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## Reproducibility and transparency in anaesthesiology research. Comment on *Br J Anaesth* 2020; 125: 835–42

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Editor—We commend Okonya and colleagues<sup>1</sup> for undertaking the important work of examining reproducibility and transparency in medical research. As the authors state in their paper, the availability of key study components, including data and analysis scripts, enable replication and reproducibility. Unfortunately, there are aspects of their own study that render it irreproducible.

First, the authors provide their bibliographic search strategy, raw data arising from that search, details of the devised data extraction tool, and data extracted from the selected papers. However, they did not provide the analysis code for the statistics performed on these data to arrive at the reported results. They used functions from within Microsoft Excel™ to conduct the statistical analysis for their study, and did not provide the spreadsheet where they conducted the analysis to the reader. Microsoft Excel (Microsoft Corp., Redmond, WA, USA) is well-known to introduce errors into scientific analysis, and cannot be considered a safe component for a reproducible scientific analysis.<sup>2</sup> We are unable to verify whether the functions used were the correct ones, or whether they were applied correctly, for the statistics reported. Coding errors within Excel spreadsheets can be easily missed and difficult to debug, and there are no records of the chronology of actions taken within an Excel spreadsheet and no guarantee that if other researchers were to open the spreadsheet on a different computer, it would show the exact same data. Indeed, Excel has recently been responsible for forcing an entire branch of

science to change naming conventions, as data in this field were routinely modified on entry without alerting the researcher entering the data.<sup>3</sup>

Second, the authors state that they randomly sampled 450 papers from the more than 28 000 that were found using their search strategy. They did not state how the random sampling was conducted, and another researcher with the same raw bibliographic data would thus not be able to replicate their sampling procedure without this information. If a script was used to generate a random numerical sequence for selecting their sample, providing the random seed and the details of the computing environment used for random selection would be needed for independent researchers to replicate the pseudo-random number generation process.

Within the published protocol of their study on the Open Science Framework repository, they stated that they intended to perform the statistical analyses using STATA™, which would have likely addressed the above two issues as a STATA (StataCorp LLC, College Station, TX, USA) script file could have been published alongside their publication.

It is ironic that a study purporting to examine reproducibility and transparency has itself not met minimum basic standards to achieve either goal. We call on the authors and other anaesthesia researchers to adopt the approaches advocated by the Turing Way, a collaborative resource and community built around making research open and reproducible, focusing particularly on researchers working in the data science sphere.<sup>4</sup> We feel that sharing and publishing data and code alongside research outputs using the methods advocated

by the Turing Way will hugely improve the quality of research outputs within our specialty.

### Declarations of interest

The authors are both Fellows of the Software Sustainability Institute.

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