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Depression in healthcare workers: Results from the nationwide AMADEUS survey

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ABSTRACT

Background: There is now a wealth of evidence showing that work is a major determinant of physical and mental health. Recent studies have suggested increased rates of depression in healthcare workers (HCWs) in the context of the Covid-19 pandemic, with direct impact on care quality and productivity.
Aim: To determine the rate of clinical depression in a national sample of HCWs in France during the post-Covid-19 area and to identify related factors (professional, individual and health-related risk behaviors) using a structural equation modeling analysis.
Method: A survey comprising a number of standardized scales was sent to public and private national healthcare facilities through the mail or disseminated through emails from professional associations and social networks.
Results: 10,325 participants were recruited; 3122 (30.2%, 95% confidence interval [29.4–31.1]) met likely diagnostic criteria for clinical depression. Professional factors had the largest total effect ($\beta = 0.57$) (burn-out: $\beta = 0.74$, sustained bullying at the workplace $\beta = 0.48$ and decision-making latitude $\beta = -0.47$), followed by individual factors ($\beta = 0.30$) (the main individual factor was recurrent major depression, path coefficient = 0.67). Professional factors had both a direct (path coefficient = 0.38) and indirect (through health risk behaviors, path coefficient = 0.19) effect on depression. Individual factors had a direct (path coefficient 0.21) and indirect (through health risk behaviors (path coefficient = 0.09) effect on depression. Health risk behaviors had a direct effect on depression (path coefficient = 0.31).
Interpretation: These results provide potential explanations for the likely causes of poor psychological health among HCWs. We propose several potential interventions related to professional factors and health risk behaviors. Our results suggest that improving organizational issues, reducing exposure to potentially morally injurious events, promoting brief naps at work and provision of evidence-based prevention approaches have been reported to be helpful in supporting the mental health of hospital staff (not only relaxation or stress management but training in leadership aspects, increasing the knowledge and practice of giving efficient performance feedback, reducing conflicting demands and peer support programs such as Trauma Risk Management. Our data suggest that developing caregivers reported experience and outcome measures (CREMs/CROMs) would be helpful to monitor work environment and its effect on depression in healthcare workers.

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What is already known

- Depression prevalence is high among physicians but little is known about other healthcare workers.
- Work environment may impact the risk of depression, but little is known on the role of professional factors, individual factors and health risk behavior.

What this paper adds

- The prevalence of depression was estimated at 30% in a nationwide survey of more than 10,000 healthcare workers.
- Depression was associated with professional, individual and health-related risk behaviors.
- Preventing, and actively managing, depression in healthcare settings is therefore a priority.

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1. Introduction

The World Health Organization recognizes work as a major social determinant of physical and mental health (World Health Organization, 2021a). Job-related factors such as wages, work hours, workload, interactions with co-workers and supervisors, and access to paid leave impact the wellbeing of workers, their families, and their communities (CDC, 2021).

The Diagnostic and Statistical Manual of mental disorders (5th ed. – DSM-5) outlines the following criterion to make a diagnosis of depression (American Psychiatric Association, 2013). The individual must be experiencing five or more symptoms during the same 2-week period and at least one of the symptoms should be either (1) depressed mood or (2) loss of interest or pleasure. The first-wave Covid-19 pandemic has been followed by a wave of meta-analyses reporting high rates of depression in healthcare workers (Kunzler et al., 2021; Li et al., 2021; Marvaldi et al., 2021; Olaya et al., 2021; Pappa et al., 2020; Salari et al., 2020). Approximately 25% of nurses and 24% of physicians were found to be depressed in a recent survey (Olaya et al., 2021). However, this phenomenon was not new as previous studies already reported increased risks of depression in HCWs. The first concern was raised regarding young physicians/residents who were found to have a depression rate of 20.9% - 43.2% depending upon the measurement tool used (Fond et al., 2021a; Mata et al., 2015). An increase trend of 0.5% per year was reported from 2015 (Mata et al., 2015) associated with increased absenteeism, decreased productivity and quality of care (Evans-Lacko and Knapp, 2016; Johnston et al., 2019; Pranjic and Males-Bilic, 2014; Rost et al., 2004). The authors concluded that this population was at risk of work-induced depression due to specific professional factors. We need now to determine the factors that could help identify the most effective levers to curb this phenomenon.

We know that unfavorable professional factors increase the risk of depression onset. Professional factors have worsened since the 2008 financial crisis due to increased economic constraints (Boyer et al., 2016; Clemens et al., 2014; Fernández Castañer et al., 2018). However, we do not know if the public sector has been affected to a similar level as the private sector (Ervasti et al., 2017). We do however know that work environment (including speed/quantity, complexity/intensity, fragmentation/unpredictability, decision latitude and social support) (Enns et al., 2015; Gi et al., 2011; Huang et al., 2022; Power et al., 2020; Tsutsumi et al., 2001), absenteeism/presenteeism (Dyrbye et al., 2019; Enns et al., 2015), sustained bullying at the workplace (Messiaen et al., 2020), sexual harassment (Duba et al., 2020a) and sexual orientation-based discrimination (Duba et al., 2020b) have also been associated with increased risk of depression in physicians. The role of burnout has been debated with some authors highlighting a causal role in the onset of depression (Peter et al., 2020a; Peter et al., 2020b; Rudman et al., 2020) with overlap between burnout and depression (Bianchi et al., 2015). We don't know if full-time jobs are at increased risk of depression due to increased exposure to these factors, and if random schedules or working longer than expected may increase the risk of depression. A recent meta-analysis has concluded that night shift work was associated with increased risk of depression in HCWs (Lee et al., 2017). The authors mentioned the need for additional large-scale studies. Since then, two studies have been published showing negative results (Angerer et al., 2017; Behrens et al., 2021).

