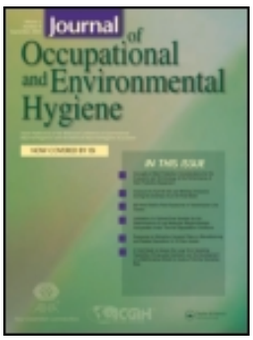

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Letters to the Editor

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Letters to the Editor

CORRECTION TO "HEAD AND FACE ANTHROPOMETRIC SURVEY OF U.S. RESPIRATOR USERS"

The purpose of this letter is to bring to your attention an error in a sample size formula appearing in a 2005 article[1] published in this journal. The article described the development of a head and face anthropometric survey of U.S. respirator users. The sample size formula ($n = (1.96\times CV/a)^2\times 1.534$) that was used in the development of that survey and subsequently reported in the article was incorrect. The authors of that article intended to use the sample size formula published in the ISO 15535 standard "General Requirements for Establishing an Anthropometric Database" ($n = (1.96 \times CV/a)^2\times 1.534^2$).[2] Since there was an error in the sample size calculation (missing ^2), an analysis was conducted and described below to understand the possible implications of the error.

The purpose of calculating the sample size in the original survey design was to be able to make subsequent independent statistical conclusions about each sampling cell. The ISO sample size formula estimates the sample size needed based on the variability in the dimension of interest (expressed as its coefficient of variance; CV); the percentage of relative accuracy desired (a), and the level of confidence desired in the resulting database. The values used for "CV" and "a" in the study design were based upon values from a previous anthropometrics survey of military personnel.[3] The constant (1.534^2) is based on converting the sample size formula from estimating confidence (95%) at the mean to estimating confidence at the 5th and 95th percentiles. The parameter "a" is relative accuracy expressed as percent of the mean being estimated. A conservative value of 1% was used in the original calculation. Using the incorrect formula, a sample size (n) of 166 for each sampling cell was determined. Since there were 24 separate sampling cells (for two genders, four racial groups, and three age groups), the required total was calculated to be 24×166, or about 4000. Using the correct formula (with the same values of "CV" and "a"), each cell-specific sample size should have been 257, for a grand total of 24×256, or 6170.

The significance of using the incorrect sample size formula can be analyzed from two different perspectives: (1) the magnitude of the relative accuracy being achieved with a given sample size, and (2) the subset of the population about which we would like to make conclusions. An analysis and brief discussion from these two perspectives is provided below:

1. The value chosen for relative accuracy (a) directly impacts the target sample size for a given cell (n). The estimated sample size of 166 results per cell that was obtained using the incorrect sample formula can still be obtained using the correct formula if the selection of "a" is changed to 1.24%. We believe this (only slightly larger) relative accuracy level is more than sufficient to achieve results within a scientifically reasonable margin of error. Using the ANSUR data, 1% of the mean of face length of 121.9 mm is 1.2 mm, while 1.24% of the mean is 1.5 mm.[3] Because the allowable measurement error for traditional measurement techniques is 3 mm for face length, we consider the practical significance of the relative accuracy level differences of 1.2 and 1.5 mm to be negligible. Thus, the calculated sample size of 166 results per cell in the original survey design can be used to make the subsequent independent statistical conclusions about each sampling cell because a 1.24% relative accuracy level is acceptable.
2. The purpose of the calculated sample size in the original survey design was to be able to make subsequent independent statistical conclusions about each sampling cell. The intent was to be able to draw statistical inferences from, for example, White Males, aged 30–44. In effect, n was calculated to allow 24 separate statistical conclusions. However, respirator and other personal protective equipment standards are not created for specific age-ethnic-sex groups but rather for the whole population. For example, there are not separate respirator fit test panels for males and females. Therefore, the database as a whole—or even males and females separately—results in sample sizes much larger than 257 or 166.

In conclusion, although we regret the miscalculation, we find that the resulting final sample size of the NIOSH head and face anthropometric survey of U.S. respirator users is more than adequate for its practical purpose and should pose no potential problems in the expected application (e.g., respirator fit test panels, headforms, respirator product design, etc.) of the database. However, the ability to use the database for research on specific population subsets may be somewhat limited because of the slightly higher level of relative accuracy.

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