Hospital Readmission Outcomes by Frailty Risk in Behavioral Health Adults

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Abstract

The purpose of this retrospective study is to determine whether frailty is predictive of 30-day readmission in adults 50 years of age and older who were admitted with a psychiatric diagnosis to a behavioral health hospital, 2013-2017. A total of 1,063 patients were included. A 26-item frailty risk score (FRS-26-ICD10) was constructed from electronic health record (EHR) data. There were 114 readmissions. Cox regression modeling for demographic characteristics, emergent admission, comorbidity, and FRS-26-ICD determined prediction of time to readmission was modest (iAUC=0.671; the FRS-26-ICD was a significant predictor of readmission alone and in models with demographics and emergent admission; however, only the ECI was significantly related to hazard of readmission adjusting for other factors (adj.HR = 1.26, 95% CI=(1.17, 1.37), p<0.001) while FRS-26-ICD became non-significant. Frailty is a relevant syndrome in behavioral health that should be further studied in risk prediction and incorporated into care planning to prevent readmissions.

Key words: aged, frailty, electronic health records, data modeling, geriatric psychiatry, hospitalization, mental health, psychiatric nursing, readmission, retrospective studies, risk

Research on frailty has increased exponentially in the past decade. Aging demographics globally portray a burgeoning older adult population that is increasing in number and longevity and in complexity of their health needs; thus, there is interest in age-related conditions such as frailty. Frailty is a clinical syndrome that describes older adults who are vulnerable to adverse health outcomes due to system-wide physiologic impairments, failed integrative responses, and diminished capacity to effectively respond to and recover from stressors (Dent et al., 2016; Rodriguez-Mañas & Sinclair, 2014). Numerous studies demonstrate that frailty is associated with a higher incidence of morbidity, disability, hospitalizations, and premature mortality (Vermeiren et al., 2016). In the acute care hospital setting, the prevalence of frailty ranges from 21.6% to 99.4%, depending on the patient population and measurement used (Cunha et al., 2019; Theou et al., 2018). More recently, research on frailty in behavioral health hospitals indicate frailty prevalence ranges from 53% to 59% (Benraad et al., 2020; Stolz et al., 2020). Although these figures are alarming, not all older adults are frail or become frail. In the community, the overall prevalence of frailty is 10.7%, with and increases with age (Collard et al., 2012). Although frailty is typically characterized in physical terms based on frameworks that include phenotypic criteria or biological and functional deficits (Lim et al., 2019; Ding et al., 2017), there is growing recognition of psychological aspects of frailty. In emerging research, psychological frailty has been operationalized as cognitive frailty defined by coexisting physical frailty and mild cognitive impairment and by inclusion of emotional disorders such as depression and anxiety in physical frailty measures (Dent et al., 2014; Kelaiditi et al., 2013; Panza et al., 2018; Vella Azzopardi et al., 2018).

Psychiatric illness exerts a negative impact on health and wellbeing and imposes increased health care needs. In 2017, almost one million adults in the United States 55 years of age and older experienced a mental or substance abuse disorder (Substance Abuse and Mental Health Services Administration (SAMHSA), 2019). The most frequently reported diagnoses were depressive and bipolar disorders (45.1%) and schizophrenia and other psychotic disorders (21.7%) (SAMHSA, 2019). Data from the Healthcare Cost

and Utilization Project (HCUP) indicate that schizophrenia, bipolar and mood disorders were the most frequent principal diagnoses among hospitalizations involving mental and substance abuse disorders in 2011 (Heslin & Weiss, 2015). Among all hospitalizations in the U.S. in 2011, the sixth most common diagnosis was mood disorders, accounting for nearly 900,000 hospital stays (Heslin & Weiss, 2015). Both frailty and psychiatric disorders are associated with adverse outcomes such as increased morbidity, greater care needs, lower quality of life, and increased health care utilization. However, relationships between frailty and psychiatric illness such as major depression, bipolar disorders, and schizophrenia are not well studied. Specifically, factors associated with readmission in patients who are hospitalized for treatment of psychiatric illness and the role of frailty are poorly understood. Thus, this study aimed to determine whether frailty is predictive of 30-day readmission in adults 50 years of age and older who were admitted with a primary psychiatric diagnosis to a behavioral health hospital.