It is likely that individual factors and health risk behaviors also play an important, yet often neglected, role in the onset of depression and furthermore it is likely that all HCWs do not have the same vulnerability to depression. For instance, other evidence shows that depression is more frequent in women (Morssinkhof et al., 2020) and in family caregivers or people with chronic illness (Irwin et al., 2013; Liew et al., 2019). Having children has been associated with increased turnover in HCWs (Daouda et al., 2021) but its potential association with depression has not been explored in HCWs thus far and we don't know if the presence of a partner at home may also influence depression risk (Andersson et al., 2022). Chronic illnesses increase the risk of depression (Asselmann et al., 2019; Ervasti et al., 2014; Pan et al., 2012) but are poorly included as explaining or confounding factors in studies including healthcare professionals. Also, while recurrent depressive disorder is classified in the International Classification of Diseases, this psychiatric vulnerability is poorly reported in studies exploring depression in HCWs thus far.

It is now well established that health risk behaviors (including overweight/obesity, tobacco smoking, hazardous drinking, insufficient physical activity and sleep reduction) are associated with increased risk of depression in HCWs (Bourbon et al., 2019; Choi et al., 2019; Fond et al., 2021b; Marvaldi et al., 2021; Pan et al., 2012; Yao et al., 2020). These behaviors need to be evaluated as they may guide prevention and more effective interventions.

Thus, whilst we know that professional, individual factors and health risk behaviors are associated with increased depression in HCWs, we do not yet know the interdependent relationships between them. This understanding is needed to guide prevention and tailor efficient interventions for depression. We used structural equation modeling (SEM), which is a useful statistical procedure, to test a theory involving non-straightforward relationships and is therefore well suited to the management of cross-sectional data for inferential purposes (Falissard, 2019).

The objective of the present study was to measure the depression prevalence in HCWs in the post-Covid-19 era and to determine its association with professional and individual factors and health risk behaviors.

2. Population and methods

2.1. Study population

Design. The AMADEUS ("AMéliorer l'ADaptation à l'Emploi pour limiter la soUffrance des Soignants"/"improve employment adaptation to limit HCWs suffering") study is a cross-sectional survey carried out in French public and private healthcare facilities at a national level in France between 2021 May 2 and 2021 June 30th. This survey was supported by professional healthcare worker associations and the directions of the healthcare settings in which the survey was disseminated. The detailed protocol has been previously published (Lucas et al., 2021).

2.1.1. Recruitment and sampling method

The participants were contacted through public and private facilities and professional associations by professional mailings and through social networks. All professional associations were contacted by email, and all regional health agencies and Territory hospital groups (*Groupements hospitaliers de territoire*/GHT including regional networks of academic and non-academic public hospitals) were contacted by phone to increase participation rates. The recruitment process is described in Supplementary Table 1.

2.1.2. Inclusion criteria

The participants were graduated HCWs currently working in a French public or private health facility. The detailed list of the professions included in the study is presented in Supplementary Table 1.

2.1.3. Exclusion criteria

As the purpose was to evaluate work environment, HCWs working in their private office were not included.

2.2. Collected data

2.2.1. Major depression

The Center for Epidemiologic Studies- Depression Scale (CES-D) (Van Dam and Earleywine, 2011) was used in its French version to determine major depression risk. The CES-D is a 20-item self-reported questionnaire that has been specifically developed to assess self-

reported depressive symptoms during the past week in large-scale/non clinical populations. Possible range of scores is zero to 60, with the higher scores indicating the presence of higher depressive symptomatology. A probable depression is defined by a score ≥ 17 in men and ≥23 in women (Fuhrer and Rouillon, 1989). CES-D has shown satisfactory psychometric properties (sensitivity of 0.853 and a specificity of 0.859) and reliability (Morin et al., 2011).

2.2.2. Professional factors

The following work characteristics were reported as binary variables: Public sector vs. private sector, Full-time job, Night shift work, Random schedules (defined by the true working schedule being different to the roster over the last two weeks), working longer than expected at least once a week.

Work environment was explored with the Job Content Questionnaire (Niedhammer, 2002). The ten dimensions, explored by 26 items, were reported as continuous scores: speed and quantity (3 items), complexity and intensity (3 items), fragmentation and unpredictability (3 items), decision-making latitude (3 items), use of skills (3 items), skill development (3 items), professional support by superiors (2 items), professional support by colleagues (2 items), emotional support by superiors (2 items), emotional support by colleagues (2 items). Higher scores were associated with poorer work conditions except for Decision-making latitude, Use of skills and Skills development. All factor dimensions had a satisfactory Cronbach alpha ≥0.65 (Niedhammer et al., 2006). Convergent validity tests confirmed the expected association with key variables, age, work status, sector of activity, occupation, job satisfaction, perception of job stress, and intent to change job (Niedhammer et al., 2006). Burnout syndrome was defined as a binary variable using the French version of the 22-item Maslach Burnout Inventory (MBI) scale (Maslach et al., 2001). This 22-item scale has shown satisfactory psychometric properties (Langevin, 2012). The Cronbach alpha coefficients for the three dimensions of the MBI are superior to 0.70 (emotional exhaustion (9 items): 0.90, depersonalization (5 items) 0.79, personal accomplishment (8 items) 0.71) (Langevin, 2012). The stability coefficients are 0.82 and 0.80 at respectively 2–4 weeks and one year (Langevin, 2012). Burnout as measured by the MBI was used as a binary variable defined as recommended by the authors by the presence of at least one of the three dimensions of burnout, according to the cut-off scores of each dimension (≥30 for emotional exhaustion, ≥12 for depersonalization and ≥40 for personal accomplishment) (Maslach et al., 2001). Absenteeism was defined using the following question "What is your number of unworked days (except holidays) during the last 12 months?". The participants reporting ≥8 unworked days (to exclude short-time unworked days due to benign infections or accidents) were classified in the absenteeism group.

