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Original Contribution

Psychosocial Work Environment as a Risk Factor for Absence With a Psychiatric Diagnosis: An Instrumental-Variables Analysis

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Recent reviews show that self-reported psychosocial factors related to work, such as job demands and job control, are associated with employee mental health, but it is not known whether this association is attributable to reporting bias. The authors examined this question using objectively measured hospital ward overcrowding as an instrument. The extent of overcrowding provided a strong instrument for self-reported job demands but not for job control, and it was used to examine unbiased associations between self-reported job demands and sickness absence with a psychiatric diagnosis among 2,784 female nurses working in somatic illness wards in Finland. During the 12-month follow-up period (2004–2005), 102 nurses had an absence with a psychiatric diagnosis, 33 with a diagnosis of depressive disorder. Both greater extent of overcrowding and higher self-reported job demands were associated with increased risk of psychiatric absence. The latter association was stronger but less precisely estimated in an instrumental-variables analysis which took into account only the variation in self-reported job demands that was explained by overcrowding. Repeating these analyses with absence due to depressive disorders as the outcome led to similar results. Findings from this instrumental-variables analysis support the status of high self-reported job demands as a risk factor for absence with a psychiatric diagnosis.

absenteeism; behavior; depression; employment; mental disorders; psychology; risk factors; sick leave

Abbreviations: CI, confidence interval; ICD-10, *International Classification of Diseases*, Tenth Revision.

In 3 recent reviews, investigators concluded that work-related psychosocial factors may contribute to the development of psychiatric disorders or depression (1–3). The leading theoretical model explaining these effects is the demand/control model, suggesting that the critical components of the psychosocial work environment are job demands and control over work (4). Summary estimates from longitudinal observational studies show a 1.3- to 1.4-fold risk of common mental disorders or depressive disorders for employees with high self-reported job demands and a weaker association for low self-reported job control (1, 3).

In spite of the widespread acceptance of the demand/control model, it has never been tested in a randomized controlled trial; only observational studies are available. It has been recognized for a long time that associations observed in such studies might be spurious—reflecting, for example, reporting bias, which hampers the validity of self-reported data on work conditions (5). Recently, this issue has been increasingly and controversially discussed in the literature (6–8).

Quasi-experiments are the next best approach after trials to strengthening causal inference. One form of quasi-experiment is an instrumental-variables analysis in which objective exposures are used as proxy measures for self-reported variables (9). In the present investigation, which to our knowledge is the first of this kind, we used patient overcrowding in hospital wards as an instrument for evaluating self-reported psychosocial work-related risk factors among ward personnel. We hypothesized that the relation between self-reported psychosocial factors and psychiatric disorders would not be attributable to reporting bias if differences in the levels of self-reported job demands, as

predicted by objectively assessed overcrowding, were to predict psychiatric disorders among employees.

MATERIALS AND METHODS

Participants and study design

To measure ward overcrowding, we collected data on bed occupancy from 203 somatic illness wards in 16 Finnish hospitals during a 3-month period preceding a questionnaire survey on psychosocial factors between March and November 2004. This investigation is based on a subsample from a register study on overcrowding and antidepressants which additionally included those employees who did not participate in the questionnaire survey (10). The study was approved by the Ethics Committee of the Finnish Institute of Occupational Health (Helsinki, Finland).

Female nurses who worked in these 203 wards were identified from the employers' registers, including beginning and end dates for all employment contracts; 3,103 (78%) of the nurses responded to the questionnaire. To ensure that the study participants were exposed to conditions on the wards for a reasonable length of time, we selected all employees who had had at least a 3-month job contract for employment on the wards before the survey ($n = 2{,}965$). In order to assess sickness absence which started after the measurement of overcrowding and job demands, we excluded those employees who had had 1 or more periods of absence with a psychiatric diagnosis during the 6 months prior to the survey ($n = 39$). In addition, we excluded those participants who had missing data for any of the study variables ($n = 142$). We followed up the participants through record linkages for absence with a psychiatric diagnosis during the 12-month period after the questionnaire survey. Record linkages were successful for all participants and covered the entire follow-up period. The final cohort consisted of 2,784 female nurses aged 20–64 years.

