

RESEARCH ARTICLE

Occupational exposure factors for mental and behavioral disorders at work: The FOREC thesaurus

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Abstract

Background

Mental disorders in the workplace are a major public health problem. Knowledge of the impact of the psychosocial work environment on mental and behavioral disorders can assist occupational physicians in the identification and description of occupational risk situations, and help to define priority actions. However, no classification for occupational exposure factors is currently available. We aimed to build a thesaurus of “Organizational, Relational, Ethical and other Contributing Factors” (FOREC) linked with the onset of mental and behavioral disorders.

Methods

The French Agency for Food, Environmental and Occupational Health and Safety (ANSES) initiated and supervised a multidisciplinary working group consisting of the representatives of the main French occupational and public health actors. All decisions were accepted on a

consensus basis. This collaborative work led to the classification of occupational exposure factors for mental and behavioral disorders in the workplace. To test this thesaurus in clinical practice, a French multicenter study was implemented. Patients were workers referred to the Occupational Disease Centers for mental health issues at work. Factors contributing to mental and behavioral disorders among workers were identified and coded retrospectively from the worker's point of view using the FOREC thesaurus.

Results

We recruited 323 workers, aged 44.9 ± 9.2 years, of which 31.3% were men. The most commonly encountered disorders were generalized anxiety disorders (106 workers, 32.8%) and moderate depressive episodes (86 workers, 26.7%). We identified 1357 factors, i.e. an average of 4.2 factors per worker. Among them, 575 (42.4%) were relational and 515 (37.9%) were organizational. All factors identified during consultations were described in the thesaurus.

Conclusions

We built the first thesaurus of "Organizational, Relational, Ethical and other Contributing Factors" (FOREC) that may help to generate profiles of mental and behavioral disorders at work. Encoding and describing these exposure factors, as well as using a worldwide standardized and shared terminology, will help to identify specific workplace prevention programs.

Introduction

Mental disorders are major public health problems in the workplace [1]. Work stressors, such as psychological and organizational demands (e.g. work pace, time pressure, complexity of work and conflicting tasks [2]), have an impact on common mental disorders [3]. Mental disorders increase business and social costs due to losses in productivity [4,5,6,7], sick leave [8,9] and staff turnover (Ref. needed). Mental disorders are also associated with morbidity and mortality [10,11,12]. For these reasons, work-related mental disorders constitute an important public health challenge.

Since 2000, the French National Occupational Diseases Monitoring and Prevention Network (RNV3P) has been gradually expanded in metropolitan areas of France. This network collects data, in a sustainable and coordinated way, from Occupational Disease Centers in 32 university hospitals and about ten occupational health services. The initiative targets the improvement and harmonization of practices for the diagnosis of work-related diseases, the identification of emerging risks in occupational health, the identification and description of occupational risk situations, and helps to define priority actions [13,14,15,16].

Between 2001 and 2012, the RNV3P logged 294,243 consultations. Due to the size and importance of the RNV3P database, encoding data in a consistent manner is essential, especially for statistical analyses. The aim of using a standardized and shared terminology is to describe and characterize work situations related to occupational diseases, to develop prevention strategies for occupational risks, and to facilitate the exchange and sharing of information between different stakeholders. Thus, a common classification of occupational exposure factors was developed which is freely available for all healthcare professionals, including

physicians and public health specialists [14]. In 2012, the most frequently encountered health problems in occupational consultation centers were related to mental and behavioral disorders (19%). However, no classification of occupational exposure factors for mental and behavioral disorders at work is currently available. Knowledge of the impact of the psychosocial work environment on mental and behavioral disorders can assist occupational physicians in the identification and description of occupational risk situations, and helps to define priority actions.

The primary aim was to build a thesaurus of “Organizational, Relational, Ethical and other Contributing Factors” (FOREC) that contribute to the onset of mental and behavioral disorders. In this article we present the methodology that led to its creation. The secondary aim was to describe the results obtained after using the FOREC thesaurus in clinical practice during consultations for work-related mental disorders.

Methods

Development of the FOREC thesaurus

The French agency for Food, Environmental and Occupational Health and Safety (ANSES) initiated and supervised a multidisciplinary working group to build the FOREC thesaurus. This working group was set up with the representatives of the main occupational and public health actors, such as the ANSES, the French National Health Insurance System (CNAM), Occupational Disease Centers, Occupational Health Services, the French Institute for Public Health Surveillance (InVS), the Interdepartmental Center of Health and Occupational Medicine in Factories (CISME), and the French Institute for Research and Security (INRS). This work was collaborative. The representatives of the main occupational and public health actors who attended the meetings for the creation of the FOREC thesaurus were nationally recognized experts in health, occupational medicine, mental disorders, and work-related stressors (organization, relation, or ethics). Specialized physicians from Occupational Diseases Centers of university hospitals, who undertake mental health consultations in the workplace [17,18], participated in the meetings. For two years, they were asked to list all organizational, relational, ethical and other contributing occupational factors linked with mental and behavioral disorders that were identified during their mental health consultations. Other actors also proposed other putative contributing factors from their own personal experiences. Eleven national meetings were held over three years. Firstly, the occupational exposure factors that could promote mental health and prevent mental and behavioral disorders were listed. All decisions regarding the inclusion of factors within the FOREC thesaurus were approved on a consensus basis. They were then classified, which led to an updated FOREC thesaurus.

