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Do contact precautions cause depression? A two-year study at a tertiary care medical centre

H.R. Day^{a,*}, E.N. Perencevich^{b,c}, A.D. Harris^{a,d}, S.S. Himelhoch^a, C.H. Brown^a, A.L. Gruber-Baldini^a, E. Dotter^a, and D.J. Morgan^{a,d}

^aUniversity of Maryland School of Medicine, Baltimore, MD, USA

^bUniversity of Iowa Carver College of Medicine, Iowa City, IA, USA

^cIowa City VA Medical Center, Iowa City, IA, USA

^dVA Maryland Health Care System, Baltimore, MD, USA

SUMMARY

Contact precautions, used to reduce the transmission of infectious diseases, include the wearing of gowns and gloves for room entry. Previous small studies have shown an association between contact precautions and increased symptoms of depression and anxiety. A retrospective cohort of all patients admitted to a tertiary care centre over two years was studied to assess the relationship between contact precautions and depression or anxiety. During the two-year period, there were 70 275 admissions including 28 564 unique non-intensive-care-unit (ICU), non-psychiatric admissions. After adjusting for potential confounders, contact precautions were associated with depression [odds ratio (OR) 1.4, 95% confidence interval (CI) 1.2–1.5] but not with anxiety (OR 0.8, 95% CI 0.7–1.1) in the non-ICU population. Depression was 40% more prevalent among general inpatients on contact precautions.

Introduction

Healthcare-associated infections are an important cause of morbidity and mortality in hospital inpatients, and are a major focus for quality improvement.¹ Infections with multi-drug-resistant (MDR) bacteria are associated with increased length of stay, costs and mortality.² Contact precautions are recommended by the Centers for Disease Control and Prevention (CDC) to prevent the spread of MDR bacteria in the hospital setting, with approximately 20% of inpatients on contact precautions at any one time.^{3,4} Screening for methicillin-resistant *Staphylococcus aureus* (MRSA) is mandatory in several US states and the Veteran's Affairs Healthcare System, which will inevitably increase the number of such patients.^{5–7}

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*Corresponding author. Address: 685 W. Baltimore Street, MSTF 334, Baltimore, MD 21201, USA. hday@epi.umaryland.edu (H.R. Day).

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Although contact precautions are an important tool to block transmission of MDR bacteria in the hospital setting,⁸⁻¹⁰ they have been associated with negative outcomes including fewer doctor visits, more adverse events, and increased symptoms of depression and anxiety.^{4,11,12} Previous studies have demonstrated that hospital inpatients with depression are less likely to receive adequate care and follow treatment plans, and have increased comorbidities and higher mortality.^{13,14} Anxiety has also been associated with negative outcomes in hospitalized patients.^{15,16}

Previous studies have examined the severity of symptoms of depression and anxiety in patients on contact precautions, but have not examined the actual diagnoses of these conditions.⁴ These studies were small, with the largest study only including 42 patients on contact precautions.^{4,17,18} Despite limited data, the popular media has picked up on the controversy surrounding contact precautions, and has often presented the existing studies as definitive.^{19,20} National guidelines in the USA warn that depression and anxiety may result from the use of such measures.^{4,7,21}

A two-year retrospective cohort study of all patients admitted to a tertiary care centre was undertaken to examine the impact of contact precautions on a large population of general inpatients.

Methods

All adult patients over 18 years of age at admission, who were hospitalized for >24 h at the University of Maryland Medical Center (UMMC) between 1 February 2007 and 31 January 2009 were included. UMMC is a 662-bed tertiary care teaching hospital in Baltimore, USA. This study was approved by the institutional review board of the University of Maryland, Baltimore.

Data were obtained from the UMMC central data repository. This is a relational database containing patients' administrative, pharmacy and laboratory data, which is maintained by the University of Maryland Information Technology Group. These data have been used in previous epidemiological studies.²⁴⁻²⁶

The UMMC CDR uses the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) to record patients' diagnoses at the UMMC. ICD-9-CM is a set of codes based on the World Health Organization's International Classification of Diseases (ICD-9). These codes are developed by the National Center for Health Statistics, and Centers for Medicare and Medicaid Services. ICD-9-CM codes are used in the USA to code diagnoses and procedures in hospital. At UMMC, the first 15 ICD-9 codes given to a patient by trained coders, using information extracted from medical records, are kept in the administrative database.