History of lifetime sustained bullying at work, sexual harassment and sexual-based orientation discrimination were explored using the definitions of the French law used in our previous studies (Duba et al., 2020a, 2020b, 2020c; Messiaen et al., 2020, 2021) and reported as binary variables.

2.2.3. Individual factors

Age was reported as continuous variable (years). The following binary variables were reported: sex, presence of a partner at home, presence of children at home, being a family caregiver (defined as a person who provides regular direct support to another person for self-care, administrative management or other activities of daily living), history of recurrent major depression (defined by history of 3 or more lifetime major depressive episodes including the potential current one), having an ongoing chronic illness (defined by requiring long-term treatment).

2.2.4. Health risk behaviors

The following health risk behaviors were reported as binary variables: Overweight/obesity (defined by body mass index ≥25 kg/m^2) as a proxy for both poor diet habits, hard smoking (defined by daily tobacco smoking≥20 cigarettes/day), hazardous drinking (defined by a CAGE questionnaire score ≥ 2 (Rueff et al., 1989)), and moderate to vigorous physical activity using six items of the International Physical Activity Questionnaire (IPAQ) in its French version (Crinière et al., 2011)). IPAQ is the most widely used questionnaire to capture physical activity (World Health Organization, 2021b) with Cronbach's $\alpha = 0.73$ (Mannocci et al., 2010). In this questionnaire, the weekly duration of physical activity was self-reported by 6 items evaluating the intensity, duration and weekly frequency of 3 levels of physical activity: mild, moderate and intense level) (Mannocci et al., 2010). A weekly duration ≥150 min of moderate-vigorous physical activity was classified as adequate physical activity level based on the World Health Organization recommendations (World Health Organization, 2021b). Mean sleep duration (hours) was reported as a continuous variable using the dedicated item of the Pittsburgh Sleep Quality Index (PSQI) in its French version (Ait-Aoudia et al., 2013). The 10-items PSQI has shown satisfactory validity and reliability with an Cronbach's $\alpha = 0.73$ and with good convergent validity with emotional problems (moderate-to-large positive correlations with CES-D, $r = 0.58$) (Blais et al., 1997; Raniti et al., 2018).

Geographical coverage. To ensure correct geographical coverage, the postal code was reported. The postal codes were gathered by region Auvergne-Rhône-Alpes, Bourgogne-Franche-Comté, Bretagne, Centre-Val de Loire, Corse, Grand Est, Hauts-de-France, Ile-de-France, Normandie, Nouvelle-Aquitaine, Occitanie, Pays de la Loire, Provence-Alpes-Côte d'Azur.

2.3. Statistical analysis

All variables were presented using measures of means and dispersion (standard deviation) for continuous data and frequency distribution for categorical variables. Comparisons between HCWs with depression and those without were carried out using the chi-square test for categorical variables. All continuous variables were analyzed with Student t-tests for normally distributed data. As detailed in the rationale, the present study was hypothesis-driven, no correction for multiple testing has been therefore carried out (Bender and Lange, 2001).

Multivariate logistic regression models were employed to determine which factors were associated with increased risk of depression. The variables associated with depression with a p value <0.20 in the univariate analyses were included in the multivariate model.

A SEM based on a theoretical model was performed to identify the direct, indirect and total effects of associated factors with depression as identified by multivariate logistic regression. We also examined the possibility of omitted pathways using the relatively large modification indices (>80). These modifications were included in a refined model only if they made sense theoretically and if they and did not affect our a priori assumptions. Based on our previous works on medical students (Duba et al., 2020a, 2020b; Messiaen et al., 2020), our hypothesis stated that each factor category (professional factors, individual factors and health risk behaviors) had a direct effect on the risk of depression and that professional and individual factors had an indirect effect through health risk behaviors (the theoretical model is presented in Supplementary Fig. 1). Because there has been a longstanding debate as to whether burnout is a cause of depression, or a cause of other relevant mental health problems, in HCWs, a sensitivity analysis was carried out excluding burnout from the model to determine if the other estimates were robust. Standardized path coefficients (β) and 95% confidence intervals (CI) were reported. The weighted least squares means and variance adjusted (WLSMV) robust estimator was used since it is recommended for modeling latent factors with both categorical (binary and ordinal) and continuous variables, even if they are not normally distributed. The Comparative Fit Index (CFI), the Tucker–Lewis Index (TLI), and the Root Mean Square Error of Approximation (RMSEA) and the Standardized Root Mean Square Residual (SRMR) were used to assess the general fit of the models. A CFI and TLI ≥ 0.90, a RMSEA ≤0.08 and a SRMR ≤0.08

indicate a good model fit (Hu and Bentler, 1999). In addition to the statistical significance of the path coefficients, the strength of the relationship plays a role in determining whether the relationships are weak (<0.2), moderate (0.2–0.5) or strong (>0.5) (Cohen, 1988). This analysis was performed with R software, using Lavaan package (Rosseel, 2012).

2.4. Ethical considerations

The study was carried out in accordance with ethical principles for medical research involving humans (WMA, Declaration of Helsinki) and the French Jardé law. Ethical considerations. This survey was approved by the National Ethical Committee (IRB n°C08 / 21.01.06.93911, CNIL). All data was collected anonymously. As this study was voluntary and anonymous, no written informed consent was required and the participants were informed that clicking on the first page of the questionnaire was equivalent to giving their consent to participate. They were also informed that they could stop the survey and remove their participation at any time.

2.5. Funding

No funding.

