Systematic comparative content analysis of 17 psychosocial work environment questionnaires using a new taxonomy

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Background: Many questionnaires have been developed to measure how psychosocial characteristics are perceived in a work environment. But the content validity of these questionnaires has rarely been questioned due to the absence of a reference taxonomy for characteristics of work environments.

Objectives: To propose an exhaustive taxonomy of work environment characteristics involved in psychosocial risks and to apply this taxonomy to questionnaires on workplace psychosocial factors.

Methods: The taxonomy was developed by categorizing factors present in the main theoretical models of the field. Questionnaire items most frequently cited in scientific literature were retained for classification.

Results: The taxonomy was structured into four hierarchical levels and comprises 53 categories. The 17 questionnaires analyzed included 927 items: 59 from the “physical environment” category, 116 from the “social environment” category, 236 from the “work activity” category, 255 from the “activity management” category, and 174 from the “organizational context” category.

Conclusions: There are major content differences among analyzed questionnaires. This study offers a means for selecting a scale on the basis of content.

Keywords: Stress, Occupational health, Workplace, Questionnaires, Content analysis, Taxonomy

Introduction

Work-related health risks are a major public health issue. Over the last 30 years, while work-related physical risks have become less frequent in modern western societies, greater importance has been placed on other risks, whose health effects are more insidious because they are less direct and delayed in time. Different expressions are used to describe these non-physical risks, the most frequent of which are “psychosocial hazards” (“psychosocial factors”) and “stressors.” These two expressions convey a negative influence of work on health; therefore we prefer a more neutral expression, namely “work environment characteristics.” In this paper, “work environment characteristics” are characteristics identified by authors who have developed theoretical models of psychosocial hazards potentially harmful for workers.

Apart from a few of notable exceptions,¹ the majority of research studies regarding with the influence of work environment characteristics on health focus on the negative effects of these characteristics. These are often qualified as

strain or stress, when referring to short-term effects;² health outcomes *per se* manifest themselves in the longer term.³ Today, we know a great deal not only about the prevalence of such hazards,⁴ but also about their psychic,⁵ somatic^{6,7} and psycho-somatic⁸ effects. Moreover, a whole range of theoretical models, emerging from various disciplines and trends, has been developed to explain these effects.⁹

Identifying work environment characteristics with an impact on health has a purpose in terms of scientific knowledge, but it also promotes occupational health- and stress-related interventions in companies.¹⁰ Although other methods for measuring work environment characteristics exist (checklists, observations, interviews, focus groups, etc.), the questionnaire is the preferred methodology for this identification process for both theoretical and practical reasons: (1) when focusing on psychosocial factors, perception of the hazard is more important than the presence of the hazard;¹¹ (2) questionnaires are inexpensive, easy to implement, and generate results that are easy to analyze.¹²

Following initial work on stress in the workplace in the 1960s and its subsequent embryonic measures,³ many questionnaires have been published, especially since the 1980s.¹² There are a number of available questionnaire

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summaries aimed at highlighting their psychometrical qualities, discussing the relevance of the theoretical model on which they rest, evaluating their cost-usefulness ratio or discussing their limits.^{2,3,12–14}

Descriptions of questionnaire content nevertheless remain superficial.¹⁵ Authors typically limit their explanations to a list of the dimension names provided by designers. However, these names are frequently idiosyncratic and may not provide enough information to adequately decide if a given questionnaire effectively measures a specific work environment characteristic. For example, the Job Content Questionnaire¹⁶ has been criticized¹⁷ for items within the “skill discretion” dimension referring more to aptitude usage, task complexity and task variety, than job control. Furthermore, the exhaustiveness of work environment characteristics measured by various questionnaires is a recurrent issue,^{18–22} to which satisfactory answers are rarely found. As Rick et al. pointed out,² even though the psychometrical qualities of most questionnaires are satisfactory, content validity can and should be questioned.

A reference taxonomy for work environment characteristics is required to accurately describe questionnaire content. In 1998, Kasl¹¹ regretted that there was no taxonomy of these characteristics, analogous with Mendeleev’s periodic table of the elements. He proposed a list of 10 work environment categories, which he used to describe the content of 4 questionnaires. Other authors²³ also proposed a list of 10 categories, but without an explicit development methodology. Yet, other authors advanced smaller lists broken down into subcategories (nine for Cox²⁴, seven for Cousins et al.²⁵); each of them considering that his or her list represented a reasonable consensus without revealing the criteria for this approval. The typology proposed by Morgeson and Humphrey²¹ comprised 18 categories, but their approach was deliberately consigned to a specific line of research, namely *job design*. Others²⁶ considered the taxonomy of Warr²⁷ to be the most comprehensive, but it comprises only nine categories. The most recent and ambitious taxonomic effort has resulted from the work of the *National Institute for Occupational Safety and Health* researchers,²⁸ who brought together 8 experts to produce a list of 22 categories grouped into four levels (work, organization, interpersonal, and personal). However, for all its interest, this taxonomy was not exclusively based on content criteria: it also took into account pragmatic considerations (such as malleability and the possibility of intervening on the characteristics retained).

Existing questionnaire content descriptions are therefore often general, relatively unsystematic, and based on *ad hoc* taxonomies or a small number of questionnaires.^{2,15,28–30} The purpose of this paper is therefore dual: (1) to propose a taxonomy of work environment characteristics that is as exhaustive and detailed as possible by implementing an explicit approach to its development and (2) to apply this taxonomy to existing questionnaires using item contents as analysis units to overcome the

terminological idiosyncrasies commonly found in scale headings. Our taxonomy is envisaged across a wide spectrum of theories that not only account for relationships between work environment and health, but also stem from several occupational disciplines.⁹

Methodology

To develop the taxonomy, we first selected theoretical models designed to highlight relationships between work environment and health. Models had to refer explicitly to a list of work environment characteristics likely to have an impact on occupational stress and health. The methodologies for the literature review and model selection have been previously published.⁹

We then extracted the work environment characteristics identified in the selected theoretical models. The first author categorized these characteristics by drawing on and refining existing taxonomies. A hierarchical taxonomy was chosen to ensure the possibility of reporting the specific characteristics introduced by the different researchers. We chose positive or neutral headings for building taxonomy categories (e.g. “role clarity” instead of “role ambiguity,” “variety” instead of “repetitiveness,” “range of relationships” instead of “isolation at work,” etc.). As previously stated, negative expressions convey implicitly the idea of a necessarily negative influence of work on health. Hence, negative terms cannot be sufficient to account for the scope and diversity of work environment characteristics. For example, in the case of role clarity, a worker can be dissatisfied with the lack of role clarity at work (“role ambiguity”), but also with an excess of clarity and preciseness in instructions and orders. The co-authors then classified independently the characteristics listed in the various categories. Each disagreement in classifications was discussed by the authors to reach a consensus. Discussions around disagreements enabled titles to be refined and/or more specific subcategories to be created. A new classification of characteristics in the revised taxonomy was then drawn up independently by at least two of the authors. This process was repeated several times until sufficient convergence of individual categorizations was achieved.