Presentation of the FOREC thesaurus

The classification was proposed by members of the multidisciplinary working group on a consensus basis. Occupational factors linked with mental and behavioral disorders were grouped into clinically relevant headings and sections based on ICD-10. The multidisciplinary working group proposed a FOREC thesaurus composed of six chapters: inherent demand of the work, functional organization of the business, relations at work and violence, personal ethics, ethics of the business, and other contributing factors. The first five chapters classify the professional situation inside the enterprise. The sixth chapter concerns the “contributing factors” that are related to the person’s status or are totally external to the enterprise. These six chapters are divided into a total of 34 subchapters. Subchapters are coded with 3 digits and are divided into 186 items in total. Items are coded with 4, 5 or 6 digits. The FOREC thesaurus is presented in [Table 1](#) in its entirety.

Table 1. Organizational, relational, ethical and other contributing factors–Thesaurus completed to 4, 5 or 6 digits.

Code	Heading
70	Inherent demand of the work
700	Work schedule
7000	Shift work (2x8, 3x8, 5x8 . . .)
7001	Night work
70010	Regular night work (>5 nights per month)
70011	Occasional night work
7002	On-call working
7003	Working on Sundays and public holidays
7004	Length of working day consistently in excess of 10 hours
7005	Split shifts (<i>divisible or split working day</i>)
7006	Weekly rest period regularly less than 48 hours
7007	Unpredictability of working schedule
7009	Other working schedule capable of causing disturbance to health
701	Business travel
7010	Business travel (<i>mission</i>) disturbing social life without sleeping out
7011	Business travel (<i>mission</i>) disturbing social life with sleeping out
7012	Business travel (<i>mission</i>) disturbing chronobiology (<i>jet lag</i>)
7019	Other business travel capable of causing disturbance excluding chosen journeys/commuting cited in 7533.
702	Other specific features imposed by the work
7020	On call by telephone or email
70200	On call by telephone (<i>or SMS or email</i>) only
70201	On call by telephone (<i>or SMS or email</i>) with call out
70209	Other on call
7021	Involuntary part-time work
7022	Imposed teleworking
7023	Imposed working from home
7024	Imposed temporary work
7025	Imposed overtime
7026	Requests at any time outside of working hours
70260	Requests at any time outside of working hours by clients
70261	Requests at any time outside of working hours by management or colleagues
7029	Other specific imposed conditions capable of causing disturbance
703	Distinctive feature of the work
7030	Poor quality of work content
70300	Monotonous work, little or no creativity
70301	Versatility of tasks resulting in a lack of identity (<i>stand in</i>)
70309	Other features of poor quality of work content
7031	Specific demand of work content
70310	Activities requiring alertness, concentration, very close attention
70311	Function involving high human, financial or safety responsibilities (<i>increase in responsibilities</i>)
70312	Regular contact with the public
70313	Working alone (<i>work with a lack of contact causing feelings of isolation</i>)
70314	Variability, unpredictability of workload
70315	Work with strong emotional loading (<i>e.g. empathy, contact with people who are suffering</i>)
70316	Work requiring continuous or excessive control of emotions (<i>facticity, inauthenticity, hiding emotions</i>)

(Continued)

Table 1. (Continued)

Code	Heading
70317	Working under imposed time constraints (<i>assembly line work, high throughput, performance based wages, pace imposed</i>)
70318	Fragmented or segmented work: multiple, concurrent tasks or frequent interruptions.
70319	Other demands of work content capable of causing disturbance
7039	Other distinctive feature of the work capable of causing disturbance
709	<i>Other general inherent demand of the work capable of causing disturbance</i>
71	Functional organization of the business
710	<i>Change in the organization and specific approach of management</i>
7100	Major restructuring in preceding or coming months
71000	Elimination of position
71001	Outsourcing of business
71002	Takeover
7101	Change of personnel
71010	Change of colleagues
71011	Change of management
71019	Other change of personnel
7102	Change of methods
71020	Change of management methods
71021	Change of production methods
7103	Non-regulated matrix management or cross-cutting project
7109	Other change in the organization capable of causing disturbance
711	<i>Insufficient or excessive workload experienced</i>
7110	Excessive workload experienced
71100	Excessive workload experienced during working hours
71101	Excessive workload experienced requiring working at home
7111	Insufficient workload experienced
7119	Other workload conditions capable of causing disturbance
712	<i>Excessive procedures and supervision</i>
7120	Procedures perceived as excessive
7121	Supervision perceived as excessive
7122	Continuous supervision by material means (<i>video surveillance, computer, recording, informer</i>)
7129	Other procedure or supervision perceived as excessive
713	<i>Low decision latitude in the organization of their work</i>
714	<i>Few opportunities to learn or develop their skills</i>
715	<i>Lack of recognition (encouragement, congratulations etc.) or reward (e.g. salary, promotion, annual appraisal)</i>
7150	Perceived deficiencies in verbal expression, lack of expression of recognition in oral or written form
7151	Perceived deficiency of salary
7152	Perceived deficiency (<i>lack or delay</i>) of promotion
7153	Perceived deficiency of recognition of title or of degree
7159	Other perceived deficiency of recognition or of reward
716	<i>Insufficiency of resources</i>
7160	Mismatch objective/resources
7161	Insufficient training in connection with the task to be undertaken
7162	Failings in communications flow
7163	Objective deficiency of management (<i>lack of management personnel or overly distant management</i>)