Ward overcrowding

The participating hospitals collected monthly figures on bed occupancy in each ward according to the procedure set by the National Institute for Health and Welfare in Finland. As previously described (10), we calculated monthly bed occupancy by dividing the sum of inpatient days by the number of beds available (i.e., number of beds × number of days the ward was in use). Ward closure days were excluded from the denominator. The day of admission but not the day of discharge for each patient was included in the sum of inpatient days. The rate above which a hospital ward is overcrowded is less than 100% and is defined as >85% (10–12). To assess the excess rate of bed occupancy, we first coded the optimal bed occupancy rate (≤85%) as 0% and calculated all rates above 85% (i.e., overcrowding) by subtracting 85 from the rate. We then created a 4-level overcrowding score based on the mean of the monthly excess bed occupancy rates over the preceding 3 months before the survey (1 = 0% excess occupancy; 2 = >0%–≤5%; 3 = >5%–≤10%; and 4 = >10%). In previous studies, the measure of hospital ward overcrowding has been associated with suboptimal employee (10) and patient (11) outcomes.

Psychosocial factors at work

We used established questionnaires to assess job demands (3 items; Cronbach's $\alpha = 0.75$) and job control (9 items; $\alpha = 0.82$) (4). The response format was a 5-level Likert-type scale. We calculated the mean score of the items for each employee (range, 1–5 in both scales).

Absence with a psychiatric diagnosis

We retrieved data on absences and related diagnoses from the national absence register of the Social Insurance Institution of Finland. All permanent residents aged 16–67 years in Finland are entitled to daily allowances due to absence based on a medical certificate. Absences are covered for up to 1 year, after a waiting period of 9 days, in addition to the first day of illness. If the absentee is paid a wage or salary while out on sick leave (this was the case for all of the participants in the present study), the sickness allowance is paid directly to the employer. The data cover virtually all recorded absence episodes of 10 days or more. The data also include diagnoses for each absence episode. An *International Classification of Diseases*, Tenth Revision (ICD-10) (13) diagnosis with a 3-level classification is assigned to each absence episode by the treating physician.

We defined absence cases as persons who were absent from work because of any mental or behavioral disorder (ICD-10 codes F00–F99) during the 1-year follow-up period after the survey. We separately identified persons who were absent because of depressive disorders (ICD-10 codes F32–F34).

Covariates

From the employers' registers, we obtained information on the following covariates: age, length of employment contract, type of contract (temporary vs. permanent), hospital district, and specialty (internal medicine, surgery, pediatrics, other). We used standard questionnaire measures to assess smoking status (yes/no), physical inactivity (<2 metabolic equivalent task-hours per day), high alcohol consumption (>21 g/week), and body mass index (based on self-reported weight and height). These covariates are among the risk factors that have been shown to be potential confounders or mediators of the association between psychosocial factors at work and psychiatric disorders (14–18).

Data analysis

All statistical analyses were performed using Stata 10.0 software (Stata Corporation, College Station, Texas). We assessed the associations of job demands, job control, and hospital ward overcrowding with baseline covariates by using χ^2 tests and analysis of variance. We examined the strength of ward overcrowding as an instrument for psychosocial factors

by using F statistics (values of 10 or more are taken to indicate sufficient strength to ensure the validity of instrumental-variables methods) (19, 20), and we examined the exogeneity of the instrument by using Wald tests. Using conventional and instrumental probit regression analysis, we examined associations between psychiatric absence and those psychosocial factors for which overcrowding provided a sufficiently strong instrument. The probit model is based on the standard cumulative normal probability distribution, and the coefficient of the probit model is called the probit index (21). Results were adjusted for baseline covariates. To illustrate differences between standard and instrumented analyses, we calculated probabilities of absence with a psychiatric diagnosis for persons at the bottom and top quartiles of the psychosocial work factors. We repeated all of these analyses using absence with a diagnosis of depressive disorder as the outcome variable.