At UMMC, targeted populations are actively screened for MRSA, vancomycin-resistant enterococci (VRE) and Gram-negative bacteria resistant to two or more classes of antibiotics excluding polymyxin or tigecycline.²¹ Patients are placed on contact precautions when they receive an electronic medical record indicator for the presence of (MDR) bacteria including MRSA, VRE and MDR Gram-negative bacteria.²¹ Local hospital guidelines require the patient to be in a private room when possible, but if no private room is available, patients can be cohorted with other patients infected or colonized with the same organism. In practice, it is not always possible for a patient to have a private room given the size of the hospital and the number of patients on contact precautions.

Depression was defined as the presence of any of the following ICD-9 codes: 296.2x (major depressive disorder single episode), 296.3x (major depressive disorder recurrent episode),

300.4x (dysthymic disorder), 309.0x (adjustment disorder with depressed mood), 309.1x (prolonged depressive reaction), 311.xx (depressive disorder not elsewhere classified) or 301.12 (chronic depressive disorder). Anxiety was defined as the presence of any of the following ICD-9 codes: 300.00 (anxiety state unspecified), 300.01 (panic disorder), 300.02 (generalized anxiety disorder) and 300.09 (other anxiety state). These ICD-9 codes have been validated previously to identify depression and anxiety.^{27,28}

Placement of patients under contact precautions and the primary outcomes associated with this were validated by chart review. The electronic indicator for contact precautions was validated as 96% accurate compared with paper records (77/80). Diagnosis of depression or anxiety by electronic records was validated as 100% (72/72) compared with paper records.

Other variables analysed were patient age, gender, length of stay and comorbidities. ICD-9 codes were used to identify comorbid diagnoses including acquired immunodeficiency syndrome, chronic obstructive pulmonary disease, diabetes, heart failure, paralysis, malignancy, metastatic tumour, cerebrovascular disease, mild and severe liver disease, myocardial infarction, renal disease, rheumatological disease and peripheral vascular disease.

Associations between contact precautions and ICD-9 coded diagnoses of both depression and anxiety were assessed. After completing univariate descriptive analyses, bivariate analyses were performed using Chi-squared test for categorical variables and Student's *t*-test. The authors decided *a priori* to stratify by admission to the ICU due to coding differences in severely ill patients.^{22,23}

Logistic regression was used to estimate odds ratios (ORs) and 95% confidence intervals (CIs), adjusting for confounding variables. Age and length of stay were included in the model because of their possible relationship with carriage of organisms that warranted implementation of contact precautions,²⁹⁻³¹ and gender was included for its relationship with depression and anxiety.^{32,33} For length of stay, a cutoff of 3.5 days, representing the median length of stay in the hospital over these two years, was used to classify patients who had a prolonged hospital stay. All variables significantly associated with contact precautions in the bivariate analyses were added to the model according to size of effect to control for confounding. Variables were left in the model if they were significantly associated with the outcome ($P > 0.05$), or they altered the regression coefficient of the primary exposure variable by more than 10%. Analyses were performed using SAS Version 9.2 (SAS Institute Inc., Cary, NY, USA).

Results

In total, there were 70 275 hospital admissions during the study period, of which 36 112 admissions of ≥ 24 h were included in the final analysis (Figure 1). Patients admitted to a psychiatric service or with a diagnosis of schizophrenia or bipolar disorder were excluded from the study, as a diagnosis of depression or anxiety was likely to be related to the underlying psychiatric condition.

Of the 70 275 admissions, 18.0% (12 679/70 275) were on contact precautions. Among the non-ICU population ($N=28\,564$), 3138 patients (10.9%) were on contact precautions, as were 22.4% (1694/7548) of the ICU population.

Table I shows the demographic characteristics of the study population. Unadjusted analyses showed that non-ICU patients on contact precautions were 40% more likely to be diagnosed with depression than those not on contact precautions (OR 1.4, 95% CI 1.2–1.5). No association was found between contact precautions and anxiety. After adjusting for

confounding variables, contact precautions were associated with depression (OR 1.4, 95% CI 1.2–1.6) but not with anxiety for non-ICU patients. No relationship was found between contact precautions and depression or anxiety in the ICU population (Table II).

