Patient Overcrowding in Hospital Wards as a Predictor of Diagnosis-Specific Mental Disorders Among Staff: A 2-Year Prospective Cohort Study

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Objective: Hospital ward patient overcrowding has been hypothesized to increase psychiatric morbidity among staff, but it is unknown whether the association is specific to depressive disorders. This study examined whether patient overcrowding in hospital wards predicts diagnosis-specific mental disorders among staff.

Method: A 2-year prospective cohort study was conducted, in which the extent of hospital ward overcrowding was determined using routinely recorded patient bed occupancy rates between 2003 and 2004 and linked to sickness absence for 5,166 nurses and physicians in 203 somatic illness wards in 16 Finnish acute-care hospitals. Medically certified long-term (> 9 days) sickness absence spells in 2004 and 2005 with physician-determined diagnosis (based on *ICD-10* criteria) were obtained from the register of the Social Insurance Institution of Finland.

Results: Cox proportional hazard models for recurrent events adjusted for sex, age, occupation, type and length of employment contract, hospital district, and specialty showed that health professionals working in wards with a patient occupancy level 10 percentage units above the optimal during a 1-year period experienced twice the risk of sickness absence due to depressive disorders (HR = 1.95; 95% CI, 1.18–3.24) relative to colleagues working in wards with optimal or below-occupancy levels. No significant association was found for diagnoses of severe stress and adjustment disorders or other psychiatric disorders.

Conclusions: Chronic workload, as expressed by patient overcrowding in hospital wards, is associated with the onset of depressive disorders among staff.

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The extent to which long-term work overload contributes to the risk of mental disorders remains largely unclear: a perennial problem with existing studies is that workload is self-reported, so raising concerns regarding subjectivity bias. Recently, more objective measures have been called for, and it has been proposed that measuring overcrowding by patients in hospital wards may represent a new method to objectively quantify workload in relation to employee health.[1] Ward overcrowding and high patient-to-nurse ratio, another objective measure of work overload, have been found to be associated with a serious disadvantage for patients, such as increased hospital infections and mortality.[2–7] High patient-to-nurse ratio has also been associated with self-reports of staff burnout and job dissatisfaction,[5] while we showed in our recent study that ward overcrowding increased the risk of antidepressant use among staff.[1] Antidepressant use alone is an imprecise measure of depression, as antidepressants are also used to treat other conditions, such as anxiety disorders, chronic pain, and sleeping problems.[8] To date, no data have been available to determine the associations of hospital ward overcrowding with specific psychiatric diagnoses.

In the present study, we examined the association between patient overcrowding and diagnosis-specific[9] sickness absence among staff in Finnish hospitals. We used monthly bed occupancy records for each hospital ward during a 1-year period before follow-up and daily information on sickness absence records from the national reimbursement register for sickness absence during a 2-year follow-up period. We focused on diagnoses of depressive disorders and reactions to severe stress and adjustment disorders, as they may imply work stress as a potential etiologic factor. For comparison, we examined the association between hospital overcrowding and sickness absence due to other psychiatric diagnoses. To our knowledge, this is the first study to examine the relationship between an objective measure of hospital workload and records of sickness absence based on a physician diagnosis.

METHOD

Participants and Procedure

In Finland, specialized health care is provided by 21 hospital districts of which 5 participate in the ongoing Work and Health in Finnish Hospital Personnel study of which this study is a part.[1] The study is coordinated by the Finnish Institute of Occupational Health and approved by its ethics committee.

Routinely collected data on bed occupancy were available for 203 somatic illness wards in 5 city hospitals and 11 regional hospitals. The participating hospitals collect monthly figures of bed occupancy in each ward according to the procedure set by the National Institute for Health and Welfare. For the present study, the 1-year bed occupancy exposure for each employee was determined using these monthly records between January 2003 and December 2004, depending

on the timing of employee attendance. From the employers' registers, we identified all 5,168 registered nurses, licensed practical nurses, and physicians who had at least a 12-month job contract between January 1, 2003, and December 31, 2004. Two of them were on long-term sick leave during the whole exposure period. Thus, the final cohort consisted of 5,166 employees (4,803 women, 363 men).

Bed occupancy is calculated by dividing the sum of inpatient days with the number of beds available (ie, the number of beds × the number of days the ward is in use) and expressed as a percentage. Ward closure days are excluded from the denominator. The day of admission but not the day of discharge for each patient is included in the sum of inpatient days. The rate above which a hospital ward is overcrowded is less than 100% and is usually defined as > 85%,[1,4,10,11] and high occupancy rates have been associated with suboptimal employee[1] and patient outcomes[4] in previous studies.