Once the taxonomy was built up, it was applied to psychosocial work environment assessment questionnaires to characterize them and overcome their specific terminological characteristics. We started by retaining the 19 English language questionnaires from the 26 questionnaires listed by Tabanelli et al.¹² and we kept the 17 questionnaires for which we could access the detailed content (we failed to find the Stress Risk Assessment Questionnaire and the Stress Profile).³¹ Questionnaire items were then independently categorized in the taxonomy developed during the previous stage by at least two co-authors. Possible divergences were resolved by comparing viewpoints and consensus.

In addition to univariate and bivariate descriptions, we resorted to correspondence analysis³² to present a

summary form of the specific characteristics of the questionnaires content with respect to the taxonomy categories. Correspondence analysis was performed on the contingency table of categories and questionnaires using the FactoMineR package³³ provided by R software³⁴.

Results

Taxonomy of work environment characteristics

Seventeen theoretical models representing different lines of research (*Institute for Social Research, Person-Environment Fit, Job Design, Preventive Stress Management, etc.*) were selected following the literature review (cf. Althaus et al.⁹ for the list and an analysis of these models). These models relied on lists of work environment characteristics comprising between 9 and 39 items. The total of 315 partially redundant characteristics was used for developing the taxonomy (Table 1), which enabled classification of virtually all the 315 characteristics. Only six of them could not be included in the grid; these were very general statements referring to the work environment (occupational differences, working conditions) or items unrelated to it (personality variables, external requests).

The resulting taxonomy was composed of 53 categories divided into four hierarchical levels. At its most global level, there were five major areas that could be assessed in relation to their greater or lesser distance from the worker: *Physical environment*, *Social environment*, *Work activity*, *Activity management*, and *Organizational context*. Two of these categories were represented in every model considered (*Work activity* and *Activity management*), while *Social environment* was considered in 15 models, *Organizational context* in 14 and *Physical environment* in 12. At the lower hierarchical level, the categories most frequently represented were: *Work content* (15 models), *Appropriateness of demands* (15), *Autonomy-control* (15), *Assigned role* (14), *Human resources management* (11), and *Physical characteristics* (10). Categories less frequently represented were *Organizational communication* (one model), *Available resources*, *Association with decisions*, and *Organizational climate* (each in two models).

Questionnaires analyzed

As previously explained, 17 of the 19 questionnaires available in English and listed in Tabanelli et al.¹² were accessible (Table 2).

Table 1 Taxonomy of work environment characteristics

Level 1	Level 2	Level 3	Level 4
I. Physical environment	(1) Physical characteristics	(a) Noise; (b) light; (c) temperature; (d) air; (e) smell; (f) radiation; (g) vibration; (h) chemical/biological agents; (i) other hazards	
	(2) Working rooms	(a) Furnishing/ergonomics; (b) Aesthetics/hygiene	
	(3) Resources – equipment		
II. Social environment	(1) Range of relationships		
	(2) Quality of relationships	(a) Colleagues; (b) superiors; (c) subordinates; (d) persons outside work (customer, provider, etc.)	
	(3) Social support	(a) Instrumental (b) Emotional	(i) Colleagues; (ii) superiors (i) Colleagues; (ii) superiors
III. Work activity	(1) Work content	(a) Responsibilities (b) Variety; (c) interest; (d) meaning	(i) For persons; (ii) for equipment
	(2) Demands	(a) Physical; (b) cognitive; (c) emotional	
	(3) Appropriateness of demands	(a) Quantitative (workload); (b) qualitative (type of skills)	
IV. Activity management	(1) Assigned role	(a) Clarity (b) Coherence	(i) Of work requirements; (ii) of status
	(2) Feedback		
	(3) Autonomy – control	(a) Decision latitude (b) Dependence	(i) Of pace; (ii) interruptions; (iii) of other persons
	(4) Time-related pressure – urgency		
V. Organizational context	(1) Time-based organization	(a) Schedule; (b) hours	
	(2) Human resources management	(a) Career; (b) salary; (c) skills development; (d) work assessment; (e) management style	
	(3) Perceived fairness		
	(4) Involvement in decision-making		
	(5) Organizational climate		
	(6) Organizational communication		
	(7) Prospective	(a) Job security; (b) changes – restructuring	

Table 2 Questionnaires retained for item content analysis

Abbreviated name	Questionnaire name	Version – comments	Number of items/scales	Reference
COPSOQ	Copenhagen psychosocial questionnaire	Version 2, medium form (questionnaire for advisory purposes)	87/28	Pejtersen et al. ³⁵
ERI	Effort reward imbalance	Short version	16/2 (4)	Siegrist et al. ³⁶
GJSQ	NIOSH – generic job stress questionnaire	Full version except “social support from family/friends,” “non-work activities,” “type A personality,” “self-esteem,” “somatic complaints,” “job satisfaction”	97/15	Hurrell and McLaney ³⁷
HSE	Health and safety executive management standards indicator tool		35/6	Edward et al. ³⁸
JCI	Job characteristic inventory		30/6	Sims et al. ³⁹
JCQ	Job content questionnaire	Recommended format (49 q.)	49/9	Karasek et al. ¹⁶
JDS	Job diagnostic survey	Original version	21/7	Hackman and Oldham ⁴⁰
JSS	Job stress survey		30/2	Spielberger and Vagg ⁴¹
OSI	Occupational stress index	Full version except the first nine items	57/7	Belkić and Savić ⁴²
OSInd	Occupation stress indicator	Only “sources of pressure” part	61/6	Cooper et al. ⁴³
OSI-R	Occupational stress inventory	Revised version, only “Occupational Roles Questionnaire” part	60/10	Ospow ⁴⁴
OSQ	Occupational stress questionnaire	Full version (except “personal background,” “stress and satisfaction” and “need for work development and support”)	41/12	Elo et al. ⁴⁵
PMI	Pressure management indicator	Sources of pressure scales only	40/8	Williams and Cooper ¹⁹
QPS-N	Nordic questionnaire for psychological and social factors at work	Full version (except “personal background,” “work centrality” and “work motives”)	103/26	Lindström et al. ⁴⁶
SDS	Stress diagnostic survey	30-item version	30/6	Ivancevich and Matteson ⁴⁷
WES	Work environment scale		90/10	Moos ⁴⁸
WOCCQ	Working conditions and control questionnaire		80/6	Hanse ¹⁷

Item categorization in the taxonomy

The 17 obtainable questionnaires provided a total of 927 items that were categorized at the most refined level of the taxonomy. Table 3 reports the outcome of this categorization. The most detailed categorization is not shown for reasons of space (see supplemental material for a detailed table). Table 4 presents each category with one or more examples of items and indicates the questionnaires, in which the category is either strongly or scarcely represented.

