Commentary

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We are writing with respect to three recently published papers[1–3] that address the global burden of disease due to occupational exposures. This work by the Global Burden of Disease (GBD) 2016 Occupational Risk Factors Collaborators presents what appear to be precise estimates of the global burden of death and disease due to occupational exposure, for example, 2.8% of deaths and 3.2% of disability-adjusted life years (DALYs) from all causes.[1] For cancer, the estimates are 3.9% of all cancer deaths and 3.4% of all cancer DALYs.[3] For chronic respiratory disease, the authors report only population attributable fractions (based on DALYs) of 17% for chronic obstructive pulmonary disease and 10% for asthma.[2] In the accompanying commentary by Loomis some limitations of these estimates have been outlined (eg, considering only a limited number of established carcinogens).[4] In addition to these limitations, we wish to consider some inherent issues with the occupational exposure estimates used in the development of these global burden of occupational disease estimates.

The GBD 2016 Collaborators broadly acknowledge the limitations of estimating prevalence of occupational exposures on a global scale, explaining their assumptions with 'However, currently the necessary data are not available'. We agree that limited exposure data availability, particularly in low-and middle-income countries, is a concern for various global initiatives focussed on surveillance, hazard and risk assessment and disease burden estimation. However, there are presently a number of opportunities to improve exposure estimation through the use of existing data sources and methods. We contend that more effort should be applied to leverage existing occupational exposure data that has been collected through decades of occupational hygiene, exposure science and epidemiological investigations. Recent advances in text and data mining methods could be used to more effectively identify and collate data, to better inform our knowledge of exposure prevalence and intensity.[5] With reference to the aforementioned GBD 2016 studies, we provide some examples of data sources and approaches that could be used to strengthen future occupational disease burden estimation.

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PROPORTIONS EXPOSED AND LEVEL OF EXPOSURE

The GBD 2016 Occupational Carcinogens Collaborators estimated prevalence of exposure at the level of nine industries, without consideration of differences between countries.

Large occupational exposure databases in Europe, USA, Canada and Russia, as well as global monitoring activities, can and should be used to obtain a better understanding of the differences in exposure prevalences between countries and within industries and occupations. For example, carcinogen exposure estimation initiatives such as CAREX Europe and CAREX Canada have shed light on differences between countries, industries and even over time.[6–8]

Substance-specific data sources are also available. The WOODEX (estimates of occupational exposure to inhalable wood dust) project provides information on level of exposure and type of wood dust by country and industry for 25 European Union member states for the years 2000 to 2003.[9] The Industrial Minerals Association-Dust Monitoring Programme, has been ongoing since 2000 and provides quantitative insights into differences in respirable dust and quartz exposures between middle-income and high-income countries.[10] In the SYNERGY project, time-specific, job-specific and region-specific quantitative exposure levels for four carcinogens (asbestos, chromium-VI, nickel and quartz) were estimated based on thousands of personal measurements collected in Europe and Canada.[11]

Exposure information collected in general population case-control studies and cohort studies have been used to develop (population-specific) job exposure matrices and could also be used to develop more precise estimates of exposure prevalence by industry.[12–14]

EXPOSURES ACROSS COUNTRIES AND TIME

It is widely understood that occupational exposures can differ between high-income and low- and middle-income countries due to, for example, variations in workforce structures (especially regarding informal economies), technologies, regulations and types of hazards present.[15] The limited availability of occupational data in low- and middle-income regions has driven the use of information from more economically developed countries as a proxy for local conditions.[16] While sometimes justified due to 'no better option', assumptions about the comparability of such proxies can lead to uncertainties and biasses in the estimates of the health impacts of work exposures.[16]

The GBD 2016 Occupational Carcinogens Collaborators assumed the proportions exposed at respectively lower and higher levels to be 90:10 for developed regions and 50:50 for developing countries. The assumption translates into differences in concentration between developed and developing countries being between a factor of 3 to 6 depending on the assumed exposure variability. Are these differences realistic? Using wood dust as a 'real life' example, Basinas and colleagues analysed almost 21 000 personal measurements of wood dust.[17] Between various European high-income countries, exposure to wood dust varied by a factor 3. A large study on wood dust exposure in small-scale wood industries in Tanzania reported levels that were (only) twofold higher than average European levels.[18] It is clear that differences between high-income and low-income and middle-income countries do exist, but even among high-income countries differences in exposure intensity might be substantial.

The GBD 2016 authors acknowledge that published information has suggested that exposure have decreased over time, but did not explicitly consider such temporal changes in exposure intensity in their estimates.[1] This was justified with the suggestion that many instances of high exposure remain even in high-income countries and that transition of heavy industries would indicate opposite trends of increasing exposure in low-income and middle-income countries.

Basinas and colleagues observed that wood dust concentrations in seven European countries decreased on average by 7% per year over a 25-year period, indicating that exposures in 1980 had been six times higher than in 2005.[17] Differences in measured respirable crystalline silica across countries provide another illustrative example of the same concept. Zilaout and colleagues[10] analysed almost 26 000 respirable dust and 23 000 respirable quartz measurements from 35 industrial mineral companies from 154 sites located in 23 countries (19 high-income and 4 middle-income countries) collected between 2002 and 2016. Geometric mean respirable dust concentrations per job per site over time varied over three orders of magnitude from 0.01 to 10 mg/m^3. Geometric mean respirable quartz concentrations varied even more, at four orders of magnitude from 0.0001 to 1 mg/m^3. It was also demonstrated that downward temporal trends in average exposure concentrations were time dependent, occurred also in middle-income countries and were halted and even reversed in times of unfortunate macroeconomic developments.[10]

CONCLUSION

Do we need precise estimate of exposure when analysing the global burden disease due to occupational exposures? Perhaps not, if we wish to simply highlight that: 'Occupational exposures continue to cause an important health burden worldwide, justifying the need for ongoing prevention and control initiatives.'[1] However, if the aim of burden estimation is to inform targeted disease reduction strategies, we strongly believe that more effort should be applied to access, combine and apply existing data sources, and to improve them going forward. It is also imperative to initiate and support data collection endeavours, particularly in understudied regions where local exposure conditions are inadequately captured by proxy studies.[16] While in some instances this is straightforward, in others it will require substantial effort and concerted action. Of course there will be situations where quantitative exposure data are very sparse or not available. In such circumstances the acquired insights from situations with measurement data could be used to facilitate informed estimations.

Although additional effort might be required, we believe that use of more quantitative approaches for exposure data are essential to inform targeted interventions that reduce the global burden of occupational diseases and deaths.

Contributors HK conceptualized this commentary and drafted a first version. Consequently, MvT, CEP and ALH contributed to and revised the manuscript. All authors have read and approved the final version.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Disclaimer The views expressed are those of the authors and do not necessarily represent the decisions, policy or views of their respective institutions.

Competing interests None declared.

Patient consent for publication Not required.

Provenance and peer review Not commissioned; internally peer reviewed.

To cite Kromhout H, van Tongeren M, Peters CE, *et al*. *Occup Environ Med* 2020;**77**:513–514.

Received 18 April 2020
Revised 8 May 2020
Accepted 13 May 2020
Published Online First 12 June 2020

Occup Environ Med 2020;**77**:513–514.
doi:10.1136/oemed-2020-106624

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