# Occupational exposure limits––at the crossroads

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Setting occupational exposure limits (OELs) for hazards in the workplace has been an integral component of worker health protection programs for many decades. These OELs have been established by many authoritative bodies around the world, such as the Threshold Limit Value Committee (TLV) of the American Conference of Governmental Industrial Hygienists (ACGIH). The traditional approach has been to develop OELs by expert review of the available evidence, and set levels based primarily on health considerations. OELs, such as the TLVs, are usually used to guide occupational health practitioners in the assessment and control of workplace hazards, although some regulatory authorities use OELs as legal standards.

OELs have been criticised for not protecting all workers as, for example, the ACGIH states that TLVs represent conditions under which nearly all workers may be repeatedly exposed without adverse health effects. Another criticism is that OELs have only been set for a small fraction of the hazards to which workers can be exposed. A third criticism is that expert judgement is not a rigorous enough method for setting robust OELs and can quickly get out of date.[1] Despite these criticisms, OELs have continued to be a major source of guidance for hazard control in workplaces in many countries around the world.

Some recent developments threaten the standing and continued use of traditional OELs and this caused lively discussion at the recent Scientific Conference of the International Occupational Hygiene Association. One important development has been the introduction of the European Community regulation on chemicals and their safe use, which came into force in 2007, with full registration due to take effect at the end of 2012. This deals with the **R**egistration, **E**valuation, **A**uthorisation and Restriction of **Ch**emical substances, widely known as REACH.

For many years, recommendations for OELs in Europe have been made by the Scientific Committee on Occupational Exposure Limits.[2] Under REACH, Derived No Effect Levels (DNELs) are required to be developed for those chemicals where use is greater than ten tonnes per year. The setting of DNELs uses a very different approach from that used to set OELs; identifying no effect levels and then applying a series of pre-set adjustment factors. Concern has been expressed that this approach will lead to substantially lower workplace exposure limits than derived using the traditional OEL approach. For example, a recently published calculation for styrene estimated that the DNEL was likely to be at least an order of magnitude lower than recommended OELs.[3]

While lower worker exposure limits is something to be encouraged, when justified, the DNEL approach may lead to the need for considerable additional resources to be employed to reduce workplace exposures by an order of magnitude, which in many instances may result in minimal health gain. There is also the potential problem of too stringent exposure standards leading companies to take their production facility off shore to countries where exposure limits are either non-existent, set too high or poorly enforced. Another problem is that having DNELs and OELs sitting side-by-side is likely to cause confusion. There is further concern that the responsibility for setting the DNELs lies with importers and manufacturers, with no mechanism for input by occupational health professionals and other stakeholders.

This problem of the profusion of widely different occupational exposure recommendations and/or standards is highlighted by the current situation in the USA, where many different bodies have set their own OELs. Some of these are recommended, such as the NIOSH Recommended Exposure Limits (RELs) and the TLVs, while others are regulatory standards, such as the OSHA Permissible Exposure Limits (PELs). The different terminologies and values among these various OELs, some of which date back to the 1970s, can cause confusion about what is the most appropriate OEL to use. In the absence of clear direction and leadership regarding OELs, many larger companies in the US now set their own internal values.

What about the situation in newly industrialising countries? In many South American countries, TLVs are generally used, although keeping these up to date is a major challenge. In Brazil, for example, almost all of the 33 regulatory exposure standards are based on the 1976 TLVs. In the Asia Pacific region, it has been shown that there is considerable variability in both the approach to setting OELs and the numerical levels across different countries, often by more than an order of magnitude for carcinogens such as asbestos and silica.[4]

A further factor leading to reduced use of OELs is the increasing application of control banding, which has become popular, especially in the United Kingdom following the introduction of the Control of Substances Hazardous to Health (COSHH) Regulations and Workplace Exposure Limits (WELs), based on maximum exposure levels. Control banding advocates the application of a set of risk reduction measures for identified categories of exposure, rather than relying on exposure monitoring, and reference to OELs, to direct controls. Control banding has come under some criticism as it may not always result in an adequate margin of safety, especially for dusts, and in situations where there is considerable inherent variability.[5]

Concern about the declining standing of OELs in workplace hazard assessment and control has prompted calls to ensure that OELs continue to be used and regularly updated.[6] This is particularly important in newly industrialising countries, where alternative approaches are less well developed. One limitation of the OEL approach is that it does require considerable input by experienced occupational health professionals to keep them up-to-date, but due to increasing demands on their time, there is a declining pool of the necessary people to undertake this role. As the date for the full implementation of the DNELs in Europe approaches, the success or otherwise of REACH is likely to be an important deciding factor in whether OELs are consigned to the historical archives of occupational health and safety practice. This would be an unfortunate development, as it would remove a well established, although not perfect, evidence-based tool from the armament of those committed to improving worker health.