Polysemic items

The categorization process enabled us to highlight the polysemy of some items. For example, the item “How much influence do you have over the availability of supplies and equipment you need to do your work” in the GJSQ questionnaire refers to both the autonomy a person has in his/her work (*Activity management/Autonomy-control* category) and the equipment availability (*Physical environment/Resources* category). The item “Are you content with your ability to maintain a good relationship with your customers or clients?” in the QPS-N questionnaire refers to the *Work activity/Appropriateness of demands/Qualitative* and *Social environment/Quality of relationships/(with)*

persons outside work categories. We considered therefore that these items assessed two work environment characteristics: one is the initial cause and the other is a possible outcome. In the first example, the level of autonomy can be assimilated to the initial cause and, in the second example, it is the appropriateness of demands in relation to the worker’s resources. We decided to classify all the polysemic items ($n = 54$, i.e. 5.8%) with respect to their initial cause.

Unclassifiable items

As shown in Table 3, 115 items appeared to be unclassifiable (12.4%) for the following reasons:

- 28 items were too general and did not fit into one of the specific categories of Table 1. They were thus classified at a more general level of the taxonomy (see supplemental material). For example, this was the case of OSInd questionnaire item “Personal beliefs conflicting with those of the organization,” which was placed in the *Organizational context* category, but could not be more accurately allocated to a specific subcategory.
- 53 items were potential outcomes of the work environment and not work characteristics. The following outcomes were concerned:
 - Respondent’s motivation (e.g. QPS-N: “This organization really inspires me to give my very best job

Table 3 Absolute (first row) and relative (second row) frequencies of questionnaire items in taxonomy categories (simplified)

COP-			WOC-														Total
SOQ	ERI	GJSQ	HSE	JCI	JCQ	JDS	JSS	OSI	OSI-R	OSInd	OSQ	PMI	QPS-N	SDS	WES	CQ	
Unclassifi- able	21	0	1	1	0	0	1	0	0	2	0	2	7	0	11	7	53
	24.1	0.0	1.0	2.9	0.0	0.0	3.3	0.0	0.0	3.3	0.0	5.0	6.8	0.0	12.2	8.8	5.7
	0	0	0	0	0	0	0	0	0	5	2	5	4	0	0	0	16
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.2	4.9	12.5	3.9	0.0	0.0	0.0	1.7
Physical Environment	0	0	0	0	0	0	0	11	0	0	0	0	0	0	0	0	11
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2
	0	1	0	0	0	5	0	0	0	0	0	0	1	0	0	0	7
	0.0	6.3	0.0	0.0	0.0	10.2	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.8
Social Environment	3	0	0	0	4	1	0	0	1	5	0	3	3	0	5	3	28
	3.4	0.0	0.0	0.0	13.3	2.0	0.0	0.0	1.7	8.2	0.0	7.5	2.9	0.0	5.6	3.8	3.0
	1	0	9	0	0	0	1	9	8	0	1	0	0	0	4	9	42
	1.1	0.0	9.3	0.0	0.0	0.0	3.3	15.8	13.3	0.0	2.4	0.0	0.0	0.0	4.4	11.3	4.5
Work Activity	0	0	1	0	0	0	0	1	0	0	1	0	0	0	5	0	8
	0.0	0.0	1.0	0.0	0.0	0.0	0.0	1.8	0.0	0.0	2.4	0.0	0.0	0.0	5.6	0.0	0.9
	0	0	2	0	0	0	2	1	1	1	0	0	1	0	0	1	9
	0.0	0.0	2.1	0.0	0.0	0.0	6.7	1.8	1.7	1.6	0.0	0.0	1.0	0.0	0.0	1.3	1.0
Work content	0	0	1	0	5	1	0	1	1	2	1	1	3	0	0	0	16
	0.0	0.0	1.0	0.0	16.7	0.0	4.8	0.0	1.7	3.3	2.4	2.5	2.9	0.0	0.0	0.0	1.7
	9	1	5	5	1	4	0	2	1	5	4	2	7	0	4	3	54
	10.3	6.3	5.2	14.3	3.3	8.2	0.0	6.7	1.8	8.2	9.8	5.0	6.8	0.0	4.4	3.8	5.8
Work Responsibilities	4	1	8	7	0	3	0	2	0	3	2	3	5	0	5	2	45
	4.6	6.3	8.2	20.0	0.0	6.1	0.0	6.7	0.0	4.9	4.9	7.5	4.9	0.0	5.6	2.5	4.9
	1	1	4	0	0	1	1	2	10	4	2	4	3	5	1	3	48
	1.1	6.3	4.1	0.0	0.0	2.0	4.8	6.7	16.7	6.6	4.9	10.0	2.9	16.7	1.1	3.8	5.2
Activity	0	0	0	0	5	2	1	1	0	1	2	0	2	0	5	0	20
	0.0	0.0	0.0	0.0	16.7	4.1	4.8	3.3	1.8	1.6	4.9	0.0	1.9	0.0	5.6	0.0	2.2
	1	0	0	0	0	0	2	0	2	2	0	1	0	1	1	0	10
	1.1	0.0	0.0	0.0	0.0	0.0	6.7	0.0	3.3	3.3	0.0	2.5	0.0	3.3	1.1	0.0	1.1
Activity Management	3	0	1	0	1	0	0	0	0	0	1	0	2	1	0	0	11
	3.4	0.0	1.0	0.0	3.3	0.0	9.5	0.0	0.0	0.0	2.4	0.0	1.9	3.3	0.0	0.0	1.2
	4	2	7	1	1	12	1	3	7	4	4	4	6	1	3	1	61
	4.6	12.5	7.2	2.9	3.3	24.5	4.8	10.0	12.3	6.6	9.8	10.0	5.8	3.3	3.3	1.3	6.6
Activity Management	5	3	12	1	0	1	1	0	2	8	3	3	11	7	4	11	80
	5.7	18.8	12.4	2.9	0.0	2.0	4.8	0.0	13.3	13.1	7.3	7.5	10.7	23.3	4.4	13.8	8.6
	4	0	7	5	0	0	0	0	9	1	2	0	6	4	5	6	51
	4.6	0.0	7.2	14.3	0.0	0.0	0.0	0.0	15.0	1.6	4.9	0.0	5.8	13.3	5.6	7.5	5.5
Activity Management	2	0	5	1	0	1	0	2	1	1	1	2	1	3	1	4	33
	2.3	0.0	5.2	2.9	0.0	2.0	0.0	6.7	13.3	1.6	2.4	5.0	1.0	10.0	1.1	5.0	3.6
	2	0	0	1	5	0	6	0	1	1	1	1	2	0	0	1	21
	2.3	0.0	0.0	2.9	16.7	0.0	28.6	0.0	1.7	1.6	2.4	2.5	1.9	0.0	0.0	1.3	2.3
Activity Management	5	1	15	5	7	6	8	1	7	2	10	1	12	1	10	18	110
	5.7	6.3	15.5	14.3	23.3	12.2	38.1	3.3	12.3	1.6	24.4	2.5	11.7	3.3	11.1	22.5	11.9
	5	0	3	3	0	2	0	2	3	2	2	0	2	1	3	2	30
	5.7	0.0	3.1	8.6	0.0	4.1	0.0	6.7	5.3	3.3	0.0	4.9	0.0	1.9	3.3	2.5	3.2

(Continued)

Table 3 (Continued)