Background

Hospital Readmission

Concern about hospital readmissions in the United States is driven by their negative effects on patient safety and healthcare costs. Hospital readmission, defined as an admission to a hospital within 30 days of a discharge from the same or another hospital, affected 17.1% of Medicare beneficiaries and 13.9% for all payers, with estimated annual costs exceeding $17 billion in 2016 (Bailey et al., 2019; Centers for Medicare and Medicaid Services (CMS), 2019). Given their associated personal, organizational, and economic burden, unplanned hospital readmissions are considered a marker of poor quality of inpatient care or hospital-to-home transition and primary target for hospital quality improvement initiatives (Burke et al., 2016).. With the enactment of the Affordable Care Act (ACA) in 2010 and initiatives such as the Medicare Hospital Readmissions Reduction Program, early readmission after an acute care hospitalization became a key quality indicator (Hanrahan et al., 2016). Much of the literature on hospital readmission has focused on the general hospital population and patient subgroups with excessive readmissions for quality

indicator conditions such as heart failure, acute myocardial infarction, and pneumonia (CMS, 2019); however, there is limited evidence on readmission of adults with cooccurring frailty and psychiatric illness.

Frailty and Hospital Readmission

Frailty is increasingly recognized as a relevant aspect of patient health status that impacts care needs, recovery, and risk for adverse outcomes in hospitalized populations (Theou et al., 2018; Warnier et al., 2016). Frailty has been tied to greater risk of hospital readmission. A growing body of literature on hospital readmission has included measures for frailty in risk prediction models (Theou et al., 2018). Wou et al. (2013) examined the performance of five frailty scales in a sample of 667 hospitalized adults 70 years of age and older; all frailty scales were significantly associated with readmission (Relative Risk (RR) range 1.3 - 1.6); however, their predictive properties were poor to modest (AUC ranging from 0.52 to 0.57) (Wou et al., 2013). Using a 36-item frailty index, Hao et al. (2019) found that frail patients on a geriatric ward had a higher risk for readmission compared to patients who were not frail. While there is interest in including frailty in risk prediction models, the optimal frailty measure to use in these models for hospital readmission has not been determined.

Psychiatric Illness and Hospital Readmission

Research indicates that psychiatric disorders contribute to hospital readmissions in patients hospitalized for non-psychiatric medical illness (Sartorious, 2013). Estimates indicates that about one in seven persons who are hospitalized for psychiatric illness are readmitted within 30 days (OECD, 2013). Findings from a longitudinal cohort study of 925,705 adults hospitalized with a primary medical diagnosis and co-occurring serious mental illness such as bipolar disorder, major depression, and substance abuse were at increased risk of subsequent hospitalization for medical reasons over a 5-year period compared to patients without serious mental illness (Daratha et al., 2012). Several studies also confirm that among medical and surgical inpatients the odds of an unplanned 30-day readmission were 1.5 to 2.4 times greater for patients diagnosed with serious mental illness compared to patients without

serious mental illness (Hanrahan et al., 2016). Data from the Healthcare Cost and Utilization Project (HCUP) nationwide database found that patients admitted for mood disorders were more than twice as likely to be re-hospitalized within 30 days for the same principal or secondary diagnosis compared with those with an initial hospitalization for a non-mental/substance abuse disorder (12.6 versus. 3.8 percent) in 2012 (Heslin & Weiss, 2015). Similarly, in patients with an initial hospitalization for schizophrenia, the 30-day readmission rate for the same principal or secondary diagnosis was over four times higher than for a non-mental/substance abuse disorder (18.6 versus 3.8 percent) (Heslin & Weiss, 2015). Readmission rates are even higher when mood and psychotic disorders are counted as both a principal and a secondary diagnosis.