(Continued)

Table 1. (Continued)

Code	Heading
7164	Objective deficiency of non-managerial personnel, of work colleagues (<i>unfilled position, absence not covered</i>)
7165	Slippage of task and responsibility (ambiguity of roles)
7169	Other insufficiencies of resources
717	<i>Dysfunctions in the instructions of management</i>
7170	Content of the work poorly defined (<i>absence of job description or procedures</i>)
7171	Paradoxical instructions
7172	Regularly exceeding contractual hours, unpaid, unrecovered overtime
7173	Perceived ambiguous positioning of management
7174	Management perceived as evasive (<i>failure to arbitrate, not taking decisions, etc</i>)
7175	Objectives seen as unattainable (<i>pressure, not objective</i>)
7179	Other dysfunctions in the instructions from management capable of causing disturbance
718	<i>Transfer to another position or another site (or announced in the 3 months preceding the first signs)</i>
7180	Transfer for a determined period
71800	Transfer for a determined period not requiring family relocation
71801	Transfer for a determined period requiring family relocation
7181	Transfer for an undetermined period
71810	Transfer for an undetermined period not requiring family relocation
71811	Transfer for an undetermined period requiring family relocation
7182	Imposed redeployment
71820	Imposed redeployment to another position at the same site
71821	Imposed redeployment to another position at another site
7189	Other transfer to another position or another site
719	<i>Other general features of the functional organization of the business capable of causing disturbance</i>
72	<i>Relations at work and violence</i>
720	<i>Quality of relations at work</i>
7200	Deleterious relationships experienced
72000	Deleterious relationship with management experienced
720001	Deleterious relationship with management with constant criticism experienced
720002	Deleterious relationship with management through lack of being heard experienced
720003	Deleterious relationship with management through asymmetric communications experienced
720004	Deleterious relationship with management with implicit threat of dismissal experienced
72001	Deleterious relationship with the work group or peers experienced (<i>sidelined, categorical divide</i>)
72002	Deleterious relationship in isolation with a colleague experienced
72003	Deleterious relationships experienced after undergoing disciplinary measures (<i>suspension . . .</i>)
7201	Deficiency of support experienced
72010	Deficiency of support from management experienced
72011	Deficiency of support from the work group or peers experienced
7209	Other qualitative feature of relations capable of causing disturbance
721	<i>External violence (persons outside of the workplace)</i>
7210	Verbal aggression (<i>external violence</i>)
721010	Verbal aggression without credible threat of death (<i>external violence</i>)
721011	Verbal aggression with credible threat of death (<i>external violence</i>)
7211	Physical aggression
7212	Robbery, hold-up
7213	Witnessing a traumatic event

(Continued)

Table 1. (Continued)

Code	Heading
7219	Other external violence
722	Internal violence (another company employee)
7220	Verbal aggression (<i>internal violence</i>)
72200	Verbal aggression without credible threat of death (<i>internal violence</i>)
72201	Verbal aggression with credible threat of death (<i>internal violence</i>)
7221	False accusation experienced
72210	False accusation experienced without a procedure
72211	False accusation experienced with involvement in a procedure
7222	Aggression, physical violence suffered
7223	Traumatic event experienced as a witness or through an account received
72230	Witnessing verbal or physical aggression
72231	Witnessing workplace death, excluding suicide
72232	Witnessing a suicide
722320	Witnessing a successful suicide at work
722321	Witnessing a suicide attempt at work
72233	Received account of verbal or physical aggression or of a suicide attempt
722330	Received account of verbal or physical aggression or of a suicide attempt linked to work, outside of workplaces (<i>threats during journeys</i>)
722331	Received account of verbal OR physical aggression or of a suicide attempt occurring in the workplace
72234	Received account of a successful suicide
722340	Received account of a successful suicide linked to work outside of the workplace
722341	Received account of a successful suicide in the workplace
72235	Received account of a death (<i>excluding suicide</i>) linked to work (<i>colleagues</i>) wherever the place of occurrence
72239	Other traumatic event related to work
7224	Sexual harassment experienced
7225	Discrimination experienced (<i>gender, age, sexual orientation, etc.</i>)
7226	Bullying at work experienced
7227	Deskilling
7228	Sidelined
7229	Other internal violence
729	Other general features of relations at work capable of causing disturbance
73	Personal ethics—conflict of values
730	Performing an act going against their principles (miss-selling, making redundancies)
731	Being a powerless witness to acts going against their principles
732	Lacking resources or time to do quality work
739	Other conflict of values relating to personal ethics
74	Ethics of the business
740	General level of safety or a low safety culture
741	General level of hygiene or poor hygiene culture
742	Lack of means
7420	Lack of collective means of protection
7421	Lack of individual means of protection
743	Lack of respect in verbal communications
749	Other ethical failing of the business capable of causing disturbance
75	Other contributing factors
750	Particular medical or social status capable of altering relationships
7500	Inadequate or inappropriate consideration of limitations of ability (<i>excluding disability</i>)

(Continued)

Table 1. (Continued)