Organi- zational context	COP- SOQ		ERI	GJSQ	HSE	JCI	JCQ	JDS	JSS	OSI	OSI-R	OSInd	OSQ	PMI	QPS-N	SDS	WES	WOC- CQ		Total
Time-based organization	1		0	0	2	0	0	0	1	1	1	1	0	1	0	0	0	1		9
Human Career	1.1		0.0	0.0	5.7	0.0	0.0	0.0	3.3	1.8	1.7	1.6	0.0	2.5	0.0	0.0	0.0	1.3		1.0
re-sources	0		2	2	0	0	1	0	2	0	2	5	0	3	3	4	0	0		24
man-agement	0.0		12.5	2.1	0.0	0.0	2.0	0.0	6.7	0.0	3.3	8.2	0.0	7.5	2.9	13.3	0.0	0.0		2.6
Skills development	0		1	0	0	0	0	0	1	2	0	1	0	0	1	0	0	1		7
Work assessment	0.0		6.3	0.0	0.0	0.0	0.0	0.0	3.3	3.5	0.0	1.6	0.0	0.0	1.0	0.0	0.0	1.3		0.8
Management style	0		0	0	0	0	1	0	0	0	1	2	0	1	1	1	1	0		8
Perceived fairness	0.0		0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	1.7	3.3	0.0	2.5	1.0	3.3	1.1	0.0		0.9
Involvement in decision-making	2		0	0	0	0	0	0	1	1	1	1	0	0	0	0	2	0		8
Organizational climate	2.3		0.0	0.0	0.0	0.0	0.0	0.0	3.3	1.8	1.7	1.6	0.0	0.0	0.0	0.0	2.2	0.0		0.9
Organizational communication	3		0	0	0	1	4	0	0	0	0	0	0	0	6	1	11	0		26
Prospective	3.4		0.0	0.0	0.0	3.3	8.2	0.0	0	0	0	0	0	0	5	0	12.2	0.0		2.8
	3		2	0	0	0	0	0	1	0	0	2	2	1	5	0	0	1		17
	3.4		12.5	0.0	0.0	0.0	0.0	0.0	3.3	0.0	0.0	3.3	4.9	2.5	4.9	0.0	0.0	1.3		1.8
	2		0	2	1	0	1	0	1	0	0	1	0	1	0	0	1	0		10
	2.3		0.0	2.1	2.9	0.0	2.0	0.0	3.3	0.0	0.0	1.6	0.0	2.5	0.0	0.0	1.1	0.0		1.1
	3		0	8	0	0	0	0	2	0	0	1	0	1	7	0	8	1		31
	3.4		0.0	8.2	0.0	0.0	0.0	0.0	6.7	0.0	0.0	1.6	0.0	2.5	6.8	0.0	8.9	1.3		3.3
	2		0	0	2	0	0	0	0	0	0	0	0	0	1	0	0	0		5
	2.3		0.0	0.0	5.7	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	1	0	0	0		0.5
	1		1	4	0	0	4	0	0	0	1	1	0	0	1	0	0	5		18
	1.1		6.3	4.1	0.0	0.0	8.2	0.0	0.0	0.0	1.7	1.6	0.0	0.0	1.0	0.0	0.0	6.3		1.9
Total	87		16	97	35	30	49	21	30	57	60	61	41	40	103	30	90	80		927
	9.4		1.7	10.5	3.8	3.2	5.3	2.3	3.2	6.1	6.5	6.6	4.4	4.3	11.1	3.2	9.7	8.6		100

performance”) or motivation of other employees (e.g. WES: “People put quite a lot of effort into what they do”) ($n = 16$).

- Perceived health (e.g. COPSOQ: “How often have you felt tired?”) ($n = 13$).
- Attitude toward work or the company (e.g. JSS: “Experiencing negative attitudes toward the organization”) ($n = 11$).
- The respondent’s work performance (e.g. QPS-N: “Are you content with the quality of the work you do?”) or work performance of other employees (e.g. WES: “People seem to be quite inefficient”) ($n = 9$).
- Family life (e.g. OSInd, PMI: “Not being able to ‘switch off’ at home”) ($n = 4$).
- 16 items referred to characteristics outside work: the attitude of the respondent’s spouse (e.g. OSInd: “My spouse’s attitude towards my job and career”) ($n = 8$) or the opportunity to find work problem-related support in people outside work (e.g. QPS-N: “If needed, can you talk with your friends about your work-related problems?”) ($n = 8$).
- 11 items were open questions (e.g. OSI: “What could be done to improve working conditions at your current job?”).
- 7 items referred only to work environment characteristics and did not fit into our taxonomy (e.g. JCQ: “I am a member of a union or employee association;” QPS-N: “Do you belong to a permanent working group or team?”).

Resolving disagreement in classification

Two of the authors classified items independently. When an item obtained two different classifications, the authors resolved the disagreement by consensus. This occurred mostly with items that had an over-general meaning or a meaning too vague to refer directly to a specific category of the taxonomy. Initial disagreements mainly involved distinctions between:

- Items that could be classified vs. those that could not: the items concerned here were either very general (COPSOQ: “Do you feel part of a community at your place of work?” item finally classified in the *Social environment* category, and no subcategory) or were referring to aspects that are both related and unrelated to work (PMI: “Demands that work makes on my private/social life”; item finally classified in the *Work activity/Appropriateness of demands/Quantitative* subcategory) or were questioning other employees’ perception (WES: “People seem to take pride in the organization;” item finally considered unclassified).
- The *Activity management/Autonomy-control* subcategory vs. the following subcategories:
 - *Organizational context/Human Resources management/Management style* (WES: “Employees are encouraged to make their own decisions;” item finally classified in *Organizational context/Human resources management/Management style*).
 - *Organizational context/Involvement in decision-making* (GJSQ: “How much influence do you have over the availability of materials you need to do your work?” item finally classified in *Activity management/Autonomy-control*).

- *Social environment/Range of relationships* (JDS: “The job requires a lot of cooperative work with other people;” item finally classified in *Activity management/Autonomy-control/Dependence/of other persons*).
- *Work activity* (OSI-R: “I spend time concerned with the problems others at work bring to me;” item finally classified in *Work activity/Work content/Responsibilities/for persons*).
- The *Social environment* and *Organizational context* categories for some items. For example: JCQ “My supervisor pays attention to what I am saying” (item finally classified in *Organizational context/Human resources management/Management style*); COPSOQ “Do the employees in general trust each other?” (item finally classified in *Organizational context/Organizational climate*); WES “Employees often eat lunch together” (item finally classified in *Organizational context/Organizational climate*);
- The *Work activity/Work content/Responsibilities* and *Work activity/demands* subcategories (OSI: “Do you oversee the work of one or more machines or automatic devices?” item finally classified in *Work activity/Work content/Responsibilities/for equipment*);
- The *Work activity/Demands* and *Work activity/Appropriateness of demands* subcategories (HSE: “I have to work very intensively;” item finally classified in *Work activity/Demands*);
- The *Social environment/Quality of relationships* and *Social environment/Social support* subcategories (OSQ: “Do workmates keep an eye on each other?” item finally classified in *Social environment/Social support*).