Sickness Absence

We retrieved data on sickness absences and related diagnoses from the sickness 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 a sick leave based on a medical certificate after a waiting period of 9 days, in addition to the first day of illness, for a period of 1 year at the most. *International Classification of Diseases, Tenth Revision* (*ICD-10*)[9] diagnosis is assigned for each sick leave by the treating physician. The 2 major psychiatric disorder categories (*ICD-10* code) for sickness absence were chosen for the present analyses: depressive disorders (F32–F34; 134 events) and reaction to severe stress and adjustment disorders (F43; 170 events); other psychiatric disorders (45 events) were included, of which the most common diagnoses were F40–F48, excluding F43 (28 events). The sickness absence data for this study cover the dates of the beginning and ending of all reimbursed sickness absences between January 1, 2004, and December 31, 2005.

Covariates

From the employers' registers, we obtained information on the following covariates between January 1, 2003, and December 31, 2004: sex, age, occupation (registered nurse, licensed practical nurse, physician), the beginning and ending date of the employment contract, type of the contract (temporary vs permanent), hospital district, and specialty (internal medicine, surgery, other).[1]

Statistical Analysis

We constructed a measure to assess the overcrowding as the excess rate of bed occupancy. The optimal bed occupancy rate (≤ 85%) was coded as 0%, and all rates above 85%, ie, overcrowding, were calculated by subtracting 85 from the rate. These data were divided to exposure categories according to the mean of the monthly excess bed occupancy rates over the first 12 months between 2003 and 2004, during which the employee had at least a 1-year job contract and at least a 6-month job attendance. Changes of work unit were registered, that is, monthly exposure was determined according to the ward where the employee had the longest job contract.

In the present analyses, the follow-up period for each employee began on the first day the employee was present at work after the 12-month exposure period. The employees were censored on the date of the beginning of a long-term (> 6 months) exit from the studied wards if they died, if they reached the age of 63 years (official retirement age), or if the cutoff date of December 31, 2005 passed, whichever came first.

Cox proportional hazards regression for recurrent events[12] was used to estimate the risk of sickness absence. Taking this approach, the different time periods are analyzed separately and adjusted for the fact that the time periods within 1 employee are dependent. Correlation between observations was taken into account by calculating standard errors using the robust sandwich variance estimate. We used time to event approach[12] to define time at risk. In addition to the study entry, the time interval restarted each time the employee returned to work from sick leave, and the time the employee was on sick leave was excluded from time at risk.

Unadjusted and adjusted models were carried out, and the trend was tested by entering the categorical bed occupancy variable as a continuous variable into the models. Adjustments were made for sociodemographic factors (sex, age, occupation, type and length of employment contract) and for contextual factors (hospital district and ward's specialty). The results were quantified by hazard ratios (HRs) and their 95% confidence intervals (CIs). All statistical analyses were carried out using the SAS 9.1.3 program package (SAS Institute Inc, Cary, North Carolina).

RESULTS

The mean (SD) age of the sample was 41.2 (10.4) years, and the mean (SD) follow-up duration was 21.9 (3.8) months. Table 1 shows descriptive statistics of the employees at the beginning of the follow-up period. The sample largely comprised women (93%) and nurses (93%). One-third (n = 1,766) of participants were working in a ward with no excess bed occupancy, 42% (n = 2,177) in wards with an excess bed occupancy of 5 or less percentage units, 14% (n = 737) with an excess bed occupancy of more than 5 but no more than 10 percentage units, and 9% (n = 486) in wards with an excess bed occupancy of more than 10 percentage units. There was a somewhat higher proportion of men working in wards with no excess bed occupancy than there were in the higher occupancy wards. There was variation in rates of overcrowding between hospital districts, and excess bed occupancy was less common in surgical wards than in internal medicine or other specialties.

Table 2 shows the association between excess bed occupancy and subsequent sickness absence due to psychiatric diagnoses. Before and after adjustment for potential confounding factors, study participants in wards with a bed occupancy excess of > 10 percentage units were twice

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Table 1. Characteristics of the Employees at the Beginning of Follow-Up According to Hospital Ward Excess Bed Occupancy[a]

