

Open-source code to extend early-onset sepsis calculator accessibility

The Kaiser Permanente Perinatal Research Unit developed an online risk prediction web-based tool that has led to drastic reductions in empiric antibiotic administration: the neonatal early-onset sepsis calculator.¹ Use of the tool has been adopted quickly by many neonatal clinics worldwide, both in clinical and research contexts. However, the current international reliance on the Kaiser Permanente web tool might impede accessibility (eg, if the tool became temporarily unavailable) and adherence to local regulations for external users.² Therefore, the success of this tool and the efforts aimed at electronic implementation, validation, and further research warrant a central, peer-reviewed publication summarising how the tool works with a customisable software version of the algorithm.

To realise this proposal, we hereby present a summary of previously published intercepts, coefficients, and likelihood ratios for the neonatal clinical status categories (appendix p 2), along with a validated open-source version of the tool, the Shiny application (appendix pp 3–6; R, Vienna: R Foundation for Statistical Computing, Vienna, Austria).^{2,3} To validate the Shiny application, we used various input data: two scenarios with input values constituting minimum and maximum risk (appendix p 2);² two previously established clinical databases, one of 234 newborns with verified early-onset sepsis and the other of 890 at-risk newborns;^{4,5} and 30 hypothetical scenarios generated with random combinations of valid input values, to avoid any potential bias (appendix p 8). For all these scenarios, we validated the results of the Shiny application by comparing its

generated output with the estimated early-onset sepsis risk and the clinical management recommendation generated by the Kaiser Permanente web-based calculator. We validated risk estimation results up to 2 decimal places as provided by the Kaiser Permanente website. Validation confirmed accuracy in all 1156 scenarios tested (appendix p 7).

Because the Shiny application replicates the early-onset sepsis calculator on the Kaiser Permanente website, it has the same associated limitations. Most importantly, no risk factor-based approach can detect all early-onset sepsis cases, meaning clinical vigilance remains essential. However, in contrast to the Kaiser Permanente website, the R source code of the Shiny application can be hosted locally, and be modified to make corrections, improvements, and local adaptations as researchers and clinicians see fit. Furthermore, medical software is increasingly subject to medical device regulations and privacy regulations that prevent sending data to other institutions. This publication could allow institutions and clinicians to better adhere to these regulations.

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See Online for appendix

For the Shiny application see
<https://achten-nb.shinyapps.io/EOScalculator/>