Discussion

Over two years at a tertiary care centre, a significant association was observed between contact precautions and depression in patients outside of the ICU setting. Overall, contact precautions were associated with a 40% greater likelihood of being diagnosed with depression in general hospital inpatients. Contact precautions were not associated with a diagnosis of anxiety in non-ICU patients. No relationship was found between contact precautions and depression or anxiety in ICU patients.

Previous research on the psychological impact of contact precautions has focused on the symptoms of depression or anxiety, and not the diagnoses. This study is the largest to examine the relationship between infection control isolation practices and psychiatric outcomes, and the first to use actual diagnoses of depression and anxiety. The current study lends support to previous small-scale and qualitative studies reporting higher levels of depression in patients on contact precautions, and expands upon the findings that contact precautions are associated with symptoms of depression and anxiety to show that contact precautions are associated with diagnoses of depression after adjusting for confounding variables.

As it was not possible to determine the exact time when depression began, it was not possible to determine if contact precautions identify a group of patients at higher risk of depression, or if contact precautions actually cause more depression. It is known that patients on contact precautions generally have more healthcare exposure and comorbid illnesses; factors also associated with increased depression.³⁸ However, after adjusting for relevant comorbidities, depression was still strongly associated with contact precautions. Depression is a chronic condition that requires two weeks of symptoms to diagnose, so most patients identified were probably admitted to the hospital with depression. It may be that depression gives rise to greater requirement for contact precautions; people with depression are known to use healthcare resources more frequently, which is a risk factor for the acquisition of MDR bacteria that lead to contact precautions. ICD-9 codes are given on hospital discharge and relate to any diagnoses during the hospital stay. They cannot be used to distinguish between incident and prevalent depression.

Anxiety was not associated with contact precautions in this study. No other studies have examined diagnoses of anxiety, but rather symptoms, in relation to contact precautions.^{35,36} A possible explanation for the lack of association in this study is that symptoms of anxiety are more prevalent than diagnosed anxiety disorders.³⁹ In addition, anxiety disorders may have been under-coded, as anxiety was only present in 3.5% of the hospital population which is slightly less than that usually reported in the general population (4%).⁴⁰ Hospital ICD-9 coding of anxiety is known to be insensitive.^{41–43} Overall, this study suggests that contact precautions do not appear to be related to diagnosis of an anxiety disorder.

In contrast to general hospitalized patients, no association was found between contact precautions and an ICD-9 diagnosis of depression or anxiety in patients admitted to the ICU. This may be, in part, due to under-coding of depression in the ICU, where more immediate life-threatening conditions take priority as a limited number of possible billing codes can be listed.²³ It is also more difficult to evaluate depression or anxiety in more severely ill and often unresponsive patients.

This study has several limitations. Administrative data were used to define depression and anxiety. Depression is an under-diagnosed and potentially under-coded condition in hospital inpatients.⁴⁴ In this study, 9.7% of the population received antidepressants, of whom 59.9% did not have a diagnosis of depression. Performing analyses using an outcome of ICD-9 code or antidepressant use did not change the strength of association between contact precautions and depression in general inpatients (data not presented).

This is the first study to show more frequent diagnoses of depression in patients on contact precautions. This is a study of association, so further work is needed to establish if contact precautions lead to depression or if depression leads to increased requirement for contact precautions. Future work should also examine whether increased duration of contact precautions is associated with increased prevalence of depression, or if symptoms such as mood disturbance, low self-esteem or lack of perceived control affect depression or anxiety in patients on contact precautions. Individual hospitals are encouraged to review the potential unintended consequences of contact precautions as they consider the adoption of programmes that will dramatically increase the use of contact precautions, such as active surveillance culturing for MRSA or other organisms.^{45,46}

