General Hospital Psychiatry 39 (2016) 80–85

Contents lists available at ScienceDirect

General Hospital Psychiatry

journal homepage: http://www.ghpjournal.com

Current depressive symptoms but not history of depression predict hospital readmission or death after discharge from medical wards: a multisite prospective cohort study☆,☆☆,★

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ARTICLE INFO

Article history:
Received 18 August 2015
Revised 15 November 2015
Accepted 9 December 2015

Keywords:
Inpatients
Depression
Patient readmission
Interviews
Mortality

ABSTRACT

Objective: Although death or readmission shortly after hospital discharge is frequent, identifying inpatients at higher risk is difficult. We evaluated whether in-hospital depressive symptoms (hereafter "depression") are associated with short-term readmission or mortality after discharge from medical wards.
Methods: Depression was assessed at discharge in a prospective inpatient cohort from 2 Canadian hospitals (7 medical wards) and defined as scores ≥11 on the 27-point Patient Health Questionnaire (PHQ-9). Primary outcome was all-cause readmission or mortality 90 days postdischarge.
Results: Of 495 medical patients [median age 64 years, 51% women, top 3 admitting diagnoses heart failure (10%), pneumonia (10%) and chronic obstructive pulmonary disease (8%)], 127 (26%) screened positive for depression at discharge. Compared with nondepressed patients, those with depression were more frequently readmitted or died: 27/127 (21%) vs. 58/368 (16%) within 30 days and 46 (36%) vs. 91 (25%) within 90 days [adjusted odds ratio (aOR) 2.00, 95% confidence interval 1.25–3.17, $P=.004$, adjusted for age, sex and readmission/death prediction scores]. History of depression did not predict 90-day events (aOR 1.05, 95% CI 0.64–1.72, $P=.84$). Depression persisted in 40% of patients at 30 days and 17% at 90 days.
Conclusions: Depression was common, underrecognized and often persisted postdischarge. Current symptoms of depression, but not history, identified greater risk of short-term events independent of current risk prediction rules.

1. Introduction

Short-term readmissions or early deaths after hospital discharge are common and costly and are therefore receiving increased attention. Between 10% and 40% of patients discharged from hospital are readmitted within 30 days [1–3], accounting for at least 11% of total hospitalization costs [4]. Medical patients account for over two thirds of all 30-day readmissions and their readmissions are longer and more expensive compared to non-medical readmissions [4]. Thus, General Internal Medicine (GIM) wards are often the target for interventions to reduce readmission rates [4].

While many interventions have been tried to improve discharge transitions and reduce adverse events after medical hospitalization, their effects have been inconsistent and surprisingly few interventions have improved patient outcomes [5–7]. Risk stratification may increase the effectiveness of postdischarge interventions by targeting those at highest risk. Of 46 interventions to reduce 30-day readmissions, the only effective isolated intervention observed had targeted a high-risk subgroup [5]. However, current models of risk prediction are less than perfect and it is important to determine if there are other as yet unidentified or novel risk factors [8,9].

Depression may represent an underrecognized and potentially modifiable independent risk factor for unexpected readmission or early death. Depression is often poorly detected and undertreated in acute care settings [10,11], is common in adults with chronic disease and has been associated with worse long-term clinical outcomes [12–15]. Clinical symptoms of depression may range from dysthymia (mild

☆ Conflicts of Interest: None.
☆☆ Funding and Support: Salary support for JP was provided by a CRIO grant from Alberta Innovates — Health Solutions. FAM, JAJ and SRM are supported by salary awards from Alberta Innovates — Health Solutions; FAM holds the University of Alberta/Capital Health Chair in Cardiovascular Outcomes Research; SRM holds the University of Alberta Endowed Chair in Patient Health Management.
★ Role of the Funder: The funding sources had no role in the design or conduct of the study; management, analysis and interpretation of the data; preparation, review or approval of the manuscript; and decision to submit the manuscript for publication.
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http://dx.doi.org/10.1016/j.genhosppsych.2015.12.001
0163-8343/

persistent symptoms) to major depressive disorders and can be accurately and rapidly assessed by well-validated screening questionnaires, such as the Patient Health Questionnaire (PHQ-9) [16,17]. However, the prognostic value of the PHQ-9 for posthospital outcomes is rarely assessed despite evidence among depressed cardiac patients supporting a 9% increased risk of readmission with each additional point [18]. Further, although approximately 30–40% of hospitalized adults report some form of depression [11,19], relatively few readmission risk prediction models include depression. Of 26 models to predict risk of hospital readmission [9], only 5 [20–24] specified a history of depression (based on claims data or chart review) and none captured depressive symptomatology at the time of discharge.

Therefore, we studied whether the presence of moderate-to-severe depressive symptoms (hereafter, for brevity, referred to as "depression") at the time of discharge independently predict all-cause readmissions or early mortality after discharge in a representative cohort of internal medicine patients.

