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The application of simulation to quantifying the influence of bias in reproductive and perinatal epidemiology

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Background: Establishing causal effects in reproductive and perinatal epidemiology is challenging due to the many selection and

attrition processes from preconception to the postnatal period. Further challenging, is the potential for the misclassification of exposures, outcomes and confounders, contributing to measurement error. The application of simulation enables the illustration and quantification of the magnitude of various types of bias commonly found in observational studies.

Methods: A systematic search was conducted in PubMed, Medline, Embase, CINAHL and Scopus in August 2020. A gray literature search of Google and Google Scholar, followed by a search of the reference lists of included studies, was undertaken.

Results: Thirty-nine studies, covering information ($n = 14$), selection ($n = 14$), confounding ($n = 9$), protection ($n = 1$), and attenuation bias ($n = 1$) were identified. The methods of simulating data and reporting of results varied, with more recent studies including causal diagrams. Few studies included code for replication. Although there has been an increasing application of simulation in reproductive and perinatal epidemiology since 2015, overall this remains an underexplored area.

Conclusions: The studies demonstrated effectiveness in the quantification of multiple types of bias using simulation. The limited use implies that further effort is required to increase knowledge of the application of simulation, which will thereby improve causal interpretation in reproductive and perinatal studies.

Key messages: Practical guidance for researchers is required in the development, analysis and reporting of simulation methods for the quantification of bias.