Frailty, Psychiatric Illness, and Readmission Risk

There is growing evidence for inter-relationships and co-existence of frailty and psychiatric illnesses and readmission risk (Andrew & Rockwood, 2012; Ní Mhaoláin et al., 2012). Psychological wellbeing is considered a critical aspect of healthy aging and may be protective against frailty, whereas psychiatric illness is recognized as a risk factor for frailty (Gale et al., 2014). In the Canadian Study of Health and Aging study of 5,676 community living older adults without dementia, self-reported psychiatric illness was compared by levels of frailty (defined by an index of deficits that excluded mental illnesses), individuals with psychiatric illness had a higher frailty index value than those who did not and psychiatric illness was associated with higher odds of being among the most frail (Andrew & Rockwood, 2007). In a prospective study of 427 patients 70 years of age and older who were admitted to a geriatric medicine unit, in which over half were frail, frail persons with poor psychosocial resources (anxiety, depression, wellbeing, mastery, social activities) were more likely to experience 1-month rehospitalization (OR, 95% CI = 2.53, 1.10–5.82) than frail persons with good psychosocial resources (Dent & Hoogendijk, 2014). Several reports highlight that depression and frailty often co-occur in adults and may have a bidirectional relationship: individuals with depression are at high risk for frailty and frail

individuals are at high risk for depression (Buigues et al., 2014; Chu et al., 2109). Research also indicates that depressive symptoms are more severe in persons who are frail (Collard, 2014). Associations between psychiatric comorbidity such as neurocognitive deficits and frailty have also been identified (Kelaiditi et al., 2013). Indeed, the coexistence of bipolar disorder and frailty portends worse outcomes and has been termed "emotional frailty" (McDermid & McDermid, 2016).

To enable health care providers to focus more strategically on patients at high risk for readmission, there is a need for a better understanding of the characteristics of these patients. One strategy to identify high risk patients for targeted interventions is risk stratification using variables that are associated with poor outcomes (Jeffery et al., 2019; Zhou et al., 2016). Variables commonly included in risk prediction models include demographic data (e.g., age, gender, race/ethnicity), comorbidity (e.g., individual medical conditions or an index), and healthcare utilization (e.g., emergent admission, prior hospitalization, emergency department visit) (Jeffery et al., 2019; Pederson et al., 2017; Zhou et al., 2016). To improve model performance and capture patient heterogeneity and complexity, measures for frailty have been included in risk prediction models in general medical-surgical hospital populations (Hao et al., 2019; Lekan et al., 2017; Lim et al., 2019).

Hospitalization for acute psychiatric illness is a critical event signaling an acute change in condition and vulnerability that may be amplified by frailty. There is a gap in understanding the factors associated with readmission and the role of frailty in patients who are hospitalized for psychiatric illness. Therefore, the purpose of this study was to 1) assess frailty using a frailty risk score (FRS) derived from the electronic health records (EHR) of adults 50 years of age and older admitted with a primary psychiatric diagnosis to a behavioral health hospital, and 2) evaluate the FRS predictive properties in models for unplanned all-cause time to readmission within 30 days after hospital discharge.

Methods

Study Design

This was an observational, retrospective study and secondary analysis of a subset of EHR data (Epic®) from the main study of hospital readmissions in a health system (Lekan et al., in press).

Setting and Sample

The main study sample included all hospital admissions to a health system in the Southeastern U.S. for adults 50 years and older who had an inpatient stay of >24 hours and hospitalized between 2013-2017 (*N* = 55,994). The health system includes five hospitals with a capacity that ranges from 80-535 beds; three hospitals provide multi-specialty medical and surgical services, one is women's health, and one is behavioral health. This secondary analysis includes only patients initially admitted to the 80-bed behavioral health hospital. Patient exclusions were 1) not initially admitted to behavioral health hospital; 2) index admission occurred before January 31, 2013 or after December 1, 2017; 3) planned readmission; 4) <24 hour stay; and 5) died during hospitalization. The final sample for the sub-study consists of 1,063 patients. The study flowchart is shown in Figure 1.