3. Results

10,325 HCWs were recruited (1969 (19.1%) physicians, 1768(17.1%) health executives, 2819(27.3%) nurses, 847(8.2%) assistant nurses and 2922 (28.3%) other allied health professionals (AHP)). The mean age was 42.3 years (standard deviation (SD): 10.84), 1989(19.3%) were men. 3122(30.2%) (95% confidence interval: [29.4%–31.1%]) reported CES-D scores consistent with probable depression with relative consistency across groups (physicians 627(31.8%), health executives 572 (32.4%), nurses 825(29.3%), nurse assistants 246(29.0%)). The Cronbach's α coefficient was high for the CES-D (α = 0.93), PSQI (α = 0.75), as well as for the MBI burnout dimensions (emotional exhaustion α = 0.91, personal accomplishment α = 0.77, depersonalization α = 0.72) and for the three axes of the job environment JCQ scale (psychological demand α = 0.77, decision latitude α = 0.62 and social support α = 0.75). The detailed depression proportions, and the sociodemographic characteristics of each profession are presented in Table 1. Most of the depression rates ranked between 18% and 43%. The mean age was relatively homogenous across professions (approximately 40 years +/− 5 years, except for health executives and directors who were older (approximately 49–50 years). This age is comparable to the French general population (mean aged 42 years) (INSEE, 2022). All professions had a majority of women except for ambulance drivers consistent with the general sex ratio of healthcare professionals in France (Bessière, 2005).

Table 1
Proportion of depression and men according to profession (in decreased order of proportion of depression). Only professions with sample size≥20 were presented.

	N	N with MDD	% MDD	Mean age (SD)	N men	% men
Pharmacy assistant	87	37	42.5%	37.10(8.81)	11	12.6%
Administrative	295	111	37.6%	43.05(9.72)	24	8.1%
Laboratory technician	138	49	35.5%	39.38(11.51)	27	19.6%
Ambulance driver	27	9	33.3%	42.63(7.53)	22	81.5%
Pharmacist	260	86	33.1%	44.15(9.96)	69	26.5%
Health executives	1768	572	32.3%	49.10(8.02)	275	15.5%
Physicians	1969	627	31.8%	41.29(11.84)	670	34.0%
Nursery assistant	93	29	31.2%	39.91(10.25)	2	2.2%
Nurse	2819	825	29.2%	39.79(10.05)	461	16.3%
Nurse assistant	847	246	29.0%	42.44(10.36)	103	12.2%
Speech therapist	38	11	28.9%	44.39(12.56)	0	0.0%
Psychologist	216	59	27.3%	39.21(9.72)	25	11.6%
Dietician	99	27	27.3%	37.77(11.74)	6	6.1%
Occupational therapist	306	83	27.1%	36.72(10.78)	40	13.1%
Midwife	332	90	27.1%	38.26(10.17)	14	4.2%
Specialized educator	86	23	26.7%	41.52(10.49)	18	20.9%
Physiotherapist	419	111	26.5%	41.12(11.29)	120	28.6%
Radiology manipulator	142	36	25.4%	39.58(10.68)	35	24.6%
Social worker	131	30	22.9%	39.64(9.73)	6	4.6%
Psychomotrician	93	21	22.6%	36.19(10.04)	10	10.8%
Hospital director	21	4	19.0%	51.95(6.66)	6	28.6%
Director of care	105	19	18.1%	54.91(6.18)	29	27.6%

The geographical coverage of the survey was satisfactory and presented in Fig. 1. All regional territories were represented with effectives between 251 and 1573, consistently with the demographic repartition of the general population in France.

When the 95% confidence intervals of the adjusted odds ratio are strictly superior to 1, the factor is considered to be significantly associated with an increased risk of depression (with no causal relationship, given the cross-sectional nature of our data). The following variables were included in the multivariate analysis (Table 2): Age (years), Sex (man), Public sector vs. private sector, Full-time job, Random schedules, Working longer than expected at least once a week, High psychological demand, Low decision-making latitude, Poor superiors' and colleagues' professional and emotional support at work, Burnout, Absenteeism, Sustained bullying at the workplace, Sexual harassment exposure, Sexual orientation-based discrimination, Partner at home, Children at home, Family caregiver, History of recurrent major depression, Having a chronic illness, Overweight/obesity, Hard smoking, Hazardous drinking, Moderate to vigorous physical activity, Sleep reduction. In multivariate analyses, increased risk of depression was associated with professional factors (high complexity/intensity adjusted odds ratio, high fragmentation/ unpredictability, low decision-making latitude, low emotional support by colleagues, random schedules, working longer than expected at least once a week, sustained bullying at the workplace, burnout and absenteeism). No department and no professional category was significantly associated with depression in multivariate analyses ($p > 0.05$, data not shown). Demographic factors associated with increased risk of depression included older age, male sex, absence of a partner at home, being family caregiver and a history of recurrent major depression. Among health risk behaviors, increased risk of depression was associated with heavy smoking, hazardous drinking, moderate to high physical activity and sleep reduction.

The original theoretical model did not provide an adequate fit ($\chi^2(165) = 6658.044$, $p < 0.001$, CFI = 0.710, TLI = 0.666, RMSEA = 0.06295%CI [0.061–0.063], and SRMR = 0.081). Modification indices suggested theoretically relevant associations, and their inclusion, improved model fit ($\chi^2(151) = 1834.492$, $p < 0.001$, CFI = 0.925, TLI = 0.905, RMSEA = 0.033 95%CI [0.032–0.034], and SRMR = 0.046). The SEM model is presented in Fig. 2 and the standardized coefficients of the residual covariances that were added to the model based on the modification indices are presented in Supplementary Table 3.

Professional factors had the largest total effect (β = 0.57, 95%CI [0.51,0.63], $p < 0.001$) followed by individual factors (β = 0.30, 95%CI [0.23,0.37], $p = 0.005$).

All factors included in the model had a direct effect on depression risk with professional factors having the strongest association (professional factor: β = 0.38, 95%CI[0.27,0.48], $p < 0.001$, health risk behaviors: β = 0.31, 95%CI[0.17,0.45], $p < 0.001$, individual factor: β = 0.21, 95%CI [0.13,0.30], $p = 0.011$).

