

## Statistical Analysis for Occupational Exposure Measurements

**To the Editor:** The report by Jelinić et al (1) on the effective reduction of the exposure to various substances as a result of application of aggressive industrial hygiene control provides an excellent example of how industry can cooperate with a community to accomplish occupational and environmental harmony. It shows the feasibility of cost-effective methods to control exposure and reveals a close relationship between occupational medicine and industrial hygiene. The exposure to some factors was reported to be significantly reduced from the time period 1982-1988 to 2004. However, the footnotes in tables 2 and 3 indicated that statistical analysis included only the "number of samples" above the maximum acceptable concentration (MAC), although the text said that the analysis included the "measured values," whereas "concentration of harmful substances in year" was provided in the subtitle of the tables. Although the statistical analysis may be correct, the description is confusing. The authors used the  $\chi^2$  and Fisher's exact tests to determine the differences, as it seems, for the number of samples exceeding the MAC, but they also reported the median exposure values and ranges. We would like to suggest that, in addition to the evaluation of the number of samples exceeding the MAC, comparison of sample concentrations is also appropriate. It has been suggested that, for chronic toxicants, the mean exposure concentration is the best indicator of health outcomes (2) rather than exceedance of the occupational exposure limit value or MAC. Therefore, statistical difference should be determined for concentration values between the two time periods.

Because data on airborne exposure, including occupational measurements, are best represented as a logarithmic distribution, alternative tests to parametric analysis (e.g., t test) are appropriate. Since these data are interval (time period between the measurements is the same and there is a zero value), the appropriate tests are either the Mann-Whitney U or Wilcoxon Rank test (3-5). In addition, the Mann-Whitney U can be used for unequal sam-

ple sizes. These data can also be transformed, which allows the use of parametric statistical analysis.

These suggested changes in statistical analysis of the data presented by Jelinić et al (1) should not detract from the fine quality of their report (1). The statistical oversights that were made are just a reminder of insufficient time dedicated to the statistical training in medical education today. In this context, we would like to inform the readers interested in learning more about biostatistics about an on-going series of articles, Basic Statistics for Doctors (6-8), published in the Singapore Medical Journal.

**John H. Lange**

*johnhlange@worldnet.att.net*

Envirosafe Training and Consultants

P.O. Box 114022, Pittsburgh, PA 15239, USA

**Alessandra Buja**

**Emanuela Fadda**

**Giuseppe Mastrangelo**

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**Authors' reply:** We appreciate the fact that you recognized the problems described in our article on Managing Occupational Safety and Health in Aluminium Production Factory, Mostar, Bosnia and Herzegovina. It is true that, due to technical improvements, the job of aluminium workers has become physically less demanding, but exposure to hazardous chemical and physical agents at workplace due to the aluminium process cannot be completely avoided (1-4).

The aim of this particular study was to show how and to what extent the production modernization and applied occupation safety measures reduced the exposure to various physical and chemical factors (5). Statistical analysis did include the measured values, and you noticed correctly that tables 2 and 3 showed only statistical evaluation for the number of samples above the maximum acceptable concentration. Your suggestions about the statistical analysis for occupational exposure measurements are valuable and will be adopted in data analysis in our future research on occupational exposure.

**Jagoda Doko Jelinić**

*jdoko@snz.hr*

Department of Environmental and Occupational Health

Andrija Štampar School of Public Health

Rockefellerova 4

10000 Zagreb, Croatia

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