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## REFERENCES

1. **Stouten H,** Ott H, Bouwman C, Wardenbach P. Reassessment of occupational exposure limits. *Am J Ind Med* 2008;**51**:407—18.
2. **Bertazzi PA.** Health-based occupational exposure limits: an European experience in perspective. *Italian Journal of Occupational and Environmental Hygiene* 2010;**1**:87—95.
3. **Kreider ML,** Spencer Williams E. Interpreting REACH guidance in the determination of the derived no effect level (DNEL). *Regul Toxicol Pharmacol* 2010; **58**:323—9.
4. **Sim MR,** Phoon WO. *Legislative Controls and Compensation in Australasia and Asia (Chap 35)*. In: Hendrick D, ed. *Occupational disorders of the lung*: WB Saunders, 2002:555—68.
5. **Zalk DM,** Nelson DI. History and evolution of control banding: a review. *J Occup Environ Hyg* 2008;**5**:330—46.
6. **International Occupational Hygiene Association.** *Occupational exposure limits—do they have a* future? 2009.

# Occupational mortality studies: still relevant in the 21st century

Andrea 't Mannetje, Neil Pearce

In their article, Coggon and colleagues[1] report on work-related mortality in England and Wales over the period 1979—2000. Occupational mortality studies are one of the oldest approaches in epidemiology, including the decennial reports on patterns of mortality for occupational groups in England and Wales that have been published since the 19th century. These studies have made use of routinely collected data (death certificates), to study cause-specific mortality patterns by occupation and socioeconomic status. Even today, few other study designs, if any, can provide such a wide range of information on the occupational health status of a population, for so little cost.

Nevertheless, occupational mortality studies are currently not held in high regard. This perhaps reflects the low status of descriptive epidemiology- and hypothesis-generating studies in general,[2] but there are additional specific methodological concerns regarding occupational mortality studies. In particular, most occupational mortality studies have used census data to produce standardised mortality ratios (SMRs). Using such external denominator data risks the introduction of a numerator-denominator bias, as the occupation registered on the census (usually the self-reported occupation of that person), is not fully comparable with the occupation registered on the death certificate (usually the last held occupation of the deceased as reported by the next of kin). There therefore has been 'a certain reluctance in accepting mortality excesses registered for specific occupational groups in these studies'.[3] Other criticisms of occupational mortality studies include that the method cannot monitor occupational diseases that are not fatal; that information on confounders such as smoking is not available; that only one occupation per individual is available; and that they are susceptible to chance findings due to the multiple comparisons made.

How can then the current place of occupational mortality studies within the field of occupational epidemiology be characterised? It is probably fair to say that they have a reputation of being simple and crude, descriptive, uncreative, and susceptible to unreliable results. They still enjoy some local interest as a surveillance tool, but are by and large seen as not worthy of publication in international journals. There is perhaps a general feeling that surely by now we should have moved away from such primitive methods that were already in place more than 100 years ago.

In their article Coggon and colleagues give us a good illustration of the continuing value of occupational mortality studies. Because satisfactory denominator data were not available, Coggon and colleagues chose for a proportional mortality ratio (PMR) approach, where the proportion of deaths from a specific cause within a specific occupation is compared with the proportion of deaths from that cause among all deaths in the study, standardising for age and social class. This approach, although having certain disadvantages, eliminates the numerator-denominator bias that occupational mortality studies using the SMR approach have been criticised for. Furthermore, it makes the approach even simpler and more accessible for the many countries that do not have any denominator data (ie, census data) available, including developing countries where occupational mortality studies have never been carried out.

Occupational mortality data can be used more creatively than has been done before. Historically, occupational mortality studies were mainly seen as a hypothesis-generating tool, producing lists of occupations that show an excess in mortality for certain causes. Coggon and colleagues instead aimed to quantify the number of deaths due to known occupational risk factors and studied this pattern over time. This showed a clear decline in excess mortality attributable to work, but it also indicated which occupations and which occupational diseases contributed most to this decline. This is an interesting alternative to the attributable fraction approach that is most often used to quantify the burden of work-related mortality of a certain population. The attributable fraction approach is, however, not as flexible in detecting changes over time and within specific occupations, and often relies on attributable fraction estimates derived from other populations than the one under study, making it less population-specific than the method used by Coggon and colleagues.

The fact that occupational mortality studies have only very crude occupational information is not necessarily a disadvantage. Certainly, the field of occupational epidemiology has been working hard to improve the exposure data used in its studies, but this important development should not imply that there is no longer a place for studies that are based on occupation alone, particularly those using routinely collected data. The use of 'occupation' as unit of analysis has its own merits as illustrated by Coggon and colleagues. Their findings, for example,

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