RESULTS

The mean age of the 2,784 female nurses was 42.2 years (Table 1). A permanent employment contract and longer employment were associated with higher self-reported job demands but not with recorded ward overcrowding. Older age was associated with greater self-reported job demands but a lower extent of overcrowding and lower self-reported job control. The association between job demands and alcohol intake was stronger than that between overcrowding and alcohol intake, and only job demands were associated with body mass index. The extent of ward overcrowding provided a strong instrument for job demands ($F = 67.15$) but not for job control ($F = 2.57$). Similarly, the Wald test of exogeneity was significant for job demands (χ^2 (1 df) = 9.84, $P = 0.0017$), but it was not possible to conduct this test for job control because the test assumptions were not met. Thus, further analyses were confined to job demands only.

During the 12-month follow-up period (2004–2005), 102 persons had at least 1 absence with a diagnosis of a mental or behavioral disorder (ICD-10 codes F00–F99; our main outcome measure). The numbers of *first* absences by diagnostic group were: 64 neurotic stress-related and somatoform disorders (ICD-10 codes F40–F48), 32 mood disorders (ICD-10 codes F30–F39), 4 behavioral syndromes (ICD-10 codes F50–F59), and 2 ''other'' mental or behavioral disorders. In addition, we identified 33 participants with at least 1 absence due to depressive disorders (ICD-10 codes F32–F34; our secondary outcome measure).

As Table 2 shows, both greater exposure to overcrowding and higher self-reported job demands were associated with increased risk of absence due to a mental or behavioral disorder. The latter association was stronger but less precisely estimated in the instrumental-variables analysis, which took into account only the variation in self-reported job demands that was explained by overcrowding. On the basis of an age-adjusted instrumented model, the estimated probability of having an absence with a diagnosis of mental or behavioral disorder was 0.6% (95% confidence interval (CI): 0.4, 0.9) for persons in the bottom quartile of self-reported job demands and 26.1% (95% CI: 9.7, 50.7) for those in the top quartile. The corresponding figures in standard noninstrumented analyses were 2.1% (95% CI: 1.4, 3.2) and 5.0% (95% CI: 3.9, 6.4), respectively. Repeating the analyses with absence due to depressive disorders as the outcome produced similar associations. The findings were little affected by additional adjustment for all baseline characteristics.

DISCUSSION

In this cohort of over 2,700 female nurses, both high self-reported job demands and working in an overcrowded ward (objectively assessed) predicted sickness absence with a psychiatric diagnosis during a 12-month follow-up period. In instrumental-variables analyses, the association between job demands and psychiatric absence remained when only the variation in job demands that was attributable to objectively assessed overcrowding was taken into account. These findings provide methodologically novel evidence that supports the status of excessive self-reported job demands as a risk factor for psychiatric absences.

Investigators in some previous studies have tried to address reporting bias by adjusting for personality characteristics, negative affectivity, and other factors (1–3). This approach is problematic because the assessment of these covariates is based on self-reports and is thus, in itself, subject to reporting bias. In contrast, our analyses, which were based on an objectively assessed instrument, were largely protected against this specific bias. Other strengths of the present investigation included a homogenous study sample, which reduced confounding due to variation in demographic factors such as sex and occupation. Comprehensive records of absence with a psychiatric diagnosis from national registers that cover all Finnish adults made it possible to avoid issues related to sample attrition.