Professional and individual factors also had an indirect effect, with professional factors having again the strongest indirect effect (professional factors: β = 0.19, 95%CI[0.09,0.30], $p = 0.001$, individual factors β = 0.09, 95%CI[0.04,0.14], $p = 0.025$).

The main professional factors involved were burn-out (β = 0.74, 95%CI[0.72,0.76], $p < 0.001$), sustained bullying at the workplace (β = 0.48, 95%CI[0.45,0.50], $p < 0.001$) and decision-making latitude (β = −0.47, 95%CI[−0.49,-0.45], $p < 0.001$).

After excluding burnout from the model ($\chi^2(133) = 1551.762$, $p < 0.001$, CFI = 0.921, TLI = 0.898, RMSEA = 0.032 95%CI [0.031–0.034], and SRMR = 0.046), the other estimates remained robust: all factors

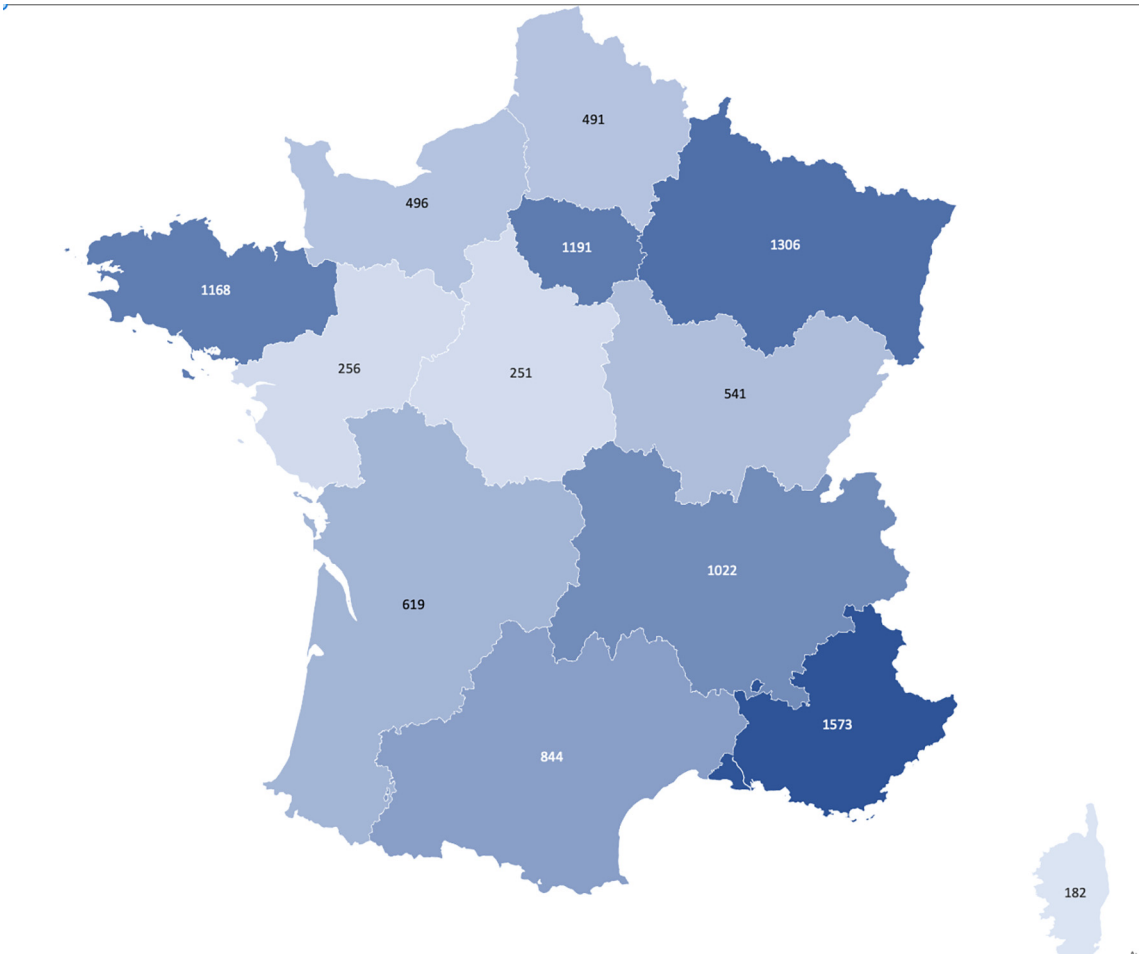

Fig. 1. Geographical distribution of the participants.

included in the model had a direct effect on depression risk with professional factors having the strongest association (professional factor: $\beta = 0.27$, 95%CI[0.15,0.39], $p < 0.001$, Health risk behaviors: $\beta = 0.35$, 95%CI [0.20,0.51], $p < 0.001$, individual factor: $\beta = 0.26$, 95%CI[0.17,0.35], $p < 0.001$). Professional and individual factors also had an indirect effect, with professional factors having again the strongest indirect effect (professional factors: $\beta = 0.22$, 95%CI[0.10,0.34], $p < 0.001$, individual factors $\beta = 0.09$, 95%CI[0.04,0.15], $p = 0.001$).

4. Discussion

This study identified a high rate of depression in all categories of HCWs (between 29 and 32%). Our SEM revealed moderate associations between depression and professional factors (mainly complexity/intensity, fragmentation/unpredictability, decision-making latitude), individual factors (mainly history of recurrent major depression) and health risk behaviors. Individual factors had the strongest effect. We also identified weak, but significant, indirect relationships between respectively professional and individual factors and depression through health risk behaviors. Among professional factors, burnout, sustained bullying at the workplace and low decision-making latitude had the strongest associations with depression, with burnout having the strongest associated. However, all other estimates remained robust after excluding burnout, suggesting that burnout is a distinct risk factor for depression.