Code	Heading
7501	Limitation of ability not accepted by the employee
7502	Return after absence
75020	Return after a break in working due to illness
75021	Return after an accident at work/occupation related illness/disease
75022	Return after maternity leave
75023	Return after parental leave
75024	Return after annual leave
75025	Return after individual training leave
7503	Person recognized as having a disability
7509	Other medical or social status able to alter relations
751	<i>Claims for entitlements including: claims concerning leave, training, bonuses not being received, payment of overtime, signing a petition</i>
7510	Action taken as a result of social commitment or elective mandate
7511	Action taken in a personal capacity
7519	Other feature of claiming rights
752	<i>Taking a personal stance or action challenging the company</i>
7520	Denouncing supposed or alleged dishonest actions connected with professional activities
7521	Externalization of an internal company issue (<i>with a labor inspectorate, a lawyer, etc</i>)
7529	Other personal stance or action challenging the company
753	<i>Specific chosen working conditions</i>
7530	Multiple employers
7531	Chosen teleworking
7532	Chosen working at home
7533	Home—work commute
75330	Home—work commute >2 hours per day
75331	Home—work commute >3 hours per day
7534	Overqualified at work
7535	Desired redeployment to another position
75350	Desired redeployment to another position at the same site
75351	Desired redeployment to another position at another site
7536	Position not meeting aspirations but accepted for economic reasons
7537	Chosen part-time work
7538	Chosen temporary work
7539	Other specific chosen working condition able to cause disturbance
754	<i>Contributing factor linked to the business (social context, economic context)</i>
7540	Unfavorable socio-economic context
75400	Unfavorable social context (<i>social upheaval, strike, periods of notice</i>)
75401	Unfavorable economic context (<i>temporary lay-offs, wage freezes, company financial difficulties</i>)
75409	Other unfavorable socio-economic context
7541	Conventional procedure of contract termination or leaving voluntarily in progress (only code if unfavorably experienced)
7542	Job insecurity
7543	Involvement in a termination procedure
75430	Involvement in a redundancy procedure
75431	Involvement in an individual termination procedure
7544	Family business context or of specific links between the individual and management
7549	Other unfavorable context linked to the company
759	<i>Other general feature constituting a contributing factor</i>

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The first chapter, “*Inherent demand of the work*”, concerns all professional constraints that cannot be dissociated from the activity, but that may be the cause of various disorders. For example, being on call in a hospital can disturb social life or cause insomnia. This chapter is divided into 5 subchapters and consists of 44 items in total.

The second chapter, called “*Functional organization of the business*”, also concerns strong professional constraints. It classifies occupational exposure factors, such as organizational changes, restructuring, insufficient or excessive workload, and workplace transfers. This chapter is divided into 10 subchapters and consists of 51 items in total.

The third chapter is entitled “*Relations at work and violence*” (referring to instances such as deleterious relationships experienced with management, verbal aggressions, and sidelining). In this chapter, the notions of individual experiences of a more subjective nature are presented. This chapter is divided into 4 subchapters and consists of 47 items in total.

Chapters four and five are respectively related to “*Personal ethics*” (e.g. performing an act going against one’s principles) and “*Ethics of the business*” (e.g. lack of respect in verbal communications). These chapters provide justification of ethical issues based on case studies.

The sixth chapter, “*Other contributing factors*”, regroups factors that may be viewed as directly related to a person (such as a return after parental leave) or totally external to the enterprise (such as an unfavorable socio-economic context). This chapter is divided into 6 subchapters and consists of 42 items in total.

Multicenter study

To check the exhaustiveness and clinical relevance of the FOREC thesaurus, we aimed to describe organizational, relational, ethical and other contributing occupational factors linked with mental and behavioral disorders identified during consultations for mental health issues at work. A French multicenter study (Clermont-Ferrand, Créteil, Toulouse, Bordeaux, Garches) was therefore implemented. The Occupational Disease Centers at these University Hospitals were chosen because they shared similar characteristics relating to the management of mental health consultations in the workplace. Included workers were addressed to those consultations by their general practitioner or their occupational physician because of a presumed diagnosis of mental health issues at work [17,18]. They were included over a period of twelve consecutive months. There were no exclusion criteria and all patients who attended a consultation for mental health issues at work were included. The protocol was approved by the ethics committee of the University Hospital of Clermont-Ferrand (approval number: n° 2015CE/69). Socio-demographic, occupational and clinical data were retrieved during two interviews, one with a psychologist and a nurse and a second with an occupational physician and a psychiatrist. The final diagnosis of a mental and behavioral disorder was made during this second, specialized, consultation for mental health issues at work, which also established a link between the issues and professional activity. The link was based on the specialist’s judgment, during the medical examination. Mental and behavioral disorder were coded according to the International Classification of Diseases 10th Revision (ICD-10) and all physicians were trained in this coding by the same organization (ANSES). A detailed medical report was systematically written by the occupational physicians and the psychiatrists for each consultation. The medical report mentioned the diagnosis and the socio-demographic, occupational and clinical data, as well as occupational exposure factors linked with the mental health issues of the workers. The medical reports identifiers were coded prior to analysis. One author (CL) reviewed all coded medical reports from all centers. The author identified and retrospectively coded the data and factors contributing to the workers’ health-related issues using the FOREC thesaurus from the perception of the worker.