Characteristic	Total, N = 5,166	Excess Bed Occupancy: None, n = 1,766	≤ 5%, n = 2,177	> 5 ≤ 10%, n = 737	> 10%, n = 486
Sex					
Women	4,803 (93.0)	1,612 (91.3)	2,030 (93.3)	705 (95.7)	456 (93.8)
Men	363 (7.0)	154 (8.7)	147 (6.8)	32 (4.3)	30 (6.2)
Occupation					
Nurse	4,822 (93.3)	1,609 (91.1)	2,047 (94.0)	715 (97.0)	451 (92.8)
Physician	344 (6.7)	157 (8.9)	130 (6.0)	22 (3.0)	35 (7.2)
Employment contract					
Permanent	3,781 (73.2)	1,322 (74.9)	1,595 (73.3)	515 (69.9)	349 (71.8)
Temporary	1,385 (26.8)	444 (25.1)	582 (26.7)	222 (30.1)	137 (28.2)
Length of employment					
< 1 year	989 (19.1)	374 (21.2)	360 (16.5)	149 (20.2)	106 (21.8)
1–4 years	2,801 (54.2)	845 (47.9)	1,261 (57.9)	451 (61.2)	244 (50.2)
> 4 years	1,376 (26.6)	547 (31.0)	556 (25.5)	137 (18.6)	136 (28.0)
Hospital district					
No. 1	1,494 (28.9)	615 (34.8)	539 (24.8)	124 (16.8)	216 (44.4)
No. 2	229 (4.4)	50 (2.8)	107 (4.9)	58 (7.9)	14 (2.9)
No. 3	670 (13.0)	260 (14.7)	285 (13.1)	98 (13.3)	27 (5.6)
No. 4	1,484 (28.7)	551 (31.2)	678 (31.1)	135 (18.3)	120 (24.7)
No. 5	1,289 (25.0)	290 (16.4)	568 (26.1)	322 (43.7)	109 (22.4)
Specialty					
Surgery	1,356 (26.2)	450 (25.5)	667 (30.6)	195 (26.5)	44 (9.1)
Internal medicine	1,178 (22.8)	245 (13.9)	467 (21.5)	251 (34.1)	215 (44.2)
Other[b]	2,632 (50.9)	1,071 (60.7)	1,043 (47.9)	291 (39.5)	227 (46.7)

[a]Values are expressed as n (%). [b]Gynecology, obstetrics, pulmonary diseases, pediatrics, ophthalmology, otology, neurology, dermatology and venereology, oncology, intensive care, and physiatrics.

Table 2. Hazard Ratios With 95% CIs for the Association Between Excess Bed Occupancy and Future Sickness Absence Due to Mental Disorders

Bed Occupancy Rate	No. of Events	Unadjusted: Hazard Ratio	95% CI	*P* for Trend	Adjusted[a]: Hazard Ratio	95% CI	*P* for Trend
Depressive disorders				.020			.008
No excess occupancy[b]	41	1.0	1		1.0	1	
Excess occupancy ≤ 5%	46	0.94	0.62–1.44		0.99	0.65–1.50	
Excess occupancy > 5 ≤ 10%	24	1.32	0.82–2.11		1.44	0.90–2.30	
Excess occupancy > 10%	23	1.94	1.14–3.28		1.95	1.18–3.24	
Reaction to severe stress and adjustment disorders				.342			.156
No excess occupancy[b]	55	1.0	1		1.0	1	
Excess occupancy ≤ 5%	72	1.09	0.76–1.56		1.17	0.80–1.69	
Excess occupancy > 5 ≤ 10%	22	0.98	0.60–1.60		1.18	0.72–1.96	
Excess occupancy > 10%	21	1.39	0.85–2.26		1.45	0.87–2.42	
Other mental disorders				.750			.992
No excess occupancy[b]	12	1.0	1		1.0	1	
Excess occupancy ≤ 5%	25	1.66	0.84–3.27		1.67	0.84–3.31	
Excess occupancy > 5 ≤ 10%	6	1.17	0.45–3.06		1.23	0.45–3.42	
Excess occupancy > 10%	2	0.61	0.14–2.68		0.72	0.15–3.36	

[a]Adjusted for sex, age, occupation, type and length of employment contract, hospital district, and specialty. [b]Twelve-month mean bed occupancy of ≤ 85%.

as likely to experience sickness absence due to depressive disorders. The association followed a dose-response pattern for a continuous measure of bed occupancy rate showing statistically significant trend. No significant association was found for disability due to reaction to severe stress or adjustment disorders or for other mental disorders.

DISCUSSION

This prospective study of diagnosis-specific sickness absence among hospital employees showed that ward overcrowding, indicated by a long-lasting excess bed occupancy of over 10 percentage units, was associated with a doubling of subsequent depressive disorders, but was not significantly related to certified absence from other mental health diagnoses.

We assume that the observed effect of ward overcrowding on the mental health of employees reflects the adverse health effects of high chronic workload. For example, if an insufficient number of employees are available to cover patient peaks, overcrowding increases workload. Paradoxically, workload may increase even if agency staff are used because supervising the agency employees increases workload among regular staff.