Our finding that near one third of HCWs are likely to be suffering from depression, regardless of their role, is somewhat alarming. Based on our results for nurses and physicians, we found higher rates of depression compared to those reported in the most recent meta-analysis published in 2021 (29.3% vs. 24%, for nurses and 31.8% vs 25% for physicians) (Olaya et al., 2021). Whilst the mental wellbeing of HCWs has always been seen as important, this need has been reinforced by the central role of these staff in dealing with the Covid-19 crisis (Arnaez et al., 2020; Azoulay et al., 2021; Kunzler et al., 2021; Li et al., 2021; Stockton et al., 2020). Our results suggest that high rates of depression are likely to continue to impact on healthcare staff's ability to deliver effective care which is concerning given that the pandemic is far from over. We know that depression has a strong impact on productivity, absenteeism (Asami et al., 2014; Baker et al., 2020; Beck et al., 2011) and quality of patient care. In 2014, a US population-based study already reported 10% of significant medical errors and 6% of suicidal ideations in physicians (Patel et al., 2018).

Our result thus suggests that the deployment of various wellbeing programs in hospitals have not been enough to curb the epidemic of depression among caregivers. Our results may explain in part this phenomenon. Whilst most wellbeing programs target health risk behaviors (e.g. healthy food options, gym membership discounts, on-site exercise facilities, smoking cessation program, personal health coaching, classes in nutrition or healthy living, web-based resources for healthy living and tobacco-free campus) (HPOE, 2016), our results have shown that health risk behaviors have only a moderate effect on depression. Second, these interventions may not be always suitable for HCWs. Providing gym discounts or on-site exercise facilities may not be suitable for exhausted employees, or employees who lack leisure time and already spend a lot of time at the workplace. Time constraints do not always allow HCWs to eat well and collective catering is not always compatible with food quality. Moreover, many healthcare staff will have been discouraged from collective meetings to eat food etc. because of fears of spreading covid when de-masked. Healthy food is

Table 2
Professional and individual factors and health risk behaviors associated with major depression (dependent variable) in 10,325 healthcare workers.

Characteristics	Univariate model			Multivariate model	
	No major depression 7203(69.8%)	Major depression 3122(30.2%)	p-value	Adjusted* odds ratio (aOR) (95% IC)	p-value
Individual factors					
Age (years)	42.13(10.92)	42.60(10.66)	0.151	1.005(1.001–1.005)	0.015
Sex(man)	1265(17.6%)	724 (23.2%)	**<0.0001**	1.771(1.539–2.038)	**<0.0001**
Partner at home	49(15.0%)	41(17.4%)	**<0.0001**	0.638(0.563–0.723)	**<0.0001**
Children at home	4288(59.5%)	1764(56.5%)	**0.004**	0.983(0.563–0.723)	0.779
Family caregiver	1188(16.5%)	688(22.0%)	**<0.0001**	1.230(1.073–1.410)	**0.003**
History of recurrent major depression	617(6.0%)	892(8.6%)	**<0.0001**	2.778(2.407–3.207)	**<0.0001**
Chronic illness	1041(14.5%)	633(20.3%)	**<0.0001**	1.078(0.933–1.244)	0.308
Professional factors					
Public sector vs. private sector	6152(85.4%)	2764(88.5%)	**<0.0001**	1.172(0.997–1.378)	0.089
Full-time job	5961(82.8%)	2669(85.5%)	**0.001**	0.985(0.845–1.149)	0.849
Night shift work	442(6.1%)	206(6.6%)	0.374	–	–
Job content questionnaire dimensions					
Speed and quantity	8.37(2.00)	9.36(1.99)	**<0.0001**	0.973(0.938–1.008)	0.126
Complexity and intensity	8.73(1.63)	9.59(1.60)	**<0.0001**	1.095(1.048–1.145)	**<0.0001**
Fragmentation and unpredictability	8.47(2.04)	9.50(1.89)	**<0.0001**	1.082(1.045–1.119)	**<0.0001**
Decision-making latitude	37.63(6.42)	33.77(7.55)	**<0.0001**	0.978(0.969–0.987)	**<0.0001**
Use of skills	17.30(2.91)	16.44(3.19)	**<0.0001**	0.992(0.971–1.013)	0.461
Skill development	19.70(2.96)	18.51(3.45)	**<0.0001**	0.999(0.979–1.020)	0.922
Professional support by superiors	5.48(1.66)	4.64(1.75)	**<0.0001**	0.937(0.859–1.022)	0.140
Professional support by colleagues	6.48(1.11)	4.64(1.75)	**<0.0001**	1.037(0.968–1.110)	0.301
Emotional support by superiors	5.50(1.72)	4.65(1.83)	**<0.0001**	1.000(0.921–1.086)	0.996
Emotional support by colleagues	6.45(1.16)	5.89(1.42)	**<0.0001**	0.853(0.801–0.909)	**<0.0001**
Work schedules characteristics					
Random schedules	3344(46.4%)	1546(49.5%)	**0.004**	1.135(1.017–1.267)	**0.024**
Working longer than expected at least once a week	4533(62.9%)	2245(71.9%)	**<0.0001**	1.178(1.076–1.384)	**0.013**
Burnout	3088(42.9%)	2624(84.0%)	**<0.0001**	4.826(4.291–5.428)	**<0.0001**
Absenteeism	1212(16.8%)	845(27.1%)	**<0.0001**	1.440(1.276–1.626)	**<0.0001**
Professional violence at the workplace					
Sustained bullying at the workplace	2397(33.3%)	1712(54.8%)	**<0.0001**	1.343(1.197–1.506)	**<0.0001**
Sexual harassment exposure	476(6.6%)	280(9.0%)	**<0.0001**	1.023(0.835–1.252)	0.828
Sexual orientation-based discrimination	406(5.6%)	248(7.9%)	**<0.0001**	1.052(0.850–1.304)	0.640
Health risk behaviors					
Overweight/obesity	2504(34.8%)	1222(39.1%)	**<0.0001**	0.976(0.871–1.093)	0.669
Daily tobacco smoking≥20 cigarettes/day	113(1.6%)	134(4.3%)	**<0.0001**	1.473(1.069–2.031)	**0.018**
Hazardous drinking	1112(15.4%)	813(26.0%)	**<0.0001**	1.548(1.356–1.767)	**<0.0001**
Moderate to high physical activity	4714(65.5%)	1678(53.8%)	**<0.0001**	0.743(0.666–0.828)	**<0.0001**
Sleep duration (hours)	6.81(1.19)	6.15(1.35)	**<0.0001**	0.700(0.669–0.732)	**<0.0001**