Statistical analysis

Statistical analyses were performed using Stata software, version 13 (StataCorp, College Station, TX, US). Continuous data were expressed as mean \pm standard deviation and categorical parameters as frequencies (associated percentages).

Results

We recruited 323 workers (31.3% males) with an average age of 44.9 ± 9.2 . The most commonly encountered diagnoses in the consultations for mental health issues at work were ‘generalized anxiety’ (106 workers, 32.8%) and ‘moderate depressive episodes’ (86 workers, 26.7%) (Table 2).

During the study period, 1357 occupational factors linked with mental and behavioral disorders were identified, i.e. an average of 4.2 factors per worker. Among them, 575 (42.4%) were relational, 515 (37.9%) were organizational and the remaining 12.2% represented other contributing factors (Table 3). All identified factors were successfully encoded using the thesaurus. Two subchapters were not found in medical reports: “Other general inherent demands of the work capable of causing disturbance” (subchapter 709) and “General level of hygiene or poor hygiene culture” (subchapter 741).

Relational factors were the most common in cases of depressive episodes (41.7%) and anxiety disorders (44.4%), followed by managerial factors (Table 4). Managerial factors were most frequently identified in cases of post-traumatic stress disorder (62.5%) and burn-out (59.6%).

Discussion

This study presents the first thesaurus of occupational exposure factors responsible for mental health issues at work, grouped into clinically relevant headings and sections.

Table 2. Characteristics of the workers.

		n = 323
Demographic characteristics		
	Gender (male)	101 (31.3)
	Age (years)	44.9 \pm 9.2
Disorders encountered		
	F320 –Mild depressive episode	9 (2.8)
	F321 –Moderate depressive episode	86 (26.7)
	F322 –Severe depressive episode without psychotic symptoms	39 (12.1)
	F410 –Panic disorder	3 (0.9)
	F411 –Generalized anxiety	106 (32.8)
	F412 –Mixed anxiety and depressive disorder	47 (14.6)
	F419 –Unspecified anxiety disorder	13 (4.0)
	F431 –Post-traumatic stress disorder	2 (0.6)
	Z730 –Burn-out	11 (3.4)
	Z03 –No pathology	3 (0.9)
	Other pathology	2 (0.6)
	No answer	2 (0.6)

Data are presented as frequencies (associated percentages) or as mean \pm standard deviation.

Encountered diseases are presented with their ICD-10 corresponding code.

Other pathology: lateral epicondylitis (M77 1) and irritability and anger (R454).

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Table 3. Number of factors identified for each chapter and subchapter.

		n = 1357
70	Inherent demand of the work	27 (2.0)
700	Work schedule	8 (0.6)
701	Business travel	2 (0.1)
702	Other specific features imposed by the work	2 (0.1)
703	Distinctive feature of the work	15 (1.1)
709	Other general inherent demand of the work capable of causing disturbance	0 (0.0)
71	Functional organization of the business	515 (37.9)
710	Change in the organization and specific approach of management	148 (10.9)
711	Insufficient or excessive workload experienced	67 (4.9)
712	Excessive procedures and supervision	22 (1.6)
713	Low decision latitude in the organization of their work	17 (1.3)
714	Few opportunities to learn or develop their skills	4 (0.3)
715	Lack of recognition (encouragement, congratulations etc.) or reward (e.g. salary, promotion, annual appraisal)	101 (7.5)
716	Insufficiency of resources	66 (4.9)
717	Dysfunctions in the instructions of management	61 (4.5)
718	Transfer to another position or another site (or announced in the 3 months preceding the first signs)	25 (1.9)
719	Other general features of the functional organization of the business capable of causing disturbance	4 (0.3)
72	Relations at work and violence	575 (42.4)
720	Quality of relations at work	306 (22.6)
721	External violence (persons outside of the workplace)	17 (1.3)
722	Internal violence (another company employee)	250 (18.4)
729	Other general features of relations at work capable of causing disturbance	2 (0.1)
73	Personal ethics—conflict of values	57 (4.2)
730	Performing an act going against their principles (miss-selling, making redundancies)	12 (0.9)
731	Being a powerless witness to acts going against their principles	19 (1.4)
732	Lacking resources or time to do quality work	11 (0.8)
739	Other conflict of values relating to personal ethics	15 (1.1)
74	Ethics of the business	17 (1.3)
740	General level of safety or a low safety culture	8 (0.6)
741	General level of hygiene or poor hygiene culture	0 (0.0)
742	Lack of means	4 (0.3)
743	Lack of respect in verbal communications	3 (0.2)
749	Other ethical failing of the business capable of causing disturbance	2 (0.1)
75	Other contributing factors	166 (12.2)
750	Particular medical or social status capable of altering relationships	45 (3.3)
751	Claims for entitlements including: claims concerning leave, training, bonuses not being received, payment of overtime, signing a petition	11 (0.8)
752	Taking a personal stance or action challenging the company	73 (5.4)
753	Specific chosen working conditions	3 (0.2)
754	Contributing factor linked to the business (social context, economic context)	32 (2.4)
759	Other general feature constituting a contributing factor	2 (0.1)

Data are presented as frequencies (associated percentages).

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Table 4. Number of factors identified for each chapter, according to work-related challenges.

