Development of a Stata command for pediatric risk of mortality (PRISM) calculation

Razvan Azamfirei, MS1,2; Colleen Mennie, BSN, RN1; James Courtney Fackler, MD1,5; Sapna Kudchadkar, MD, PhD, FCCM1, 3, 5

1Department of Anesthesiology and Critical Care Medicine, Johns Hopkins University School of Medicine, Baltimore, MD, USA

2George Emil Palade University of Medicine, Pharmacy, Science, and Technology, Targu Mures, Romania

3Physical Medicine and Rehabilitation, Johns Hopkins University School of Medicine, Baltimore, MD, USA

4Outcomes after Critical Illness and Surgery Group, Johns Hopkins University School of Medicine, Baltimore, MD

5Department of Pediatrics, Charlotte R. Bloomberg Children’s Center, Johns Hopkins University School of Medicine, Baltimore, MD, USA

*Corresponding Author

Sapna R. Kudchadkar, MD, PhD, FCCM
Johns Hopkins University School of Medicine
Charlotte R. Bloomberg Children’s Center
1800 Orleans Street, Suite 6318B
Baltimore, MD 21287
Phone: (410) 955-6412
Fax: (410) 502-5312
Email: sapna@jhmi.edu

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To The Editor:

Outcome prognostication tools have been used extensively in clinical care and research to calculate the expected mortality and control for illness severity in pediatric intensive care units (PICU). While there are many scores, including the Pediatric Logistic Organ Dysfunction-2 (PELOD-2) and the Paediatric Index of Mortality 3 (PIM-3) scores, the Pediatric Risk of Mortality III (PRISM III) score and its extension, the PRISM IV score, is widely used.\textsuperscript{1-3} The scores were validated over large patient populations, but they do not prognosticate individual outcomes. The PRISM III score assigns scores correlating to mortality based on diagnosis/disease factors, age, and physiological values at the time of PICU admission.\textsuperscript{4} The PRISM IV score extends this further by calculating the expected mortality using data from the PRISM III score, patient history, principal dysfunction, and admission source.\textsuperscript{5}

A major barrier to the widespread usage of the PRISM scores is the complexity of the calculation and the lack of robust open-source implementations. The single publicly available calculator for this score can be inaccurate depending on the units used, offers results inconsistent with the peer-reviewed versions of the scores, and supports data entry for only one patient at a time.\textsuperscript{6} Such challenges restrict the usage of the score to research groups that have implemented the score in their statistical packages. Custom implementations duplicate efforts, are not guaranteed to be consistent, and can have varying performances over large datasets. Here we describe the development of a publicly available Stata command that calculates PRISM III and PRISM IV.

METHODS
We developed a Stata command (*prismscore*) that performs PRISM III and PRISM IV score calculations in Stata/MP 17.0. In addition to implementing the scoring described in the original papers, we added robust error-proofing, data validation, the ability to use both SI and US laboratory value units, and a graphical user interface. The design principle behind the command was based on our experience analyzing large pediatric critical care datasets and observing common pitfalls during data entry and data analysis. We aimed to reduce the possibility of incorrect calculations due to incorrect variable specifications or data entry. We validated the command through unit testing and score calculation on deidentified data. We performed spot checks to double-check the accuracy of the calculation. To test the performance of the command over large datasets, we generated 10,000,000 patient records with random realistic data and predetermined PRISM scores and compared the result to the predetermined score. The run-time of the command was tested by analyzing 5 distinct datasets using Stata/MP 17.0 2-cores. The command is freely available on the Statistical Software Components (SSC) archive (https://ideas.repec.org/s/boc/bocode.html), as well as GitHub (https://razvanazamfirei.github.io/prism-score). Institutional Review Board approval was not required for the analysis of synthetic data.

**RESULTS**

The Stata *prismscore* command calculated PRISM scores with 100% accuracy on both the spot checks and the simulated data. The median run-time for PRISM III calculations over 10,000,000 simulated patient records is 50.48 (interquartile range [IQR] 46.74 - 50.83) seconds. The median run-time for PRISM IV calculations over 10,000,000 simulated patient records is 51.52 (IQR 50.46 - 53.44) seconds.
DISCUSSION

The *prismscore* Stata command is a tool that accurately and efficiently calculates PRISM III and PRISM IV scores over datasets of all sizes. The tool is designed to improve the reproducibility of research involving the scores, streamline data analysis for pediatric critical care datasets, and offer significant time and resource savings to the research community. Of note, the score was validated on patient data collected during a defined period (-2 hours to +4 hours from PICU admission). Our command calculates the score based on extracted data; if data from the entire period is not available in the electronic record, or if the data is not extracted correctly, the command may underestimate the expected mortality.
REFERENCES