Some differences in classification occurred when categorization was detailed down to three or four levels. This was the case among the subcategories of the following categories: *Activity management/Autonomy-control*; *Activity management/Assigned role*; *Work activity/work content (variety, interest, meaning)*.

Description of the major results obtained

The *Activity management* category contained the greatest number of items (30.2% of the 812 items classified in Table 3). The *Autonomy-control* subcategory represented nearly half of these items (44.9%). It was also the only subcategory of our taxonomy which was present in each questionnaire (Table 3). Given their accurate meaning, 44 items could be classified in the *Decision latitude* subcategory, while 31 others referred rather to the notion of *Dependence* with respect to (a) *Other people’s work* (14 items), (b) *Pace* (9 items), and (c) *Interruptions* (8 items) (see additional online supplemental material). The *Assigned role* subcategory represented 34.3% of the items in the *Activity management* category. The items related to *Clarity* outnumbered those related to *Coherence* (51 vs. 33). When coherence was accurately defined, it mostly referred to *Work requirements* (20 items) rather than to work *Status* (3 items). The last two subcategories founded in the *Activity management* category were related to *Time-pressure* (30 items) and to the *Feedback* provided by the work activity or by a third party (21 items).

The second most frequent category of our classification appeared to be *Work activity*, which included a number of items close to that of the *Activity management* category (230 items, i.e. 28.3%). This category included items referring to work-related *Demands* (which provided information on a level of requirement in absolute terms, 26.5% of items in the category) and *Appropriateness of demands* (which addressed – explicitly or implicitly – the concordance between the level of requirement and resources available to the person, 34.8% of the items in the category) were the most common. Questions on *Demands* mostly involved *Cognitive demands* (21 items), followed by the *Physical* (11 items) and *Emotional* (7 items) spheres. Twenty-two items did not specify the type of work-related demands. There were rather more items involving the *Quantitative* aspects of demand appropriateness (workload: 40 items) than the *Qualitative* aspects thereof (type of skills: 32 items). Eight items did not specify the type of appropriateness. The *Responsibilities* subcategory represented 20.9% of all 230 items. When specified, this especially concerned responsibility for *Persons* (23 items); three items referred to responsibility for *Equipment*, while the remaining 22 items were not detailed. *Activity variety*, *Work meaning*, and *Work interest* represented 8.7, 4.8, and 4.3% of items in the *Work activity* category, respectively.

Approximately one out of five items (20.1%) belonged to the main *Organizational context* category. Overall, the items in the *Human resources management* subcategory represented 44.8% of these items. This subcategory was further divided as follows: *Management style* (26 items), *Career* (24 items), *Skills development* (8 items), *Way in which work is assessed* (8 items) and *Salary* (7 items). Many items referred to *Organizational climate* (19.0%), followed by items on *Prospective* (11%), on *Perceived fairness* (10.4%), on *Involvement in decision-making* (6.1%), on *Time-based organization* (5.5%), and on *Organizational communication* (3.1%).

The main *Social environment* category represented 14.2% of the items. In this category, items in the *Quality of relationships* subcategory were the most frequent (47.0%). When specified, it was most often the quality of relationships with the worker's immediate *Superior* or superiors that was involved (12 items). Relationships with *Colleagues* were addressed in eight items and just two items referred to *Subordinates*. Most items (32) in this subcategory did not detail who is involved. Items involving *Social support* (39.1%), either *Emotional* or *Instrumental*, differed from the preceding items since they referred explicitly to help or assistance provided by colleagues or immediate superiors. When examining the different types of support in greater detail, we found 15 items involving *Emotional support*, 9 items involving *Instrumental support* and 21 items that provided no details. In terms of the origin of social support, 21 items targeted the immediate *Superior* or superiors, and only 9 items targeted the worker's *Colleagues* (15 did not detail the provider).

Finally, only 7.3% of the items belonged to the *Physical environment* category. Among these, *Physical characteristics* questions were most common (71.2%). *Air quality* was the focus of most questions (10 items), followed by *Temperature* (7 items), *Noise* (5 items), and *Light* (4 items). Few items involved questioning *Resources* (resources, equipment) (15.2%). Items involving *Work room* also formed a rare category. Of the eight items (13.6%) listed, *Aesthetics* was addressed in four items and *Furnishing* in two items (2 items did not specify).

Rating scales

Question types analysis was not the aim of this paper. However, it can be said that rating scales with five options were most frequently encountered (43.6% of items). Nearly one-third of the items offered less than 5 reply options (32.4%) and less than one-quarter offered more than five reply options (24.1%). It can be noticed that time-related answers were the most used ones (39.5%), followed by answers offering a degree of agreement (24.9%) and intensity-related answers (16.8%). 15% of items asked directly if the work characteristic was a more or less important source of stress (or even in some cases a source of satisfaction). The rest of the items had specific answers (2.5%) or were open questions (1.3%).

Questionnaire architecture

Tables 3 and 4 allow us to characterize the content of the 17 questionnaires analyzed by highlighting their specificities. For example, the COPSOQ had proportionally more items in the *Quality of relationships*, *Meaning of work*, *Time-related pressure – urgency*, *Work assessment*, *Perceived fairness*, *Involvement in decision-making* and *Organizational communication* categories. Conversely, the COPSOQ had proportionally fewer items (or no items at all) in the *Physical characteristics*, *Working rooms*, *Resources – equipment*, *Range of relationships*, *Responsibilities*, *Variety*, *Career*, *Salary*, and *Skills development* categories. The number of items in other categories was proportional to the number observed globally.

The description of questionnaire content was summarized by a correspondence analysis. An initial analysis was conducted based on the five main categories. This revealed opposition in the first dimension between the questionnaires featuring items in the *Physical environment* category and those not including these items. Based on reviewer feedback, we therefore proceeded with the analysis by making *Physical environment* a supplementary modality such that it no longer contributed to structuring of the factorial space. The results are presented in graphical form in Fig. 1. The first two dimensions explain 89.2% of the variance (57.9 and 31.3%, respectively).

The *Activity management* and *Organizational context* categories mainly contributed to defining the first dimension (horizontal). This means that the questionnaires with proportionally more items belonging to the *Activity*

Table 4 Illustration of items in taxonomy categories (simplified) and questionnaires, in which category is either strongly or scarcely represented