		Depressive episode (n = 575)	Anxiety disorders (n = 699)	PTSD (n = 8)	Burn-out (n = 47)	No pathology (n = 11)	Other pathology (n = 5)	No answer (n = 12)
70	Inherent demand of the work	10 (1.8)	12 (1.7)	0 (0.0)	5 (10.6)	0 (0.0)	0 (0.0)	0 (0.0)
71	Functional organization of the business	227 (39.5)	248 (35.5)	5 (62.5)	28 (59.6)	2 (18.2)	0 (0.0)	5 (41.7)
72	Relations at work and violence	240 (41.7)	310 (44.4)	2 (25.0)	10 (21.3)	6 (54.5)	2 (40.0)	5 (41.7)
73	Personal ethics–conflict of values	22 (3.8)	33 (4.7)	0 (0.0)	2 (4.3)	0 (0.0)	0 (0.0)	0 (0.0)
74	Ethics of the business	7 (1.2)	8 (1.1)	1 (12.5)	1 (2.1)	0 (0.0)	0 (0.0)	0 (0.0)
75	Other contributing factors	69 (12.0)	88 (12.6)	0 (0.0)	1 (2.1)	3 (27.3)	3 (60.0)	2 (16.6)

Data are presented as frequencies and associated percentages.

ICD-10 corresponding codes were F320, F321, F322 for depressive episode; F410, F411, F412, F419 for anxiety disorders; F431 for post-traumatic stress disorder (PTSD); Z730 for burn-out; Z03 for no pathology; M771 (lateral epicondylitis) and R454 (irritability and anger) for other pathologies.

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Consequences to mental health following exposure to occupational factors

Mental health issues at work are a public health concern. More interestingly, some factors related to work, such as organizational, relational, ethical and other contributing factors were directly linked with some health-related issues. For example, it has been shown that cardiovascular diseases were associated with job strain [19], low decision latitude [20], low reward [21] and low social support [22,23]. It has also been reported that low social support positively predicts depression [24]. Similarly, changes in organization (10.9% of the 1357 identified factors) and conflict of loyalties resulting from workplace changes may also lead to suicide [25]. Moreover, it has long been recognized that depression and anxiety share similarities in their pathogenesis [26]. Among the mental disorders identified in the present study, anxiety and depression seem to share the same exposure profile, i.e. relational (~40%) [27], whereas burn-out was mainly linked with organizational factors (~60%), as previously reported [28,29,30].

Occupational factors linked with mental and behavioral disorders

In our study, identified factors were mainly relational (42.4%). Relational regulation theory has previously been proposed as a novel way to improve mental and behavioral disorders [31]. On the other hand, inherent work demands were infrequently cited (2%), which consequently may not be a major source of mental health issues at work. In our study, the inherent work demands that cannot be dissociated from the professional activity seem to be accepted and well tolerated by workers, which might appear contradictory to some previous literature [20]. We demonstrated that 1.3% of the factors identified were related to low decision latitude, 7.5% to lack of recognition or reward and 4.9% to perceptions of a deficiency of support. Supervisor support has previously been shown to buffer the impact of excessive work demands [31]. One hundred and sixty-six contributing and contextual factors (12.2%) showed some new insights into particular medical or social status (such as perceived limitations of ability, return after absence) that may be capable of altering relationships or altering work-related self-efficacy. Studying those factors could provide possibilities for changing practices in the workplace.

Recommendation

The FOREC thesaurus has a worldwide application as the use of a standardized and shared terminology is needed to describe at-risk occupational factors that generate mental and behavioral disorders. Identifying those factors is essential for effective prevention in the workplace and must be based on useful evidence-based information in order to help to define priority

actions. At-risk workers should receive follow-ups from occupational physician [32,33], and may benefit from a targeted intervention on the occupational factors that have been identified as generating mental and behavioral disorders [34].

Limitations

There are limitations to this study. Some subchapters of the thesaurus may seem less relevant because they were less common. However, a detailed thesaurus is required for exhaustively encoding exposures. This thesaurus can be improved, as are other thesauruses which are continuously enriched by the French National Occupational Diseases Monitoring and Prevention Network (RNV3P) [35,36,37], which also guarantees that they will remain current. The sample size used for describing results from the FOREC thesaurus may seem low, however workers were recruited at the Occupational Diseases Centers of the University Hospitals' during specialized consultations for mental health issues at work [17,18]. Moreover, a relevant number of occupational factors linked with mental and behavioral disorders were identified (over one thousand), providing substantial data. Variability between independent coders also needs to be assessed. Comparing encoding between a physician and an administrative employee would be of interest. Furthermore, personality traits of the coder may influence data encoding and should be evaluated. Further studies are needed to assess the profile of occupational exposure factors with regard to socio-professional occupations and workers' demographic characteristics.

Conclusion

We built the first thesaurus of "Organizational, Relational, Ethical and other Contributing Factors" (FOREC) that may help to generate profiles of mental and behavioral disorders at work. Using the FOREC thesaurus in clinical practice during consultations for work-related mental health issues has shown that the factors identified during previous consultations were successfully encoded (all factors were described in the thesaurus). The FOREC thesaurus may provide a worldwide standardized and shared terminology, which will help to understand the impact of the psychosocial work environment on the onset of mental and behavioral disorders related to work. The identification and description of occupational risk situations can assist occupational physicians in defining priority actions in the workplace to address mental health issues.