Reasons why excess bed occupancy at the hospital ward was not as strongly related to the occurrence of events in another stress-related category of mental disorders examined—reactions to severe stress and adjustment disorders (F43)—remain unclear. However, all disorders in this category are characterized by the common feature of being clearly precipitated by an exceptional and identifiable single mental or physical stressor, such as a major negative life event, trauma, or violent victimization. The subdiagnoses in the F43 category are acute stress reaction, posttraumatic stress disorder, and adjustment disorders.[9] According to the definition, acute stress reaction is characterized by immediate onset of symptoms and relatively rapid diminution of symptoms after the stressor has been relieved, while the symptoms of posttraumatic stress disorder require duration of more than a month after the traumatic event. The third diagnosis in that category, adjustment disorders, refers to mental symptoms of relatively short duration that begin after a major life event or stressor. The most common triggers for adjustment disorders are death or serious illness of a close person, own serious illness or injury, divorce, economic difficulties, and other major changes in life. In the presence of the full diagnostic criteria for depression or anxiety disorders, the adjustment disorders are not diagnosed, even if some precipitating life event or a major stressor is identified.

Compared with acute reactions to severe stress and adjustment disorders, clinical depression seems to be a sign of chronic decompensation—a long-term inability to cope

with a stressor or recover.[9] In our study, the stressor, hospital ward overcrowding over a 1-year period, can be characterized as a persistent "milder" stressor rather than an acute or exceptionally strong one. Therefore, the association of ward overcrowding with depressive disorders rather than with acute reactions to severe stress or adjustment disorders is plausible and consistent with the chronic workload hypothesis.[13–15]

Our findings are also in agreement with a previous study of this cohort, showing that hospital ward patient overcrowding predicts elevated rates of prescribed antidepressant treatments among staff.[1] However, that study did not have diagnoses for prescriptions. An antidepressant prescription alone is an imprecise proxy measure of depression, as the drugs are often also used to treat other conditions, such as anxiety disorders, chronic pain, and sleeping problems,[8] and because those depressive disorders that are treated by psychotherapy or other nonpharmacologic treatments are not included as cases.

A specific strength of this study is that all data were standardized, based on routinely recorded monthly assessments of bed occupancy in each bed ward and daily records of sickness absence periods with physician-determined *ICD-10* diagnoses. Earlier studies have shown high job demands and time pressures to be predictive of poor mental health.[13–15] However, in most of the earlier studies on workload and mental health, measurements of both the exposure and outcome have been based upon self-reports. That is problematic, since they lack independence even in the prospective design; unmeasured subclinical depression or residual symptoms may affect individual reporting of workload. In this field of research, our study is unique in terms of using objective measurement of workload exposure. In addition, assessment of outcome was not based on self-reports.

Some limitations of our study should also be taken into consideration. Variables included in the study were selected on the basis of the availability of data in source registers. We were therefore not able to control for all possible risk factors for diseases. However, we had data on major sociodemographic factors and hospital-related contextual factors, such as specialty and geographical location. Since we found significant interinstitutional differences in occupancy rates, there could be other institutional differences, such as poor administration in overcrowded hospitals, that might have adverse effects on the mental health of staff. If overcrowding is a proxy factor for poor administration in general, there might be additional administration-related contributors to employee depression that were not captured in this study.

The sickness absence register of the Social Insurance Institution of Finland relies on absences granted by a physician, and it covers virtually all sick leaves of more than 9 days. We, therefore, were not able to examine the association between hospital ward overcrowding and sickness absence of duration of less than 10 days. We consider this as a minor limitation in relation to depression, since those absences are relatively long—3 months on average.[16] In our data, the mean (SD) length of depression-caused sickness absence was 55.4 (68.9; working) days, which corresponds to an average of 3 months. Furthermore, as our measure was sickness absence, we could not identify employees with unrecognized or untreated conditions or whose condition did not demand absence from work. Differences in treatment practices between physicians may affect the outcome of whether an employee is granted a long-term sick leave or not. However, such variability is likely to be random in relation to bed occupancy and is probably not a source of major bias in our results. Our cohort was from public sector hospitals, 93% female and 93% nurse, and rather homogeneous ethnically (mostly white employees), which, to some extent, limits the generalizability of our findings. With more men in our sample, the results might have shown diversity in response to overcrowding between men and women because mood and anxiety disorders are more common in women, whereas alcohol use disorders are more common in men.[17,18] However, the onset of depression among men seems to be more affected by work-related stress factors than that among women, and men have been shown to be more vulnerable to prolonged sickness absence due to occupational burnout.[19,20]

In conclusion, our study shows that patient overcrowding in hospital wards is associated with long-term work disability due to depressive disorders. We did not find an association between overcrowding and other psychiatric diagnoses examined, such as adjustment disorders and acute reactions to severe stress. Patient overcrowding at the hospital ward can be considered as an objective indicator of chronic work-related stress. Because previous research in this field has relied on either self-reported exposure variables or general nonspecific mental health outcomes that do not measure a specific diagnosed psychiatric disorder,[13] our study fills these methodological gaps by providing evidence on a workload exposure that does not rely on self-report and that contributes to the onset of depressive disorders. As depression is a serious problem worldwide in terms of human suffering, productivity, disability, and mortality,[21–27] our findings could have important implications for administrative policies in the health care sector.

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