There were 3 important assumptions behind this instrumental-variables analysis. First, in order for overcrowding to be valid as an instrument, it should have influenced psychiatric disorders only via its association with the exposure variable of interest, that is, perceived job demands. There should not have been a direct path from the instrument to the outcome variable (i.e., absence with a psychiatric diagnosis). Although this is an empirically untestable assumption, it seems at least theoretically plausible in this case, as stress perception is assumed to precede stress reaction. Second, there should not have been a shared common prior cause of the instrument and the outcome variable. Again, we cannot think of any major violations of this assumption in the current study. Third, there should not have been a path between the instrument and the set of unobserved confounding variables. For example, if vulnerability to stress (''a frail mental constitution'') is a confounder of the relation between job demands and psychiatric disorders, it is possible that people who are susceptible to stress selectively avoid jobs that involve high demands (e.g., overcrowded wards). Our study may have been open to this kind of limitation. Nevertheless, indirect evidence suggests that this particular scenario may not have invalidated our analyses. Confounding by

Table 1. Baseline Characteristics of Female Nurses Aged 20–64 Years ($n = 2,784$) Working at 16 Finnish Hospitals and Associations With Hospital Ward Overcrowding and Self-reported Job Demands and Job Control, 2004–2005

	No. of Subjects	Mean (SD)	%	Hospital Ward Overcrowding (Range, 1–4)		Job Demands (Range, 1–5)		Job Control (Range, 1–5)	
				β (SE)	*P* Value	β (SE)	*P* Value	β (SE)	*P* Value
Age, years	2,784	42.2 (10.3)		−0.006 (0.002)	0.003	0.009 (0.002)	0.002	−0.002 (0.001)	0.047
Employment contract									
Permanent	2,189		78.6	0 (reference)		0 (reference)		0 (reference)	
Temporary	595		21.4	0.083 (0.049)	0.09	−0.154 (0.039)	<0.0001	−0.030 (0.022)	0.17
Length of employment, years									
<1	934		33.6	0 (reference)		0 (reference)		0 (reference)	
1–4	886		31.8	0.009 (0.050)	0.87	0.127 (0.189)	0.001	0.016 (0.022)	0.49
>4	964		34.6	0.064 (0.049)	0.19	0.116 (0.068)	0.09	−0.049 (0.022)	0.03
Hospital district no.									
1	770		27.7	0 (reference)		0 (reference)		0 (reference)	
2	196		7.0	0.304 (0.084)	<0.0001	0.116 (0.068)	0.09	0.098 (0.038)	0.01
3	335		12.0	−0.080 (0.069)	0.25	0.107 (0.056)	0.06	0.076 (0.024)	0.02
4	810		29.1	0.212 (0.053)	<0.0001	0.141 (0.045)	0.001	0.084 (0.024)	<0.0001
5	673		24.2	0.179 (0.056)	0.001	0.150 (0.045)	0.001	0.001 (0.025)	0.97
Specialty									
Internal medicine	668		24.0	0 (reference)		0 (reference)		0 (reference)	
Surgery	696		25.0	−0.222 (0.058)	<0.0001	−0.086 (0.045)	0.06	0.002 (0.026)	0.95
Pediatrics	448		16.1	0.146 (0.064)	0.02	−0.348 (0.051)	<0.0001	0.063 (0.029)	0.03
Other[a]	972		34.9	−0.306 (0.053)	<0.0001	−0.427 (0.042)	<0.0001	−0.040 (0.024)	0.10
Smoking									
No	2,501		89.8	0 (reference)		0 (reference)		0 (reference)	
Yes	283		10.1	0.098 (0.067)	0.14	0.031 (0.053)	0.56	0.010 (0.030)	0.75
Physical inactivity									
No	2,270		81.5	0 (reference)		0 (reference)		0 (reference)	
Yes	514		18.5	−0.064 (0.052)	0.22	0.025 (0.042)	0.55	−0.028 (0.023)	0.23
Alcohol intake >210 g/week									
No	2,698		96.9	0 (reference)		0 (reference)		0 (reference)	
Yes	86		3.1	0.273 (0.116)	0.02	0.352 (0.093)	<0.0001	−0.046 (0.052)	0.38
Body mass index[b]	2,784	24.7 (4.0)		−0.008 (0.005)	0.11	0.012 (0.004)	0.004	−0.001 (0.002)	0.55
Hospital ward overcrowding score	2,784	1.8 (1.1)				0.123 (0.015)	<0.0001	0.014 (0.009)	0.11
Job demands score	2,784	3.6 (0.9)		0.191 (0.023)	<0.0001				
Job control score	2,784	3.8 (0.5)		0.067 (0.042)	0.11	0.012 (0.034)	0.73		

Abbreviations: SD, standard deviation; SE, standard error.
[a] Gynecology, obstetrics, pulmonary diseases, ophthalmology, otology, neurology, dermatology, venereology, oncology, intensive care, or physiatrics.
[b] Weight (kg)/height $(m)^2$.