Supporting information

S1 Appendix. French version of the FOREC thesaurus.

(DOCX)

S1 Database. Titles of columns are written without abbreviations.

(XLSX)

S1 Table. Number of workers per occupational group and per level of function according the ISCO-08 classification (n = 322 because of one missing value).

(DOCX)

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References

1. Alonso J, Angermeyer MC, Bernert S, Bruffaerts R, Brugha TS, Bryson H, et al. (2004) Prevalence of mental disorders in Europe: results from the European Study of the Epidemiology of Mental Disorders (ESEMeD) project. *Acta Psychiatr Scand Suppl*: 21–27. <https://doi.org/10.1111/j.1600-0047.2004.00327.x> PMID: 15128384
2. Roelen CA, Weites SH, Koopmans PC, van der Klink JJ, Groothoff JW (2008) Sickness absence and psychosocial work conditions: a multilevel study. *Occup Med (Lond)* 58: 425–430.
3. Nieuwenhuijsen K, Bruinvels D, Frings-Dresen M (2010) Psychosocial work environment and stress-related disorders, a systematic review. *Occup Med (Lond)* 60: 277–286.
4. Wang PS, Beck AL, Berglund P, McKenas DK, Pronk NP, Simon GE, et al. (2004) Effects of major depression on moment-in-time work performance. *Am J Psychiatry* 161: 1885–1891. <https://doi.org/10.1176/ajp.161.10.1885> PMID: 15465987
5. Waghorn G, Chant D (2006) Work performance among Australians with depression and anxiety disorders: a population level second order analysis. *J Nerv Ment Dis* 194: 898–904. <https://doi.org/10.1097/01.nmd.0000243012.91668.a5> PMID: 17164627
6. Stewart WF, Ricci JA, Chee E, Hahn SR, Morganstein D (2003) Cost of lost productive work time among US workers with depression. *JAMA* 289: 3135–3144. <https://doi.org/10.1001/jama.289.23.3135> PMID: 12813119
7. Lim D, Sanderson K, Andrews G (2000) Lost productivity among full-time workers with mental disorders. *J Ment Health Policy Econ* 3: 139–146. PMID: 11967449
8. Hussey L, Turner S, Thorley K, McNamee R, Agius R (2012) Work-related sickness absence as reported by UK general practitioners. *Occup Med (Lond)* 62: 105–111.
9. Knudsen AK, Harvey SB, Mykletun A, Overland S (2013) Common mental disorders and long-term sickness absence in a general working population. The Hordaland Health Study. *Acta Psychiatr Scand* 127: 287–297. <https://doi.org/10.1111/j.1600-0447.2012.01902.x> PMID: 22775341
10. Harris EC, Barraclough B (1998) Excess mortality of mental disorder. *Br J Psychiatry* 173: 11–53. PMID: 9850203
11. Mykletun A, Bjerkeset O, Dewey M, Prince M, Overland S, Stewart R (2007) Anxiety, depression, and cause-specific mortality: the HUNT study. *Psychosom Med* 69: 323–331. <https://doi.org/10.1097/PSY.0b013e31803cb862> PMID: 17470669
12. Mittendorfer-Rutz E, Kjeldgard L, Runeson B, Perski A, Melchior M, Head J, et al. (2012) Sickness absence due to specific mental diagnoses and all-cause and cause-specific mortality: a cohort study of 4.9 million inhabitants of Sweden. *PLoS One* 7: e45788. <https://doi.org/10.1371/journal.pone.0045788> PMID: 23049861
13. Bonnetterre V, Faisandier L, Bicout D, Bernardet C, Piollat J, Ameille J, et al. (2010) Programmed health surveillance and detection of emerging diseases in occupational health: contribution of the French national occupational disease surveillance and prevention network (RNV3P). *Occup Environ Med* 67: 178–186. <https://doi.org/10.1136/oem.2008.044610> PMID: 19776024

