Incorporating work organisation into occupational health research: an invitation for dialogue

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The last decade has seen a lively debate emerge about the proper scope of public health research and the value of examining broad social and environmental factors as interacting determinants of morbidity and mortality.[1 2] In occupational health and safety, the broader socio-ecological system of most obvious interest is that of the organisations in which workers are employed. However, occupational health researchers have been slow to incorporate broader workplace features into their exposure assessment protocols and epidemiological study designs. The dominant exposure paradigm remains largely confined to the characterisation of risk factors at the job level (fig 1, arrow B). While application of this paradigm has contributed much to our understanding of the association between work and worker health and safety, failure to consider the organisational factors and conditions that are antecedents to job-level hazards could limit our ability to design and implement effective and sustainable hazard controls (affecting arrows A, C, D in fig 1). Examples of this broader perspective already exist within systems safety and macroergonomics models[3–7] but we suggest that the importance of the organisational context is relevant for all exposure domains—including chemical hazards. We seek to stimulate dialogue within the occupational health community about the organisational context in which worker injury and illness occurs—and its implications for aetiological research and hazard control.

The investigative foci in occupational health and the organisational sciences differ significantly, from job-level to organisational-level.[8] While each contributes to our understanding of how working conditions affect worker health and safety,[9–11] limited empirical research to date has sought to integrate these scientific perspectives simultaneously. The absence within the occupational health community of standardised definitions of organisational "levels" and of organisational constructs, combined with limited forums for the exchange of theoretical and methodological developments and guidance can frustrate health researchers willing to include organisation measures into their studies. There is a need for inter- and intra-disciplinary conversation and collaboration on these issues to reduce research barriers and stimulate new areas of inquiry.

To aid communication, a hierarchical conceptual framework of workplace exposure is shown (fig 2). The inner circle, representing the traditional investigative focus of occupational health research, consists of job-level hazards. We suggest that these hazards are nested within the larger organisational context in which work is performed. The organisational context may have one or more levels and is shown as the middle and outer circles (for example, department, division). These circles signify organisational factors (structure, policy) through which workplace hazards are hypothesised to develop and persist; they also signify factors hypothesised to influence the adoption, suitability, and sustainability of hazard controls. The inclusion of extra-organisation factors would be a logical extension of the framework (for example, macro-level characteristics of the economic, political, regulatory and social environments in which a company operates).[12–15] Finally, because communication in any cross-disciplinary effort can be hampered by differences in terminology, several citations are listed to provide readers with access to key definitions relevant for research incorporating organisation-level variables.[11 16–20]

Increasing evidence, from a still-limited body of research, suggests that the organisation of work may be a determinant of job-level hazards (fig 1, arrow A). Table 1 lists examples of possible hypothesised associations between organisational factors and job hazards, some of which have been shown empirically. A more comprehensive list has been developed based on findings of the Swedish MOA Study (Modern Work and Living Conditions for Men and Women);[21] others have called attention to these associations previously.[11 12 22–26] Importantly, organisational factors can have positive effects on job-level exposures and resultant health effects.[25 27 28] Indeed, interventions that promote "healthy organisations" are the basis of integrated workplace prevention programmes.

Associations between work organisation and job hazards seem to have most often been examined in relation to the psychosocial work environment.[29–33] For example, machine-paced work and piece-rate wages are forms of work organisation that are found in highly specialised and segmented work processes, and have been found to be associated with psychosocial working conditions such as low decision latitude and skill use, in addition to stereotyped physical motion patterns, rapid motions without rest breaks,[34] and increased muscle tension.[35] The temporal pattern of exposure to many ergonomic

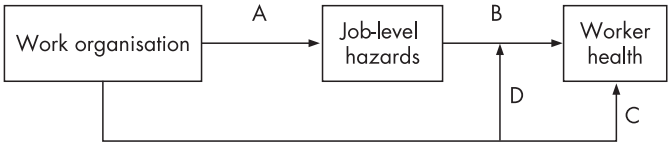

Figure 1 Conceptual pathways that link organisational characteristics with workplace health and safety hazards and worker health outcomes. The box "work organisation" potentially represents multiple levels above the job level.

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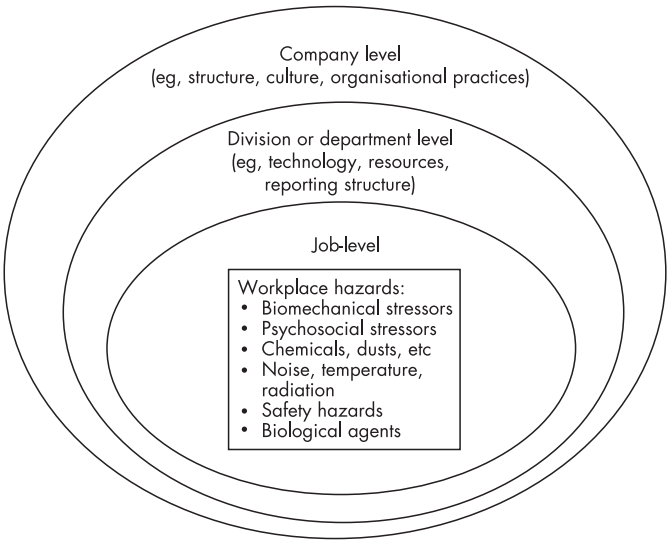