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References

1. Klevens RM, Morrison MA, Nadle J, et al. Invasive methicillin-resistant *Staphylococcus aureus* infections in the United States. *JAMA*. 2007; 298:1763–1771. [PubMed: 17940231]
2. Siegel JD, Rhinehart E, Jackson M, Chiarello L. Healthcare Infection Control Practices Advisory Committee. Management of multidrug-resistant organisms in healthcare settings 2006. 2010
3. Muto CA, Jernigan JA, Ostrowsky BE, et al. SHEA guideline for preventing nosocomial transmission of multidrug-resistant strains of *Staphylococcus aureus* and enterococcus. *Infect Control Hosp Epidemiol*. 2003; 24:362–386. [PubMed: 12785411]
4. Morgan DJ, Diekema DJ, Sepkowitz K, Perencevich EN. Adverse outcomes associated with contact precautions: a review of the literature. *Am J Infect Control*. 2009; 37:85–93. [PubMed: 19249637]
5. Illinois General Assembly Bill HB0378
6. Kussman MJ. VHA directive 2007-002.
7. Weber SG, Huang SS, Oriola S, et al. Legislative mandates for use of active surveillance cultures to screen for methicillin-resistant *Staphylococcus aureus* and vancomycin-resistant enterococci: position statement from the Joint SHEA and APIC Task Force. *Am J Infect Control*. 2007; 35:73–85. [PubMed: 17327185]
8. Cepeda JA, Whitehouse T, Cooper B, et al. Isolation of patients in single rooms or cohorts to reduce spread of MRSA in intensive-care units: prospective two-centre study. *Lancet*. 2005; 365:295–304. [PubMed: 15664224]
9. Boyce J, Opal S, Chow J, et al. Outbreak of multidrug-resistant *Enterococcus faecium* with transferable vanB class vancomycin resistance. *J Clin Microbiol*. 1994; 32:1148. [PubMed: 8051238]
10. Morgan DJ, Liang SY, Smith CL, et al. Frequent multidrug-resistant *Acinetobacter baumannii* contamination of gloves, gowns, and hands of healthcare workers. *Infect Control Hosp Epidemiol*. 2010; 31:716–721. [PubMed: 20486855]
11. Saint S, Higgins LA, Nallamotheu BK, Chenoweth C. Do physicians examine patients in contact isolation less frequently? A brief report. *Am J Infect Control*. 2003; 31:354–356. [PubMed: 14608302]

