Biological monitoring and statistical analysis

Part 2. Individual versus group results

This is the second of a three-part series to discuss the use of statistical analysis in the interpretation of biological monitoring results.

The context of biological monitoring and medical surveillance in occupational health must be understood as secondary prevention. Biological monitoring does not itself change or lessen exposures. Health professionals must ensure that biological monitoring and medical surveillance results, either group or individual, support actions in minimizing exposures.

This series of articles highlights the use of statistical analysis in biological monitoring to ensure that the most urgent and appropriate measures are taken to transfer, remove, protect and/or change the working environment accordingly.

Research has become more intense in the occupational health area of study, design and analysis. Reports and statistical data and methodology are designed in such a way as to assist the clinician in making informed decisions. Once data has been collected it must be presented in such a way as to include outcome-based analysis. Various formats (exposures, areas, working hours, group, individual, etc) should be included in such a report. Identifying the individual within the group is of paramount importance.

Statistical analysis does not have to be complicated or multi-variant or academic to support improvements within the workplace or the environment.

The importance of historical data should not be underestimated. A group of organophosphate workers exposed on a daily basis should be a concern in itself. Graphs I and II illustrate cholinesterase measurement (as a group and individual exposure respectively) over time as workplace conditions improve. This also confirms historical exposure to support individual claims of exposure due to organophosphates. (See Graphs I and II.)

Biological monitoring, despite all of its complexities, is useful in investigating exposure. Graph III illustrates the time required for a cell to detoxify itself and how evenly certain compounds are distributed within the body.

CONCLUSION

“The precautionary principle” a term used in business and environmental health, emphasises that action should be taken in the event of uncertainty, rather than delaying the action until more “evidence” is generated. “Good doctors (real occupational health professionals) use both individual clinical expertise and the best available external evidence” to make decisions, herein lies the strength of statistical analysis. These principles are especially applicable in occupational health, where prevention is the key to successful medical surveillance programmes.

The final part in this series will summarize the results of biological monitoring for 2006 from Ampath laboratories.

For additional reading of the same authors:
1. Schillack VR. Chromium (Cr) and arsenic (As) exposure – what should we be measuring? Occupational Health Southern Africa. 2003; 9(4): 30-1.

Graph III. Illustrates a very high level of total chromium in an individual worker. Notice the high red cell vs urine chromium at the beginning of the monitoring process. The urine values from 25/07/2005 to 19/05/2006 varied so much that action was very difficult. A urine result alone would have dismissed this patient as a non-exposed individual. During the time period 17/07/2006 to 31/08/2006 the patient was withdrawn from the work environment and monitored with much more information being available for corrective action.

Graph II. Demonstrates historical data of individuals exposed to organophosphates. Exposed individuals were identified and working habits and PPE were improved accordingly.

Graph I. Demonstrates a very high level of total chromium in an individual worker. Notice the high red cell vs urine chromium at the beginning of the monitoring process. The urine values from 25/07/2005 to 19/05/2006 varied so much that action was very difficult. A urine result alone would have dismissed this patient as a non-exposed individual. During the time period 17/07/2006 to 31/08/2006 the patient was withdrawn from the work environment and monitored with much more information being available for corrective action.

REFERENCES
• Ncayiyana D. Evidence-based medicine is not all randomised controlled trials and systematic reviews. SAMJ. 2007; 97(1): 7.
• Regulations for Hazardous Chemical Substances (R1179): Biological Exposure Index Table 3 of Annexure 1.
• Tickner J; Raffensperger C. The precautionary principle in action. http://www.mindfully.org/Precaution/Precaution-In-Action-Handbook.htm

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