Category	%	Examples of items	Questionnaire with relatively many items of this category	Questionnaire with relatively few items of this category
I.1. Physical characteristics	4.5	WOCCQ: "I'm exposed to too high a noise level" (I.1.a); WES: "The lighting is extremely good" (I.1.b); OSI-R: "On my job I am exposed to temperature extremes" (I.1.c); GJSQ: "The level of air circulation in my work area(s) is good" (I.1.d); OSI-R: "On my job I am exposed to unpleasant odors" (I.1.e); WOCCQ: "I'm exposed to harmful radiations" (I.1.f); OSI: "Are you exposed to vibration at work?" (I.1.g); OSI-R: "On my job I am exposed to poisonous substances" (I.1.h); OSI-R: "My job is physically dangerous" (I.1.i)	OSI (15.8%); OSI-R (13.3%); WOCCQ (11.3%); GJSQ (9.3%)	ERI, HSE, JCI, JQC, JDS, OSIInd, PMI, QPS-N, SDS (0.0%); COPSOQ (1.1%); OSQ (2.4%)
I.2. Working rooms	0.9	GJSQ: "My work area(s) is/are awfully crowded" (I.2.a); WES: "The colors and decorations make the place warm and cheerful to work in" (I.2.b)	WES (5.6%); OSQ (2.4%)	COPSOQ, ERI, HSE, JCI, JQC, JDS, JSS, OSI-R, OSIInd, PMI, QPS-N, SDS, WOCCQ (0.0%)
I.3. Resources – equipment	1.0	JSS: "Inadequate or poor quality equipment"	JSS (6.7%); GJSQ (2.1%)	COPSOQ, ERI, HSE, JCI, JQC, JDS, OSQ, PMI, SDS, WES (0.0%)
II.1. Range of relationships	1.7	JCI: "The opportunity in my job to get to know other people"	JCI (16.7%); JDS (4.8%)	COPSOQ, ERI, HSE, JQC, JSS, SDS, WES, WOCCQ (0.0%)
II.2. Quality of relationships	5.8	OSQ: "How do workmates get along at your workplace?" (II.2.a); QPS-N: "Is the relationship between you and your immediate superior a source of stress to you?" (II.2.b); OSIInd, PMI: "Simply being seen as a 'boss'" (II.2.c)	HSE (14.3%); COPSOQ (10.3%); OSQ (9.8%)	JDS, SDS (0.0%); OSI-R (1.7%); OSI (1.8%)
II.3. Social support	4.9	JQC: "My supervisor is helpful in getting the job done" (II.3.a.i); QPS-N: "If needed, are your co-workers willing to listen to your work-related problems?" (II.3.b.ii)	HSE (20.0%); GJSQ (8.2%)	OSI-R, OSI, JCI, SDS, JDS (0.0%); WOCCQ (2.5%)
III.1.a. Responsibilities	5.2	GJSQ: "How much responsibility do you have for the welfare and lives of others?" (III.1.a.i); OSQ: "At work, can you accidentally ruin some valuable equipment or work result?" (III.1.a.ii)	OSI-R (16.7%); SDS (16.7%); OSI (10.5%); PMI (10.0%)	HSE, JCI (0.0%); COPSOQ (1.1%); WES (1.1%); JQC (2.0%); QPS-N (2.9%)
III.1.b. Variety	2.2	OSQ: "How monotonous or varied is your work?"	JCI (16.7%); WES (5.6%); OSQ (4.9%)	COPSOQ, ERI, GJSQ, HSE, OSI-R, PMI, SDS, WOCCQ (0.0%)
III.1.c. Interest	1.1	WES: "The work is usually very interesting"	JSS (6.7%); OSI-R (3.3%); OSIInd (3.3%); SDS (3.3%)	ERI, GJSQ, HSE, JCI, JQC, JDS, OSI, OSQ, QPS-N, WOCCQ (0.0%)
III.1.d. Meaning	1.2	COPSOQ: "Is your work meaningful?"	JDS (9.5%); COPSOQ (3.4%); JCI (3.3%); SDS (3.3%)	ERI, HSE, JCS, JSS, OSI, OSI-R, OSIInd, PMI, WES, WOCCQ (0.0%)
III.2. Demands	6.6	JQC: "My job requires lots of physical demand" (III.2.a); GJSQ: "My job requires a great deal of concentration" (III.2.b); COPSOQ: "Is your work emotionally demanding?" (III.2.c)	JQC (24.5%); OSI (12.3%)	OSI-R (0.0%); WOCCQ (1.3%); WES (3.3%)
III.3. Appropriateness of demands	8.6	SDS: "I have to take work home in the evenings or on weekends to stay caught up" (III.3.a); OSI-R: "I feel overqualified for my job" (III.3.b)	SDS (23.3%); ERI (18.8%); WOCCQ (13.8%); OSI-R (13.3%); OSIInd (13.1%); GJSQ (12.4%)	JCI, JSS (0.0%); JQC (2.0%); HSE (2.9%); OSI (3.5%); WES (4.4%); COPSOQ (5.7%)
IV.1.a. Role clarity	5.5	COPSOQ: "Does your work have clear objectives?"	OSI-R (15.0%); HSE (14.3%); SDS (13.3%)	ERI, JCI, JQC, JDS, JSS, PMI (0.0%); OSIInd (1.6%)
IV.1.a. Role coherence	3.6	HSE: "Different groups at work demand things from me that are hard to combine" (IV.1.a.i); JSS: "Performing tasks not in job description;" (IV.1.a.ii)	OSI-R (13.3%); SDS (10.0%)	ERI, JCI, JDS (0.0%); QPS-N (1.0%); WES (1.1%)
IV.2. Feedback	2.3	JDS: "Just doing the work required by the job provides many chances for me to figure out how well I am doing"	JDS (28.6%); JCI (16.7%)	ERI, GJSQ, JQC, JSS, OSI, SDS, WES (0.0%)
IV.3. Autonomy – control	11.9	JCI: "How much are you left on your own to do your own work?" (IV.3.a); JCI: "The control I have over the pace of my work" (IV.3.b.i); OSI: "Does it happen during your work day that several people seek your attention at the same time?" (IV.3.b.ii); JCI: "How much of your job depends upon your ability to work with others?" (IV.3.b.iii)	WOCCQ (22.5%); JDS (38.1%); OSQ (24.4%); JCI (23.3%); GJSQ (15.5%)	OSIInd (1.6%); PMI (2.5%); JSS (3.3%); OSI-R (3.3%); SDS (3.3%); COPSOQ (5.7%)
IV.4. Time-related pressure – urgency	3.2	OSI: "Do you face speed-up?"	HSE (8.6%); JSS (6.7%); COPSOQ (5.7%)	ERI, JCI, JDS, OSIInd, PMI (0.0%)

(Continued)

Table 4 (Continued)