12. Stelfox HT, Bates DW, Redelmeier DA. Safety of patients isolated for infection control. *JAMA*. 2003; 290:1899–1905. [PubMed: 14532319]
13. DiMatteo MR, Lepper HS, Croghan TW. Depression is a risk factor for noncompliance with medical treatment: meta-analysis of the effects of anxiety and depression on patient adherence. *Arch Intern Med*. 2000; 160:2101. [PubMed: 10904452]
14. Wells KB, Stewart A, Hays RD, et al. The functioning and well-being of depressed patients. Results from the Medical Outcomes Study. *JAMA*. 1989; 262:914–919. [PubMed: 2754791]
15. Roest AM, Martens EJ, Denollet J, de Jonge P. Prognostic association of anxiety post myocardial infarction with mortality and new cardiac events: a meta-analysis. *Psychosom Med*. 2010; 72:563. [PubMed: 20410247]
16. Turner A, Phillips L, Hambridge JA, Baker AL, Bowman J, Colyvas K. Clinical outcomes associated with depression, anxiety and social support among cardiac rehabilitation attendees. *Aust N Z J Psychiatry*. 2010; 44:658–666. [PubMed: 20560853]
17. Wassenberg M, Severs D, Bonten M. Psychological impact of short-term isolation measures in hospitalised patients. *J Hosp Infect*. 2010; 75:124–127. [PubMed: 20381912]
18. Day HR, Morgan DJ, Himelhoch S, Young A, Perencevich EN. Association between depression and contact precautions in veterans at hospital admission. *Am J Infect Control*. in press.
19. Zuger A. Isolation, an ancient and lonely practice, endures. *The New York Times*. 2010
20. Chen PW. Losing touch with the patient. *The New York Times*. Oct 21.2010
21. Siegel JD, Rhinehart E, Jackson M, Chiarello L. Health Care Infection Control Practices Advisory Committee. 2007 Guideline for isolation precautions: preventing transmission of infectious agents in health care settings. *Am J Infect Control*. 2007; 35(Suppl. 2):S65–S164. [PubMed: 18068815]
22. Gedeberg R, Furebring M, Michaëlsson K. Diagnosis-dependent misclassification of infections using administrative data variably affected incidence and mortality estimates in ICU patients. *J Clin Epidemiol*. 2007; 60:155. [PubMed: 17208121]
23. Campbell SE, Campbell MK, Grimshaw JM, Walker AE. A systematic review of discharge coding accuracy. *J Public Health*. 2001; 23:205.
24. McGregor JC, Kim PW, Perencevich EN, et al. Utility of the Chronic Disease Score and Charlson Comorbidity Index as comorbidity measures for use in epidemiologic studies of antibiotic-resistant organisms. *Am J Epidemiol*. 2005; 161:483–493. [PubMed: 15718484]
25. Furuno JP, Perencevich EN, Johnson JA, et al. Methicillin-resistant *Staphylococcus aureus* and vancomycin-resistant enterococci co-colonization. *Emerg Infect Dis*. 2005; 11:1539–1544. [PubMed: 16318693]
26. Schweizer ML, Furuno JP, Harris AD, et al. Empiric antibiotic therapy for *Staphylococcus aureus* bacteremia may not reduce in-hospital mortality: a retrospective cohort study. *PloS One*. 2010; 5:e11432. [PubMed: 20625395]
27. Thompson D, Hylan TR, McMullen W, Romeis ME, Buesching D, Oster G. Predictors of a medical-offset effect among patients receiving antidepressant therapy. *Am J Psychiatry*. 1998; 155:824. [PubMed: 9619157]
28. Zhang AY, Cooper GS. Recognition of depression and anxiety among elderly colorectal cancer patients. *Nurs Res Pract*. 2010; 11:55/2010/693961
29. Thompson RL, Cabezudo I, Wenzel RP. Epidemiology of nosocomial infections caused by methicillin-resistant *Staphylococcus aureus*. *Ann Intern Med*. 1982; 97:309. [PubMed: 7114627]
30. Garbutt JM, Littenberg B, Evanoff BA, Sahm D, Mundy LM. Enteric carriage of vancomycin-resistant *Enterococcus faecium* in patients tested for *Clostridium difficile*. *Infect Control Hosp Epidemiol*. 1999; 20:664–670. [PubMed: 10530643]
31. Tornieporth NG, Roberts RB, John J, Hafner A, Riley LW. Risk factors associated with vancomycin-resistant *Enterococcus faecium* infection or colonization in 145 matched case patients and control patients. *Clin Infect Dis*. 1996; 23:767–772. [PubMed: 8909842]
32. Magni G, De-Leo D, Schifano F. Depression in geriatric and adult medical inpatients. *J Clin Psychol*. 1985; 41:337–344. [PubMed: 3998156]
33. Caumo W, Schmidt A, Schneider C, et al. Risk factors for preoperative anxiety in adults. *Acta Anaesthesiol Scand*. 2001; 45:298–307. [PubMed: 11207465]