Significant associations ($p < 0.05$) are in bold.
* Adjusted for all variables associated with major depression with $p < 0.2$ in univariate analyses.

expensive and not always suited for employees with low income (such as assistant nurses). Additionally, as yet the effectiveness of tobacco cessation programs in HCWs is poorly evaluated. It is also notable that encouraging staff to take brief naps at work is often absent from these programs despite evidence that this may improve productivity and decrease exhaustion (Martin-Gill et al., 2018).

Some of these interventions have targeted work environment, e.g., enhancing managerial skills of primary care workers' supervisors, such as training in leadership aspects, increasing the knowledge and practice of giving efficient performance feedback and reducing conflicting demands. These programs are poorly developed and evaluated thus far in France. Moreover, our results suggest that emotional and professional support from superiors is less likely to decrease depression than the provision of emotional support from colleagues. Targeting inter-colleagues support may therefore be a more effective strategy and peer support programmes such as TRiM (trauma risk management) have been reported to be helpful in supporting the mental health of hospital staff (Flaherty and O'Neil, 2021). This is supported by the findings of previous studies (Aziah et al., 2004; Kojima et al., 2003; Stansfeld et al., 2012).

Our results suggest that improving work organization may have the best effect to prevent depression and thus ensuring that the organization, planning and coordination of care is done to a high standard is likely to help. However, many eventualities cannot be planned for including absenteeism which is very common in this population (Cappelletti and Savall, 2018) and is likely, in part at least, to be due to mental ill-health including depression. Burnout and sustained bullying at the workplace had the strongest associations with depression among professional factors in our results, their high prevalence in HCWs is questionable. Burnout is not recognized as a diagnosis in the current version of the International Classification of Diseases and is not recognized as an occupational disease thus far. However, sustained bullying at the workplace has been penally punished in France for more than twenty years. A much lower prevalence of sustained bullying at the workplace would therefore be expected. Our previous study also found a prevalence of approximately 40% of sustained bullying at the workplace in residents (Messiaen et al., 2020). Preventing this endemic phenomenon is therefore a crucial point in the prevention and care of depression in HCWs. Our negative results have also yielded important information. For example, our results are in favor of an absence of association between nightshift work and depression (Angerer et al., 2017; Behrens et al., 2021).

It is also likely that providing staff with a mechanism to check on their own mental health may be useful; however, it is unlikely that formal mental health screening for depression among the workforce will be effective (Rona et al., 2017). Also, providing easy access to evidence-based care may be one of the most effective interventions to manage depression in HCWs, especially for those with recurrent major depressive disorder. We also identified that family caregivers are more vulnerable, yet to a lesser extent. However, depression remains a

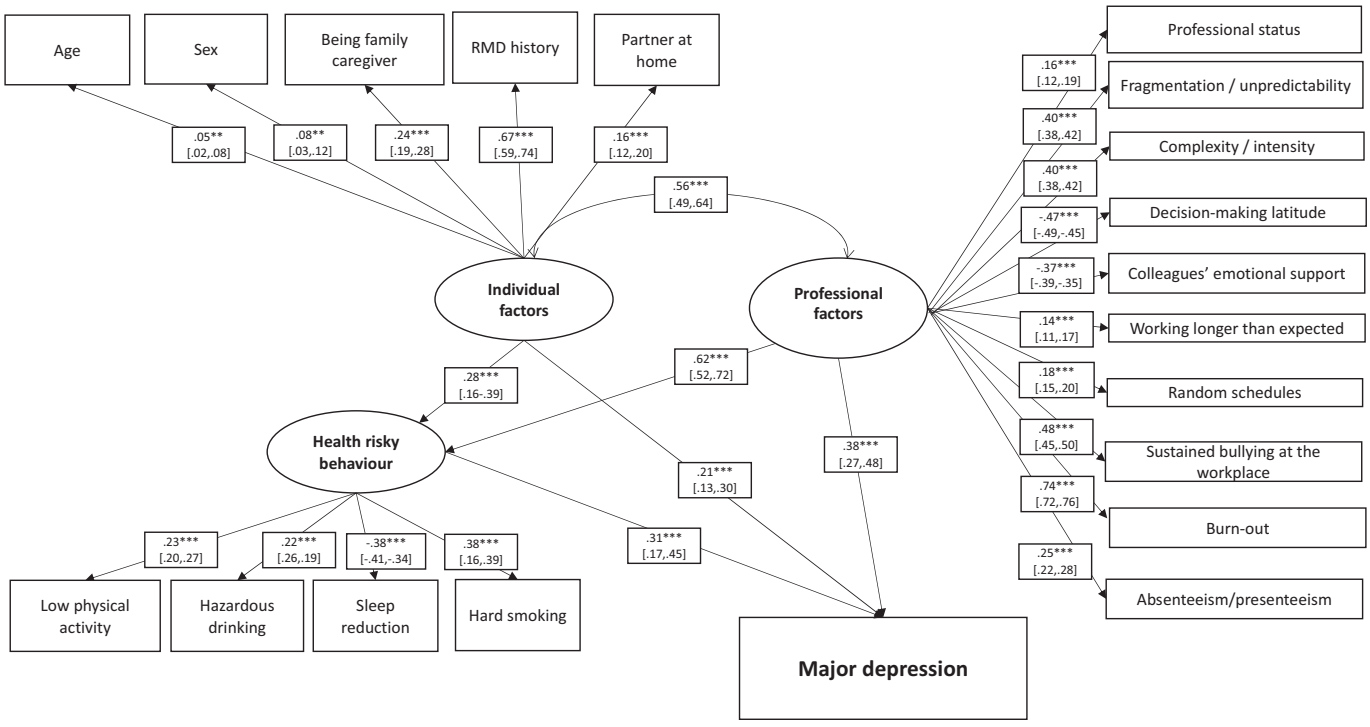

Fig. 2. SEM model with standardized path coefficients. Notes: $p < 0.001^{***}$; $p < 0.01^{**}$, RMD: recurrent major depressive disorder.

taboo and HCWs may be afraid of the stigmatization associated with depression (Arnaez et al., 2020; Doty et al., 2021).