Category	%	Examples of items	Questionnaire with relatively many items of this category	Questionnaire with relatively few items of this category
V.1. Time-based organization	1.0	HSE: "My working time can be flexible" (V.1.a); COPSOQ, JSS, OSInd: "Having to work very long hours" (V.1.b)	HSE (5.7%); JSS (3.3%); PMI (2.5%)	ERI, GJSQ, JCI, JCQ, JDS, OSQ, QPS-N, SDS, WES (0.0%)
V.2.a. Career	2.6	ERI: "Considering all my efforts and achievements, my job promotion prospects are adequate"	SDS (13.3%); ERI (12.5%); OSInd (8.2%); PMI (7.5%); JSS (6.7%)	COPSOQ, HSE, JCI, JDS, OSI, OSQ, WES, WOCCQ (0.0%)
V.2.a. Salary	0.8	WOCCQ: "My remuneration level is too low with respect to my work output"	ERI (6.3%); OSI (3.5%); JSS (3.3%)	COPSOQ, GJSQ, HSE, JCI, JCQ, JDS, OSI-R, OSQ, PMI, SDS, WES (0.0%)
V.2.b. Skills development	0.9	SDS "I have few opportunities to grow and learn new knowledge and skills in my job"	OSInd (3.3%); SDS (3.3%); PMI (2.5%)	COPSOQ, ERI, GJSQ, HSE, JCI, JDS, JSS, OSI, OSQ, WOCCQ (0.0%)
V.2.c. Work assessment	0.9	OSI-R: "I know the basis on which I am evaluated;" OSI: "How is your work evaluated?"	JSS (3.3%); COPSOQ (2.3%); WES (2.2%)	ERI, GJSQ, HSE, JCI, JCQ, JDS, OSQ, PMI, QPS-N, SDS, WOCCQ (0.0%)
V.2.d. Management style	2.8	QPS-N: "To what extent is the management of your organization interested in the health and well-being of the personnel?"	WES (12.2%); JCQ (8.2%); QPS-N (5.8%)	ERI, GJSQ, HSE, JDS, JSS, OSI, OSI-R, OSInd, OSQ, PMI, WOCCQ (0.0%)
V.3. Perceived fairness	1.8	OSInd: "Covert discrimination and favoritism;" WOCCQ: "The work is not evenly distributed within my team"	ERI (12.5%); QPS-N (4.9%); OSQ (4.9%); COPSOQ (3.4%)	GJSQ, HSE, JCI, JCQ, JDS, OSI, OSI-R, SDS, WES (0.0%)
V.4. Involvement in decision-making	1.1	HSE: "Staff are always consulted about change at work"	JSS (3.3%); HSE (2.9%); COPSOQ (2.3%)	ERI, JCI, JDS, OSI, OSI-R, OSQ, QPS-N, SDS, WOCCQ (0.0%)
V.5. Organizational climate	3.3	OSInd, PMI: "Morale and organizational climate"	WES (8.3%); GJSQ (8.2%); QPS-N (6.8%); JSS (6.7%)	ERI, HSE, JCI, JCQ, JDS, OSI, OSI-R, OSQ, SDS (0.0%); WOCCQ (1.3%)
V.6. Organizational communication	0.5	QPS-N: "Is there sufficient communication in your department?"	HSE (5.7%); COPSOQ (2.3%)	ERI, GJSQ, JCI, JCQ, JDS, JSS, OSI, OSI-R, OSInd, OSQ, PMI, SDS, WES, WOCCQ (0.0%)
V.7. Prospective	1.9	JCQ: "My job security is good" (V.7.a); QPS-N: "Are there rumors concerning changes at your workplace?" (V.7.b)	JCQ (8.2%); WOCCQ (6.3%); ERI (6.3%); GJSQ (4.1%)	HSE, JCI, JDS, JSS, OSI, OSQ, PMI, SDS, WES (0.0%)

Note: Codes in brackets refer to the category codes used in Table 1.

Figure 1 Correspondence analysis of contingency table among questionnaires (in *italics*) and most general taxonomy categories (in **bold**) without the physical environment category, which is included as a supplementary modality (dimensions 1 and 2).

management category tended to have proportionally less items belonging to the *Organizational context* category and vice versa. The second dimension (vertical) can be defined in the same way by opposing the *Social environment* and *Activity* categories. In this two-dimensional space, the way a questionnaire is positioned shows at a glance what was specific to its content based on its distance with respect to the four main categories used in the analysis. For example, the HSE questionnaire was characterized by a large number of items belonging to the *Social environment* category and a small number of items belonging to the other categories. The JDS had more items belonging to the *Activity management* category and relatively few belonging to the *Organizational context* category. The ERI questionnaire was on the top left of the factorial space: it thus included a large number of items from the category that defines the left-hand side of the horizontal dimension (*Organizational context*) and from the category that defines the upper part of the vertical axis (*Activity*). *Physical environment*, introduced as a supplementary modality, was located at the top right of the factorial space, allowing us to highlight the fact that, proportionally, the OSI and OSI-R questionnaires both featured the most items in this category.

In this space, the distance between questionnaires can be seen as a degree of similarity in respect of their content. Thus, in the COPSOQ, the QPS-N, the GJSQ and the WES, the way items were distributed among the four main categories of the taxonomy included in the analysis was very similar for each questionnaire. The same applied to the JCI, OSQ and the WOCCQ, or to the OSI, and the OSI-R. In contrast, some questionnaires appeared to differ from one another in terms of content: this was the case for

the HSE compared with the SDS and for the JDS compared with the ERI, which were positioned at extreme opposite ends of the space.

Discussion

In this article, we first established a taxonomy of psychosocial work environment characteristics based on a review of characteristics of existing theoretical occupational health models. Our resulting taxonomy is comprised of 53 categories, which were hierarchically structured, making it the most detailed current taxonomy of work environments.

This taxonomy was implemented to analyze the content of 927 items contained in 17 questionnaires. To the best of our knowledge, this was the first attempt to comprehensively systematically analyze questionnaire contents. Our analysis indicated that none of the questionnaires studied in this paper can claim to exhaustively assess work environment characteristics, and that non-trivial differences existed between the content of questionnaires.

Most categories in our taxonomy were also found in previous taxonomies. For example, characteristics of the *Physical environment*, *Time-related* aspects of work, and *Work content* were all present in Kasl's taxonomy.¹¹ Re-groupings by Morgenson and Humphrey²¹ (*Work activity*, *Work activity/Demands*, *Social environment*, *Organizational context*) or by Wiegand et al.²⁸ (*Work activity*, *Organizational context*, *Social environment*) were reflected in the five most general level categories present in our taxonomy.

Beyond these similarities, our taxonomy also had a number of original features. First, it is detailed and precise, with 53 categories, compared to the 10 categories in the taxonomy proposed by Stavroula and Aditya,²³ 18

in Morgeson and Humphrey,²¹ and 22 in Wiegand et al.²⁸ For example, *Work requirements* is a unique category in the Wiegand et al. taxonomy,²⁸ whereas we divided it into five subcategories (*Demands* themselves, for which we distinguish whether the demands are *Physical*, *Cognitive* or *Emotional* and *Appropriateness of demands*, for which we distinguished whether the appropriateness is *Quantitative* or *Qualitative*). Secondly, our taxonomy was structured in a systematically applied hierarchical manner. A similar hierarchical structure can also be found in other taxonomies,^{21,24,25,27,28} but they are not as systematic as ours. Thirdly, our taxonomy is not limited to one specific theoretical field of research (unlike the Morgeson and Humphrey taxonomy,²¹ which is dedicated to the job design field). Finally, the only criterion used to establish our taxonomy was comprehensiveness. Other taxonomies relied on several criteria (Wiegand et al.,²⁸ for example, selected their categories partly on the basis of “characteristic malleability”).