34. Catalano G, Houston SH, Catalano MC, et al. Anxiety and depression in hospitalized patients in resistant organism isolation. *South Med J*. 2003; 96:141–145. [PubMed: 12630637]
35. Gammon J. Analysis of the stressful effects of hospitalisation and source isolation on coping and psychological constructs. *Int J Nurs Pract*. 1998; 4:84–96. [PubMed: 9748937]
36. Tarzi S, Kennedy P, Stone S, Evans M. Methicillin-resistant *Staphylococcus aureus*: psychological impact of hospitalization and isolation in an older adult population. *J Hosp Infect*. 2001; 49:250–254. [PubMed: 11740872]
37. Kennedy P, Hamilton LR. Psychological impact of the management of methicillin-resistant *Staphylococcus aureus* (MRSA) in patients with spinal cord injury. *Spinal Cord*. 1997; 35:617–619. [PubMed: 9300970]
38. Centers for Disease Control and Prevention (CDC). Current depression among adults – United States, 2006 and 2008. *MMWR Morb Mortal Wkly Rep*. 2010; 59:1229–1235. [PubMed: 20881934]
39. Olsson M, Shea S, Feder A, et al. Prevalence of anxiety, depression, and substance use disorders in an urban general medicine practice. *Arch Fam Med*. 2000; 9:876–883. [PubMed: 11031395]
40. Maguire GP, Julier DL, Hawton KE, Bancroft JH. Psychiatric morbidity and referral on two general medical wards. *BMJ*. 1974; 1:268–270. [PubMed: 4818184]
41. West SL, Richter A, Melfi CA, McNutt M, Nennstiel ME, Mauskopf JA. Assessing the Saskatchewan database for outcomes research studies of depression and its treatment. *J Clin Epidemiol*. 2000; 53:823–831. [PubMed: 10942865]
42. Holland JC. Anxiety and cancer: the patient and the family. *J Clin Psychiatry*. 1989; 50(Suppl):20–25. [PubMed: 2681170]
43. Rincon HG, Granados M, Unutzer J, et al. Prevalence, detection and treatment of anxiety, depression, and delirium in the adult critical care unit. *Psychosomatics*. 2001; 42:391–396. [PubMed: 11739905]
44. Liu CF, Campbell DG, Chaney EF, Li YF, McDonnell M, Fihn SD. Depression diagnosis and antidepressant treatment among depressed VA primary care patients. *Adm Policy Ment Health Ment Health Serv Res*. 2006; 33:331–341.
45. Harbarth S, Fankhauser C, Schrenzel J, et al. Universal screening for methicillin-resistant *Staphylococcus aureus* at hospital admission and nosocomial infection in surgical patients. *JAMA*. 2008; 299:1149–1157. [PubMed: 18334690]
46. Robicsek A, Beaumont JL, Paule SM, et al. Universal surveillance for methicillin-resistant *Staphylococcus aureus* in 3 affiliated hospitals. *Ann Intern Med*. 2008; 148:409–418. [PubMed: 18347349]

Figure 1.
Process through which patients were selected for study inclusion. ICU, intensive care unit.

Study population of general medical and surgical inpatients on their first admission, comparing patients on contact precautions (CP) with those not on CP

Table 1

	General hospital			Intensive care unit		
	Patients on CP N=3138	Patients not on CP N=25 426	P-value	Patients on CP N=1694	Patients not on CP N=5854	P-value
Age (years), mean (standard deviation)	51.2 (17.5)	49.6 (19.0)	<0.01	54.9 (17.5)	56.0 (17.7)	0.03
Male (N=13 624), % (N)	58.9% (1848)	46.3% (11 776)	<0.01	61.0% (1032)	59.7% (3494)	ns
Length of stay (days), median (IQR)	7.1 (3.4–18.1)	3.2 (2.0–6.0)	<0.01*	14.8 (7.4–28.8)	7.0 (3.9–12.5)	<0.01
Comorbidities, % (N)						
AIDS (N=604)	6.2% (194)	1.6 (410)	<0.01	4.1% (70)	0.9% (53)	<0.01
COPD (N=4525)	18.0% (565)	15.6% (3960)	<0.01	19.1% (324)	15.6% (911)	<0.01
Diabetes (N=4639)	22.1% (693)	15.5% (3946)	<0.01	17.1% (290)	18.9% (1107)	ns
Complications of diabetes (N=726)	5.3% (165)	2.2% (561)	<0.01	3.5% (59)	2.0% (118)	<0.01
Cerebrovascular disease (N=2128)	9.2% (289)	7.2% (1839)	<0.01	11.4% (193)	17.1% (1001)	<0.01
Heart failure (N=1762)	9.8% (308)	5.5% (1394)	<0.01	16.5% (279)	15.5% (907)	ns
Hemi-/paraplegia (N=552)	5.4% (169)	1.5% (383)	<0.01	3.5% (60)	3.2% (189)	ns
Malignancy (N=2414)	9.7% (304)	8.3% (2110)	<0.01	9.7% (165)	9.5% (558)	ns
Metastatic tumour (N=825)	2.3% (72)	3.0% (753)	0.03	3.4% (57)	3.5% (204)	ns
Mild liver disease (N=412)	3.0% (93)	1.3% (319)	<0.01	4.8% (82)	2.2% (129)	<0.01
Myocardial infarction (N=1301)	4.6% (144)	4.6% (1157)	ns	11.3% (192)	18.5% (1082)	<0.01
Peptic ulcer disease (N=306)	1.5% (46)	1.0 (260)	0.02	1.9% (32)	1.5% (90)	ns
Peripheral vascular disease (N=856)	4.3% (136)	2.8% (720)	<0.01	5.6% (95)	7.2% (423)	0.02
Renal disease (N=2309)	16.3% (510)	7.1% (1799)	<0.01	18.0% (305)	10.4% (609)	<0.01
Rheumatological disease (N=540)	1.7% (54)	1.9% (486)	ns	1.8% (31)	1.8% (107)	ns
Severe liver disease (N=229)	1.4% (45)	0.7% (184)	<0.01	5.3% (89)	2.2% (127)	<0.01
Dementia (N=684)	3.7% (115)	2.2% (569)	<0.01	2.4% (41)	1.6% (94)	0.03
Antidepressant medications (N=2761), % (N)	12.8% (402)	9.3% (2359)	<0.01	17.5% (297)	12.4% (725)	<0.01
Death in hospital (N=91), % (N)	1.2% (37)	0.2% (54)	<0.01	19.7% (333)	9.85 (573)	<0.01