Figure 2 Conceptual framework of workplace exposure comprising multiple organisational levels and some of their features that might influence hazards at the job-level. Some organisation-level features may have influence at multiple levels, and many organisations may have more levels than shown here.

stressors has also been shown to arise from organisational features such as lean production and other process flow systems,[24 36] as well as the level of automation.[24 31–37]

During the past decade there has also been considerable attention paid to identifying the determinants of variability in exposure to chemical and biological job hazards. Rappaport and colleagues have argued that understanding the sources of exposure variability is an important consideration in exposure control.[38] The burgeoning literature on exposure determinant modelling tends to emphasise technological (for example, process technology, ventilation, personal protective clothing) rather than organisational determinants of exposure, even though a large proportion of exposure variation remains unexplained across a range of chemical and biological hazards.[39 40] While we are unaware of industrial hygiene studies that have examined organisation-level phenomena as antecedents to chemical and/or biological hazards, it seems likely, given associations with other exposure domains noted above, that the inclusion of organisation-level factors in mixed-effects models may improve their predictive power and thus better inform effective hazard control strategies.

Some evidence has also accumulated linking work organisation factors and worker health through pathways other than the established exposure-outcome relationships (arrow C vs A and B in fig 1). For example, such a pathway has been included among several possible explanations linking long or irregular work hours and adverse worker health (for example, myocardial infarction, diabetes, and adverse metabolic conditions) through negative influences on health behaviour (for example, diet, smoking, exercise, sleep hygiene).[41–45] Work organisation phenomena may also modify the exposure-response relation by altering workers' susceptibility or their recuperative capacity (fig 1, arrow D). Such an effect was implied in a review of corporate ergonomic programs showing that aspects of work organisation pertaining to reduced or limited work hours and break periods are often overlooked options to promote physiological recovery and reduce the incidence of musculoskeletal disorders.[46]

Not incorporating data on the organisational context within occupational health research has important implications. These can include (1) over-adjustment and risk factor masking in multisite studies in which "facility" is treated as a potential confounder rather than effect modifiers or precursors on the same causal pathway; (2) failure to identify wider patterns of working conditions (for example, exposure clusters) within and across industries and worksites that have common determinants arising from the way work is organised or governed; and (3) suboptimal or ineffective hazard control recommendations that fail to identify

Table 1 Examples of associations between work organisation, working conditions and job-level hazards (chemical, biological, safety, ergonomic, psychosocial)

Organisational construct	Working conditions and job-level hazards
Workplace governance (ownership, outsourcing)	Labour standards, oversight and enforcement of OSH standards, internal resources for training, hazard identification and control, management commitment to workforce health and well-being
Employment relations	Casual vs contractual relations, training and awareness of job hazards and hazard control strategies, job (in)security, disincentives to report hazards and/or morbidity, level of accommodation for injured workers
Pay structure	Fixed pay vs incentive or "piece work" accelerated work pace, incentives for bypassing hazard control measures, reduced formal and/or informal work breaks and opportunities for recovery
Process control	Benchmarking of quality and productivity (workload), formalisation of work methods (exposure variance, autonomy), accountability (work pace, vigilance), authority to halt hazardous processes
Process technology	Type of materials used/recycled, proximity to hazards, level and adaptability of mechanisation (for example, external work pace, ability to step away from point exposure sources)
Lean production techniques	Reduction of non-value added functions such as work-in-process inventory, material handling, walking, searching, machine cycle wait time and indirect labour. Possible effects on task frequency and work pace, time available for safe practices, opportunities for physiological recovery from exposure, overload of physiological clearance processes
Maintenance and housekeeping	Hazard control and effectiveness (for example, replacement of filters in local exhaust ventilation, lubricate movable machine guards, uncluttered and dry walkways, unimpeded egress)
Staffing levels (numerical flexibility)	Availability of relief staff: possible effects on individual workload, time available for safe work practices, opportunities for physiologic recovery
Job rotation	Increased task variety, more exposure variability, possibly reduced hazard awareness, may hamper use of personal protective equipment, may increase recovery opportunities
Social supports and social relations	"Buddy system" (peer safety): oversight, protection and transfer of knowledge about job hazards, workload (re)distibution, self-regulated work groups (work pace, possible peer pressure)
Work schedules	Duration and temporal patterning of all workplace exposures: possible effects on overload of physiological clearance processes, fatigue, recovery opportunities, work/family balance.

organisation-level influences impacting implementation and/or sustainability. It is our hope that readers will be stimulated to delve more deeply into the literature and to examine the organisational context of workplace hazards in their own research. Guidance in work organisation assessment and analysis of multi-level data is growing, which we hope will reduce some of the practical barriers to incorporating organisational data into occupational health research (see for example the NIOSH website Organization of Work—Measurement Tools for Research and Practice: http://www.cdc.gov/niosh/topics/workorg/tools).

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Notes