''personal vulnerability to stress'' would compromise overcrowding as a strong instrument, because persons with such vulnerability are likely to overestimate rather than underestimate job demands. In the present study, however, ward overcrowding was a strong instrument for self-reported job demands.

In both instrumented and noninstrumented analyses, the association between job demands and psychiatric disorders remained after adjustment for a number of baseline characteristics, including factors related to lifestyle and the workplace. Self-reported job demands and objectively assessed ward overcrowding were associated with potential confounding factors in a different manner; therefore, convergent evidence from the instrumental and standard analyses increases the credibility of the interpretation that the findings were not confounded.

Table 2. Associations of Ward Overcrowding and Job Demands With Absence Due to a Psychiatric Diagnosis Among Female Nurses Aged 20–64 Years ($n = 2,784$) Working at 16 Finnish Hospitals, Based on Standard and Instrumental-Variables Probit Analyses, 2004–2005[a]

Type of Analysis and Predictor	Absence Due to Any Mental or Behavioral Disorder (102 Cases)				Absence Due to Depressive Disorder (33 Cases)			
	Model A[b]		Model B[c]		Model A[b]		Model B[c]	
	Probit Index	95% CI	Probit Index	95% CI	Probit Index	95% CI	Probit Index	95% CI
Probit regression analysis								
Hospital ward overcrowding (range, 1–4)	0.132	0.056, 0.209	0.146	0.065, 0.227	0.137	0.025, 0.249	0.132	0.014, 0.250
P for trend	0.001		<0.0001		0.02		0.03	
Job demand score (range, 1–5)	0.176	0.068, 0.285	0.222	0.106, 0.339	0.251	0.078, 0.424	0.289	0.100, 0.479
P for trend	0.001		<0.0001		0.004		0.003	
Instrumented probit regression analysis								
Job demand score (range, 1–5)	0.839	0.541, 1.137	0.979	0.706, 1.251	0.881	0.450, 1.31	0.955	0.481, 1.429
P for trend	<0.0001		<0.0001		<0.0001		<0.0001	

Abbreviation: CI, confidence interval.

[a] All data are regression coefficients unless otherwise stated.

[b] Results were adjusted for age.

[c] Results were adjusted for age, type and length of employment contract, hospital district, specialty, smoking, physical activity, alcohol intake, and body mass index.

Limitations

At least 2 limitations of this study are noteworthy. First, the results are informative in relation to job demands but not job control, which was not associated with the instrument. This result is plausible, since overcrowding is conceptually closer to job demands than to job control. Second, it is important to recognize that absence with a psychiatric diagnosis is not exactly the same thing as having a psychiatric disorder. Finnish nationwide registries can be used to identify persons with psychiatric absences but not to capture undiagnosed psychiatric disorders or conditions that do not lead to sick leave. We focused on long-term ($\geq$10 days) absences. Such absences are associated with increased risk of permanent work disability (22) and mortality (23) and, compared with short-term self-certified sick leaves, are less affected by issues such as voluntary absenteeism or unwillingness to state a potentially stigmatizing cause (psychiatric ill health) on official forms.

Conclusion

In sum, these analyses provide unique evidence to exclude reporting bias as an explanation for the observed association between self-reported job demands and risk of absence with a psychiatric diagnosis. However, given that this is apparently the first study of this kind, the findings should be interpreted with some caution. Further instrumental-variables studies across different employee groups, settings, and objective instruments are needed to examine whether the present findings are generalizable and robust.

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