula or a survival model with three or more predictors were both considered to be prediction

models and may be used to estimate patient risk probabilities or identify patient risk categories.[9]

Quality assessment

The methodological quality of the included study will be evaluated using the Prediction model Risk Of Bias Assessment Tool (PROBAST).[19] The critical appraisal will be assessed by two reviewers (SF and AM) and the discrepancy between the two authors will be solved through consensus. The structure of the instrument contains four primary categories (participants, predictors, outcome, and analysis), each with 20 signaling questions to aid the risk of bias assessment. Each domain is given a risk of bias rating of high, low, or unclear.

Statistical analysis

The data will be extracted independently by two reviewers (SF and AM). The other authors will handle the accentuated differences (DT, AY, and SG). The CHARMS (CHecklist for critical Appraisal and data extraction for systematic Reviews of prediction Modeling Research) checklist will be used to extract the data. The following data will be extracted: data source, participants, predicted outcome(s), candidate predictor variables, sample size, missing data, model development, gestational age at which women were enrolled in the study, number of outcomes, model performance (discrimination, calibration, and decision curve), results including final multivariable models, and interpretation of presented models[20] to give a rough idea of the average performance. Cochrane I^2 statistics will be used to measure study heterogeneity.[21]

Discussion

A subgroup analysis will be performed to reduce the variance between primary studies. To examine the impact of individual studies on the pooled estimates, a sensitivity analysis will be performed. The funnel plot test and Egger's statistical test will be used to assess the small study effect.[22] Significant in terms of statistics, the presence of a modest study effect is shown by Egger's test (*p*-value 0.05), which will be handled by non-parametric trim and fill analysis using the random-effects model.[23]

Finally, the TRIPOD (Transparent Reporting of a multivariable prediction model for Individual Prognosis Or Diagnosis) statement guideline will be used to describe the results.[24] To analyze the outcomes of the systematic review and provide the evidence, the GRADE approach (grading of recommendations, assessment, development, and evaluation) will be used.[25]

Author contributions

All authors gave final approval of the version to be published, agreed on the journal to which the article has been submitted, and agreed to be accountable for all aspects of the work. They each made a significant contribution to the work reported, whether that was in developing the search strategy, searching, screening, evaluating the studies, and extracting the data, or in all these areas.

ORCID iDs

Sefineh Fenta Feleke 🆔 https://orcid.org/0000-0002-3051-1296

Ali Yimer 🆔 https://orcid.org/0000-0002-4805-0133

Habtamu Geremew 🆔 https://orcid.org/0000-0002-9027-9847

Supplemental material

Supplemental material for this article is available online.

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