14. Bensefa-Colas L, Telle-Lamberton M, Paris C, Faye S, Stocks SJ, Luc A, et al. (2014) Occupational allergic contact dermatitis and major allergens in France: temporal trends for the period 2001–2010. *Br J Dermatol*.
15. Ameille J, Hamelin K, Andujar P, Bensefa-Colas L, Bonneterre V, Dupas D, et al. (2013) Occupational asthma and occupational rhinitis: the united airways disease model revisited. *Occup Environ Med* 70: 471–475. <https://doi.org/10.1136/oemed-2012-101048> PMID: 23390199
16. Bonneterre V, Bicout DJ, de Gaudemaris R (2012) Application of pharmacovigilance methods in occupational health surveillance: comparison of seven disproportionality metrics. *Saf Health Work* 3: 92–100. <https://doi.org/10.5491/SHAW.2012.3.2.92> PMID: 22993712
17. Brousse G, Fontana L, Ouchchane L, Boisson C, Gerbaud L, Bourguet D, et al. (2008) Psychopathological features of a patient population of targets of workplace bullying. *Occup Med (Lond)* 58: 122–128.
18. Lac G, Dutheil F, Brousse G, Triboulet-Kelly C, Chamoux A (2012) Saliva DHEAS changes in patients suffering from psychopathological disorders arising from bullying at work. *Brain Cogn* 80: 277–281. <https://doi.org/10.1016/j.bandc.2012.07.007> PMID: 22940752
19. Schnall PL, Pieper C, Schwartz JE, Karasek RA, Schlusser Y, Devereux RB, et al. (1990) The relationship between 'job strain,' workplace diastolic blood pressure, and left ventricular mass index. Results of a case-control study. *JAMA* 263: 1929–1935. PMID: 2138234
20. Karasek R, Baker D, Marxer F, Ahlbom A, Theorell T (1981) Job decision latitude, job demands, and cardiovascular disease: a prospective study of Swedish men. *Am J Public Health* 71: 694–705. PMID: 7246835
21. Siegrist J (1996) Adverse health effects of high-effort/low-reward conditions. *Journal of Occupational Health Psychology* 1: 27–41. PMID: 9547031
22. Johnson JV, Hall EM (1988) Job strain, work place social support, and cardiovascular disease: a cross-sectional study of a random sample of the Swedish working population. *American Journal of Public Health* 78: 1336–1342. PMID: 3421392
23. Andre-Petersson L, Engstrom G, Hedblad B, Janzon L, Rosvall M (2007) Social support at work and the risk of myocardial infarction and stroke in women and men. *Social Science and Medicine* 64: 830–841. <https://doi.org/10.1016/j.socscimed.2006.10.020> PMID: 17123677
24. Aziah BD, Rusli BN, Winn T, Naing L, Tengku MA (2004) Risk factors of job-related depression in laboratory technicians in Hospital Universiti Sains Malaysia (HUSM) and Kementerian Kesihatan Malaysia (KKM) hospitals in Kelantan. *Southeast Asian Journal of Tropical Medicine and Public Health* 35: 468–475. PMID: 15691158
25. Brodsky CM (1977) Suicide attributed to work. *Suicide and Life-Threatening Behavior* 7: 216–229. PMID: 148757
26. Pomerantz AM, Rose P (2014) Is depression the past tense of anxiety? An empirical study of the temporal distinction. *Int J Psychol* 49: 446–452. <https://doi.org/10.1002/ijop.12050> PMID: 25355667
27. Mirza I, Jenkins R (2004) Risk factors, prevalence, and treatment of anxiety and depressive disorders in Pakistan: systematic review. *BMJ* 328: 794. <https://doi.org/10.1136/bmj.328.7443.794> PMID: 15070634
28. Al-Imam DM, Al-Sobayel HI (2014) The Prevalence and Severity of Burnout among Physiotherapists in an Arabian Setting and the Influence of Organizational Factors: An Observational Study. *J Phys Ther Sci* 26: 1193–1198. <https://doi.org/10.1589/jpts.26.1193> PMID: 25202179
29. Peng J, Jiang X, Zhang J, Xiao R, Song Y, Feng X, et al. (2013) The impact of psychological capital on job burnout of Chinese nurses: the mediator role of organizational commitment. *PLoS One* 8: e84193. <https://doi.org/10.1371/journal.pone.0084193> PMID: 24416095
30. Choron G, Dutheil F, Lesage FX (2016) Are nurses burned out? *Int J Nurs Stud* 58: 80–81. <https://doi.org/10.1016/j.ijnurstu.2016.02.002> PMID: 27087300
31. Rodwell J, Munro L (2013) Relational regulation theory and the role of social support and organisational fairness for nurses in a general acute context. *Journal of Clinical Nursing* 22: 3160–3169. <https://doi.org/10.1111/jocn.12385> PMID: 24118519
32. Dutheil F, Naughton G, Sindyga P, Lesage FX (2016) Ill Health-Related Job Loss: A One-Year Follow-Up of 54,026 Employees. *J Occup Environ Med* 58: 918–923. <https://doi.org/10.1097/JOM.0000000000000825> PMID: 27454396
33. Dutheil F, Pereira B, Moustafa F, Naughton G, Lesage FX, Lambert C (2017) At-risk and intervention thresholds of occupational stress using a visual analogue scale. *PLoS One* 12: e0178948. <https://doi.org/10.1371/journal.pone.0178948> PMID: 28586383
34. Dutheil F, Duclos M, Naughton G, Dewavrin S, Cornet T, Huguet P, et al. (2017) WittyFit-Live Your Work Differently: Study Protocol for a Workplace-Delivered Health Promotion. *JMIR Res Protoc* 6: e58. <https://doi.org/10.2196/resprot.6267> PMID: 28408363

35. Paris C, Ngatchou-Wandji J, Luc A, McNamee R, Bensefa-Colas L, Larabi L, et al. (2012) Work-related asthma in France: recent trends for the period 2001–2009. *Occupational and Environmental Medicine* 69: 391–397. <https://doi.org/10.1136/oemed-2011-100487> PMID: 22383588
36. Bensefa-Colas L, Telle-Lamberton M, Faye S, Bourrain JL, Crepy MN, Lasfargues G, et al. (2015) Occupational contact urticaria: lessons from the French National Network for Occupational Disease Vigilance and Prevention (RNV3P). *Br J Dermatol* 173: 1453–1461. <https://doi.org/10.1111/bjd.14050> PMID: 26212252
37. Bensefa-Colas L, Telle-Lamberton M, Paris C, Faye S, Stocks SJ, Luc A, et al. (2014) Occupational allergic contact dermatitis and major allergens in France: temporal trends for the period 2001–2010. *British Journal of Dermatology*.