We consider that developing caregivers-reported experience and outcomes measures (CREMs/CROMs) is now a priority to monitor work environments and health, following the patient-reported experience and outcome measures (PREMs/PROMs) models (Fernandes et al., 2020). There may also be value in developing personalized psychotherapies (like interpersonal psychotherapy) or group therapies (like mindfulness, resiliency training and self-acceptance interventions) so they can be used with HCWs at risk of depression; however, it is important to evaluate if such interventions are effective (Doty et al., 2021; Niedermoser et al., 2020; Rost et al., 2005; Schramm et al., 2020; Stockton et al., 2020).

4.1. Strengths

This sample is the largest sample of HCWs recruited in Western countries enabling the inclusion of multiple confounding factors. Our sample was representative of the whole healthcare population in terms of age, sex and geographical distribution. The proportion of women among nurses in France in 2011 was 86% vs. 87% in our study and the mean age 38.9 years in the whole population vs. 39.8 years in our study (Barlet, 2011). Sociodemographic variables have been included in adjustment factors and in the SEM model. The absence of missing data due to the web questionnaire is a strength of the quality of the present variables. This study is the first study combining the association of professional, individual and health risk behaviors factors and exploring the post-Covid-19 depression prevalence in HCWs. The SEM enables us to discriminate between direct and indirect factors, confirming the direct association of these factors with depression. The participation bias was limited as the title of the survey did not mention depression, and our rate may be underestimated as employees who were off work were unable to receive the study.

4.2. Limitations and perspectives

The limitations of this study are similar to those affecting other online surveys. With a cross-sectional design, no causal relationship can be drawn. We cannot calculate the accurate participation rate as the study was disseminated by the health directors of each facility and we cannot totally exclude sampling bias. The proportion of participants was not the same in nurses and health executives (health executives: 1486/6725 = 22.1% vs. nurses 2538 /479,836 = 0.5% (DRESS, 2022)). The dissemination of the study in nurses and nurse assistants was less effective due to the lack of use of professional mailing in these professions in some facilities. However, to increase geographical exhaustivity, the survey was disseminated through social networks and our geographical coverage seems satisfactory. To limit the selection bias, the title of the study did not mention burnout or depression but work adaptation. On the contrary, we may have underestimated depression as all participants off work for depression, burnout or other causes did not receive the mail by professional mailings. We have disseminated this survey at different timepoints to reach these participants. Some professions were more represented than others and our Table 1 shows that some of them have very insufficient effectives. The private sector was also underrepresented. We estimate that this may be due to lower research culture in the private sector and higher lack of time or lower desire to evaluate work conditions in these facilities. However, we found no significant difference in depression in private vs. public sector. The SEM is complex with several variables and relationships and our study needed important sample size to converge. Further studies should replicate these relationships in each professional category. However, our study has one of the largest sample sizes of Western countries in the field. This sample size was sufficient to carry out robust analyses with adjustments for multiple confounding factors, but not sufficient to carry out subgroup analyses. The daily transport time and the workforce shortage (e.g. patient to staff ratio or hidden rationing) have not been reported and can contribute to work disorganization, exhaustion and sleep disorders. They should be explored in future studies. While CES-D has shown satisfactory psychometric properties, CES-D remains a patient-reported outcome and some cases may have been misclassified. Patient-reported outcomes are known to be associated with higher levels of depression compared to clinician-rated outcomes or structured clinical interviews (Etchecopar-Etchart et al., 2020). In France, we have no direct access to the professional listings and/or mailings, which limits the

implementation of surveys. There is thus a need for nationally representative cohorts to monitor the health status of HCWs.

5. Conclusion

Despite the evidence looking at depression in HCWs during the Covid-19 first wave, our data shows that high rates of depression appear to be a persistent problem which should be addressed as a public health priority. These results should act as a wake-up call for healthcare policy-makers to address the poor health status of HCWs. We propose several interventions to improve this issue: improving organizational/planification issues, reducing sustained bullying at the workplace, reinforcing colleague's emotional support, promoting napping at work and individual and collective psychotherapies that have proved effectiveness in depression prevention (not only relaxation or stress management). Developing CREMs and CROMs is needed to monitor work environment and its effect on depression in HCWs. Last, there is a need for nationally representative cohorts to monitor the health status of HCWs.

CRediT authorship contribution statement

Concept and design: Guillaume Lucas, Laurent Boyer, Guillaume Fond.

Acquisition and analysis: Guillaume Lucas, Guillaume Fond.

Interpretation of data: Laurent Boyer, Guillaume Fond

Drafting of the manuscript: Guillaume Fond, Sara Fernandes, Neil Greenberg, Laurent Boyer.

Critical revision of the manuscript for important intellectual content: All the authors.

Statistical analysis: Guillaume Fond, Sara Fernandes, Laurent Boyer.

Supervision: Guillaume Fond.

Declaration of Competing Interest

NG is the RC Psychiatrist's lead for Trauma and the Military and the Chair of the Occupational Psychiatry Special Interest Group (OPSIG).

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ijnurstu.2022.104328.

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