AIDS, acquired immunodeficiency syndrome; COPD, chronic obstructive pulmonary disease; IQR, interquartile range; ns, not significant.

Antidepressants included selective serotonin re-uptake inhibitors, tricyclic antidepressants and miscellaneous antidepressants (bupropion, trazodone, nefazodone, mirtazapine and venlafaxine).

* Wilcoxon rank sum test.

Table II

Impact of contact precautions on depression and anxiety by ICD-9 diagnostic codes after adjusting for confounding variables using logistic regression analysis

	General hospital				Intensive care unit			
	Depression (adjusted OR, 95% CI)	P-value	Anxiety (adjusted OR, 95% CI)	P-value	Depression (adjusted OR, 95% CI)	P-value	Anxiety (adjusted OR, 95% CI)	P-value
Contact precautions (univariate analysis)	1.4 (1.2–1.5)	<0.01	0.8 (0.6–1.0)	0.05	0.8 (0.6–1.1)	0.18	0.6 (0.4–1.0)	0.05
Contact precautions (multivariate analysis)	1.4 (1.2–1.6)	<0.01	0.9 (0.7–1.1)	0.35	0.9 (0.7–1.2)	0.44	0.73 (0.4–1.1)	0.10
Age >50 years	1.3 (1.2–1.4)	<0.01	1.5 (1.3–1.7)	<0.01	0.8 (0.7–1.1)	0.13	0.7 (0.5–1.0)	0.05
Female	1.7 (1.6–1.8)	<0.01	1.7 (1.5–1.9)	<0.01	1.7 (1.4–2.1)	<0.01	2.3 (1.6–3.1)	<0.01
LOS >3.5 days	1.3 (1.2–1.4)	<0.01	1.0 (0.9–1.2)	0.65	0.8 (0.6–1.0)	0.02	0.8 (0.5–1.1)	0.16
AIDS	1.6 (1.2–2.1)	<0.01				0.01		
Renal disease	0.7 (0.6–0.8)	<0.01	0.7 (0.5–0.9)	<0.01	0.6 (0.4–0.9)	0.01		
Hemi-/paraplegia	1.4 (1.1–1.8)	<0.01	0.5 (0.3–1.1)	<0.01				
COPD	1.2 (1.1–1.4)	<0.01			1.5 (1.1–1.9)	<0.01		
Any malignancy	0.8 (0.7–0.9)	<0.01						
Diabetes			0.8 (0.6–0.9)	<0.01				
Cerebrovascular			0.5 (0.4–0.7)	<0.01				
Acute myocardial infarction							1.5 (1.0–2.2)	0.05

LOS, length of stay; AIDS, acquired immunodeficiency syndrome; COPD, chronic obstructive pulmonary disease; OR, odds ratio; CI, confidence interval.

Use of the Charlson Comorbidity Score or addition of other comorbidities did not change the strength of the relationship between contact precautions and depression or anxiety in the non-intensive care unit or intensive care unit population.