2. Methods

2.1. Setting and subjects

This study was conducted at two tertiary-care teaching facilities in Edmonton, Alberta, Canada (University of Alberta and Royal Alexandra hospitals). As discussed in full elsewhere [25], we enrolled adult Albertans hospitalized on 7 GIM wards who were being discharged back to the community between October 2013 and November 2014. The Health Research Ethics Board at the University of Alberta approved all study procedures (project ID Pro00036880) and all patients provided written informed consent.

We excluded individuals with severe cognitive impairment (≥5 errors on the Short Portable Mental Status Questionnaire) [26], communication barriers (e.g., non-English speaking or aphasia) or foreshortened life expectancy precluding 90-day follow-up [25]. Trained research assistants administered all baseline questionnaires and functional tests at the bedside within 48 h prior to discharge. Different research personnel (blinded to baseline assessments and with independent adjudication of events by medical experts) contacted patients at 30 days and 90 days postdischarge to collect outcomes data verified using provincial electronic medical records.

2.2. Independent variable of interest (depression)

Depressive symptoms were assessed prior to discharge using the previously validated 27-point PHQ-9 [16]. The PHQ-9 is a self-report measure based on the 9 diagnostic criteria for major depression in the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition*. For our main analysis, we used a cutoff score of 11 or greater, which has been shown to optimize accuracy in the hospital setting (89% sensitivity and 89% specificity) for detection of depression [17,27]. Of note, hospital attending staff were informed if PHQ-9 scores ≥14 or patients reported suicidal ideation. We repeated the PHQ-9 in all patients 30 days and 90 days after discharge and examined other cutpoints for defining depression in sensitivity analyses.

2.3. Outcomes

The primary outcome was all-cause readmission or mortality within 90 days after discharge from the index hospitalization, which accounts for competing risks during follow-up and can be adjusted for using the LACE Index.

2.4. Data collection and measurements

We collected a wide range of sociodemographic and clinical factors at baseline. LACE Index scores were calculated for each patient and range from 1 to 19. This is a validated scoring system commonly used to risk adjust the rate of a 30-day readmission or death that includes length of hospital stay (L), acuity on index admission (A), Charlson Comorbidity Index (C) and number of emergency department visits during the 6 months prior to admission (E). The LACE Index has been previously validated in both Canada and the US, in both general medical patients and populations with specific discharge diagnoses (e.g., heart failure), and it has reasonable accuracy with a c-statistic of about 0.7 [2,8,28].

2.5. Statistical analyses

First, we compared patient characteristics and outcomes according to baseline depression status. We then sequentially fit multiple logistic regression models to predict the likelihood of readmission or mortality at 30 days and 90 days in patients with depression (PHQ-9≥11) compared to those without depression. Models were built "by hand" and potential confounders (based on literature review, clinical judgment, bivariate P values <0.1 or greater than 10% changes in beta coefficients when included in models) were evaluated. The final parsimonious model adjusted for age, sex and the LACE Index. We undertook a series of sensitivity analyses to consider other recommended PHQ-9 cutpoints [16,29] and to see if a history of depression (as identified by attending staff in the medical chart) could substitute for directly measured depressive symptoms. We also assessed effect modification by exploring the association between depression and postdischarge outcomes in tertiles of LACE scores (1–9, 10–12 and 13–19). All analyses were done in STATA 13 (StataCorp LP, College Station, TX, USA, 2013).

3. Results

3.1. Participants

Primary outcome data were collected for all 495 patients in our cohort at 30 days and 97% of these patients were accounted for at 90 days (Fig. 1). Overall, the median age was 64 years [interquartile range (IQR) 51–78] and 51% were women; 115 (23%) had depression documented by the attending medical team in their chart (Table 1). The most common reasons for admission were heart failure (10%), pneumonia (10%), chronic obstructive pulmonary disease (COPD) (8%), urinary tract infection (5%) and acute diabetic complications (5%). The median Charlson Index score was 2 (IQR 1–4) and the median length of stay in hospital was 5 days (IQR 4–9).

3.2. Prevalence and correlates of depression

The PHQ-9 identified 127 (26%) patients with scores ≥11 and, of those, only 58 (46%) had depression noted in their charts. On the other hand, 57 (50%) of those with depression recorded in their charts had PHQ-9 scores <11. In general, depressed and nondepressed patients were fairly comparable, although depressed patients were significantly younger, had higher anxiety scores and more problems with self-care and reported lower rates of medication adherence (Table 1).

3.3. Readmission or mortality according to depression

Overall, 85 (17%) patients were readmitted or died within 30 days and 137 (28%) patients were readmitted or died within 90 days of discharge from hospital (Fig. 2). Depressed patients were readmitted or died more frequently than nondepressed patients: 46 (36%) vs. 91 (25%) within 90 days after discharge (P=.01) (Fig. 2). In multivariable analysis adjusted for age, sex and LACE score, depression was associated with an increased risk of readmission or mortality within 90 days [adjusted odds ratio (aOR) 2.00, 95% confidence interval (CI) 1.25–3.17, P=.004] (Table 2). When the composite endpoint was disaggregated, it was evident that readmissions were driving results (Table 2).