

## Letter to the Editor

Sir,

In his article [1], Grech compares the male:female birth ratio (sex ratio) in two time windows after 1957, the year of the Windscale reactor accident (1958–62 and 1963–67) with the sex ratio in 1953–57 in 9 countries (Iceland, Denmark, Ireland, Northern Ireland, England and Wales, Scotland, Norway, Sweden, and Finland). He tests the hypothesis that the Windscale fire might have increased the sex ratio in countries downwind from the Windscale site in Cumbria, Northern England. Since Grech presents Tables for 9 countries and in 2 time windows after 1957 he obtains altogether 18 test results. It turns out that 2 tests show a significantly increased ( $P < 0.05$ ) sex ratio, one in Norway in 1963–67 ( $P = 0.039$ ) and one in Finland in 1958–62 ( $P = 0.047$ ). A significantly decreased sex ratio is found in Denmark in 1958–62 ( $P = 0.008$ ).

Grech does not mention that one has to adjust the significance level (alpha level) when conducting multiple tests. The probability of finding significant results increases with the number of tests. Using the Bonferroni correction for 18 tests, the critical  $p$  value is  $0.05/18 = 0.003$ . So the fact that 3 tests yielded  $P < 0.05$  is likely a chance result.

To avoid multiple testing, Grech could have combined the 4 countries downwind from Windscale (Scotland, Norway, Sweden, and Finland) to a study region and the two time periods after 1957 to one period (1958–67). For the study region, a test of the sex ratio in 1958–67 vs. the sex ratio in 1953–57 yields  $OR = 1.003$ ,  $P = 0.125$ . For the other 5 countries combined, the corresponding test yields  $OR = 0.999$ ,  $P = 0.657$ . With this approach, the reported increase of the sex ratio at birth after the Windscale accident downwind from the Windscale site is not significant.

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### Reference

- [1] Victor Grech. Births and male: Female birth ratio in Scandinavia and the United Kingdom after the Windscale fire of October 1957. *International Journal of Risk & Safety in Medicine*. 2014;26:45-53.