A Bayesian Multivariate Meta-Analysis of Prevalence Data

Lianne Siegel[1],[*], Kyle Rudser[1], Siobhan Sutcliffe[2], Alayne Markland[3],

Linda Brubaker[4], Sheila Gahagan[5], Ann E. Stapleton[6], and Haitao Chu[1],[**],

[1]Division of Biostatistics, University of Minnesota, Minneapolis, MN, U.S.A.

[2]Division of Public Health Sciences, Department of Surgery, Washington University School of Medicine,

St. Louis, MO, U.S.A.

[3] Department of Medicine, University of Alabama at Birmingham, Birmingham Geriatric Research,

Education, and Clinical Center at the Birmingham VA Medical Center, Birmingham, Alabama, U.S.A.

[4] Department of Obstetrics, Gynecology and Reproductive Sciences, Division of Female Pelvic Medicine

and Reconstructive Surgery, University of California San Diego, San Diego, CA, U.S.A.

[5] Division of Child Development and Community Health, Department of Pediatrics,

University of California San Diego, San Diego, CA, U.S.A.

[6] Division of Allergy and Infectious Disease, University of Washington, Seattle, WA, U.S.A.

*email: siege245@umn.edu

**email: chux0051@umn.edu

SUMMARY: When conducting a meta-analysis involving prevalence data for an outcome with several subtypes, each of them is typically analyzed separately using a univariate meta-analysis model. Recently, multivariate meta-analysis models have been shown to correspond to a decrease in bias and variance for multiple correlated outcomes compared to univariate meta-analysis, when some studies only report a subset of the outcomes. In this article, we propose a novel Bayesian multivariate random effects model to account for the natural constraint that the prevalence of any given subtype cannot be larger than that of the overall prevalence. Extensive simulation studies show that this new model can reduce bias and variance when estimating subtype prevalences in the presence of missing data, compared to standard univariate and multivariate random effects models. The data from a rapid review on occupation and lower urinary tract symptoms by the Prevention of Lower Urinary Tract Symptoms (PLUS) Research Consortium are analyzed as a case study to estimate the prevalence of urinary incontinence and several incontinence subtypes among women in suspected high risk work environments.

KEY WORDS: Bayesian methods; meta-analysis; prevalence; missing data; sensitivity analysis; urinary incontinence

This paper has been submitted for consideration for publication in *Biometrics*