Three important points can be highlighted from our description of questionnaire contents. First, items related to the *Autonomy-control (Activity management)*, *Appropriateness of demands*, *Demands*, *Responsibilities*, *Quality of relationship*, *Social support*, *Role clarity*, and *Role coherence* categories were the most frequent in the questionnaires analyzed. These categories are central to the most widely-held theories in the occupational health, and can be found in the Job-Demands-Control (support) model,⁴⁹ and the French and Caplan model,⁵⁰ for example. This centrality emphasizes the importance of various aspects of the occupational role assigned. Secondly, the content of the questionnaires was not always coherent with their underlying theoretical model. For example, it was not surprising that the ERI questionnaire – linked to the eponymous theoretical model⁵¹ – contained a vast majority of items referring to the *Work activity* (6 items out of 16 for the “effort” component of the theory) and *Organizational context* (6 items out of 16 for the “rewards” component) categories. With regard to the JCQ questionnaire, it was once again not unexpected to note a large number of items involving *Social support* (3), *Demands* (12), and *Autonomy-control* (6), which operationalize the basic concepts of Karasek’s theory.^{49,52} However, these two questionnaires also contained items which content is not directly related to their respective underlying theories (e.g. *Relationship quality* and *Social support* in the first questionnaire and *Role coherence* and *Work activity variety* in the second one). Thirdly, questionnaires containing more items and clearly aiming to cover the widest possible work environment field obviously come closest to content exhaustiveness (GJSQ,³⁷ QPS-N).⁴⁶ However, some characteristics – considered to be *a priori* important – were not represented (*Physical characteristics* in the QPS-N questionnaire; *Variety of activities*, *Management style*, or *Perceived fairness* in the GJSQ questionnaire and *Interest of activities* in both).

The limits of this research are the same as those inherent to any attempt to categorize. The exhaustiveness of our proposed taxonomy can only be assessed by the yardstick of the methodology implemented for its development. As we have based our work on theories, a significant proportion of which are relatively old, we ran the risk of neglecting some work environment characteristics, which appear in more contemporary forms of work organization or which have only recently been considered by researchers. Linked to these aging theoretical frameworks, as our taxonomy was based on a historically dated vocabulary, the choices made with regard to the category headings may not sufficiently highlight some work environment aspects that are more strongly emphasized today (workplace bullying, new technologies, etc.). It would therefore be inappropriate to consider the taxonomy proposed here as definitive; its exhaustiveness is linked to a certain period of time in the development of theoretical models focusing on the relationships between work environment and health. Nevertheless, its hierarchical structure should facilitate the addition of further categories, to take theory development into account. Furthermore, our taxonomy can also be used “as it is” to study the historical development of questionnaire content, although this is not the real aim of the present paper.

The presence of the *Physical environment* category in the taxonomy could be debated because equipment and physical aspects of the work do not constitute psychosocial factors *per se*. However, this category was found in most of the theoretical models considered in this study and in the majority of questionnaires analyzed. Dedicated questionnaires⁵³ have been created to measure this risk category but these were not considered for the analysis presented here.

Concerning the description of questionnaire contents, several limitations could be raised. First, we found that some items referred to two different work environment characteristics: one being a cause, and the other one being a consequence. We classified these items according to their meaning as a cause rather than as a consequence (e.g. existence of *Decision latitude* may influence the *Resources/equipment* available to complete an activity). Nevertheless, these items could have been considered differently: i.e. as reflecting interactions between categories since these interactions occur in the form of moderating effects (e.g. the effect of low *Resources/equipment* may be partly counterbalanced by greater *Decision latitude*). Our taxonomy is flexible enough to switch to this alternative possibility. Secondly, our analysis also revealed that some items could not be classified in the taxonomy and, while their percentage is relatively high (12.4%), we do not believe it raises questions about the relevance of our taxonomy. Indeed, the majority of these items (60%) did not represent work environment characteristics. Other items (34%) could not be classified in our taxonomy because their meaning was too general. In all, out of 927 items, only 7 (0.8%) were unclassifiable. The content of these seven items did not

match any of our taxonomic categories. Given this very low percentage and given that the seven items concerned were very specific, it is no exaggeration to say that our taxonomy effectively achieved exhaustiveness. Thirdly, despite this exhaustiveness, we must stress the necessarily reductive nature of the item categorization process. The semantic finesse introduced when classifying some items sometimes casts a doubt on the appropriateness of their classification. Conversely, some wordings make it impossible to easily recognize certain distinctions introduced into the taxonomy. The prototypical example illustrating this point is that of the categories *Quality of relationships/superiors*, *Activity management*, and *Management style*. Several items could be classified in one or another of these categories. Thus, if these distinctions are theoretically relevant, we hope that the present work will prompt questionnaire designers to use less ambiguous wordings that better reveals to which category an item belongs. A fourth limit of this study relates to comparison between questionnaires, which was restricted to the work environment characteristics addressed. Other item aspects were omitted, e.g. wording, level of language, length, etc. With regard to these aspects, how questionnaire responses are prompted and considered are perhaps the most fundamental ones. Some items attempted to measure exposure level (with time- or intensity-related answers), while others tended to assess exposure consequences (with answers given in degree-of-agreement terms). Such elements should be taken into account in future work. Finally, the approach adopted in this paper remains purely descriptive. Far more accurate theoretical models than those currently available would be required to fully assess the validity of questionnaire content. However, as Cattell⁵³ observed in a completely different context, “(...) a good descriptive taxonomy, as Darwin found in developing his theory, and as Newton found in the work of Kepler, is the mother of laws and theories” and our contribution should be viewed so.

In their paper, describing construction of the JDS questionnaire, Hackman and Oldham⁴⁰ wrote: “Any measuring device is based on some underlying theory of ‘what’s important’ regarding the phenomena under consideration (even if such a theory is implicit) (...)” We hope that the present study has succeeded in highlighting the various work environment characteristics considered to be important in the different questionnaires analyzed. From an occupational health intervention perspective, it is important to select an instrument that embraces a wide range of work environment characteristics or, at least, does not overlook segments of the environment likely to be determinant for intervention success. While this condition is necessary, it is clearly not sufficient, and other criteria should be taken into account. These criteria should depend on scientific development in a research field, in particular aspects expressing the predictive validity of work environment characteristics on health.^{5,54} Moreover, criteria should depend on the match between the type of information

sought (exposure level or exposure consequences) and the intervention context. For example, if an occupational safety and health (OSH) specialist has no ready-formed hypotheses concerning the type of difficulties employees face, a questionnaire providing balanced sampling of the different work environment characteristics will undoubtedly be the most suitable (i.e. questionnaires appearing in the center of Fig. 1). In contrast, if a researcher wishes to assess the effects of preventing actions/training on local management, he/she should opt for an instrument that maximizes items in the *Activity management* category (i.e. questionnaires appearing in the right-hand part of Fig. 1). If this preventive action occurs in an industrial company, it will undoubtedly be necessary to try to consider possible interactions with the perceived characteristics of the physical environment and, thus, to opt for a questionnaire comprising items based on this category (i.e. questionnaires appearing at the top of the right-hand part of Fig. 1).

The purpose of this paper is to incite users to select a questionnaire on the basis of how well its content corresponds to their needs in relation to their problem area or on the basis of what they anticipate in terms of company issues, rather than on the basis of its popularity.³

Supplemental material

The supplemental material for this paper is available at <http://dx.doi.org/10.1080/10773525.2016.1185214>.

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