Data Collection

Electronic files of raw EHR data were transferred from the health system into the university's high security virtual desktop followed by data preprocessing, cleaning, and transformation for analyses using a de-identified dataset.

Measures

Sociodemographic and Clinical Data

Sociodemographic and clinical data from the index admission have been previously detailed (Lekan et al., in press) and for this sub-study include: age, sex, race/ethnicity, marital status, living arrangement, preadmission location, discharge location, insurance payer, emergent index admission, length of stay, principal problem, and secondary medical diagnoses based on International Classification of Disease, 10th Revision, Clinical Modification (ICD-10-CM) codes.

Frailty

A 26-item frailty risk score (FRS-26-ICD) was constructed from the EHR data using ICD-10-CM classification codes as proxies for geriatric syndromes, psychosocial risk factors, and blood biomarkers that are associated with frailty (Lekan et al., 2017; Lekan et al., in press). Table 1 lists the FRS-26-ICD risk factors and indicators including 19 ICD-10-CM codes and seven blood biomarkers derived from laboratory data. Risk factors were scored dichotomously as 0 = not present and 1 = present and then summed, with higher scores indicating greater frailty.

Comorbidity

The Elixauser Comorbidity Index (ECI) was used to account for cooccurring chronic medical conditions that represent disease burden and collectively have a negative impact on health status and outcomes (Elixhauser, Steiner, Harris, & Coffey, 1998). The ECI was calculated according to Quan et al. (2005) using the ICD-10-CM codes for 30 unweighted secondary diagnoses derived from the patient's problem list that were present on admission but were not directly related to the principal problem.

Outcomes

The primary outcome was time to first readmission after discharge from the index admission and rates for 3-day, 7-day, and 30-day readmission were estimated.

Data Analysis

Descriptive statistics were used to describe characteristics of the sample (frequency (*n*), percentage (%), mean (*M*), standard deviation (*SD*), and range (*Min, Max*)). Cox regression was performed to model the hazard for time to readmission. Modeling was performed incrementally with inclusion of demographic characteristics, ECI comorbidity, and FRS-26-ICD scores. Effects were quantified with hazard ratios (HRs) and precision with their 95% confidence intervals (CIs). Model predictive ability was quantified using integrated/time-dependent area under the receiver operating characteristic curve (iAUC) (Guo et al., 2017). All analyses were conducted using SAS v9.4 (SAS, Inc., Cary, NC, USA) and SPSS v26 (IBM Corp, Armonk, NY). A two-sided p-value < .05 was considered

statistically significant, and is reported along with effect size (HR) and its precision (95% CI) (Wasserstein & Lazar, 2016).

Ethical Considerations

Ethics approval for this study was obtained from the university and health system institutional review boards for a limited dataset with a waiver of research consent and HIPAA authorization.

Results

After exclusion criteria, a total of 1,063 patients initially admitted for behavioral health acute care were included in the study. Table 2 provides a summary regarding characteristics of the patients. Overall, about half of the patients were female (50.5%, *n*=537) with an average age of 56.6 years old (*SD*=5.2). Two-thirds of patients were White/Caucasian (66.9%), 29.0% were Black/African American, and 4.1% Other/Two or more races/ethnicities with 1.2% of patients with Hispanic/Latino ethnicity. Approximately 34% of the patients were married, 33% lived alone, and most were privately insured (70%). Thirty-five (3.3%) of the 1,063 initial admissions were of emergent nature. The average length of stay was 5.6 days (*SD*, 3.4, range 1-49). The most prevalent reason for the index admission was major depressive disorder (24.6%, *n*=262), followed by alcohol dependence-related (5.9%, *n*=63) and bipolar disorders (5.2%, *n*=55). The mean ECI was 2.5 (*SD*, 1.8; median, 2; range 0-11).

The FRS-26-ICD frailty indicators based on ICD-10-CM coding were available for 1,060 (99.7%) of patients while lab-based indicators (albumin, sodium, creatinine, glucose, hemoglobin, and white blood cell (WBC)) were only available for 13.0% (*n*=138) to 34.8% (*n*=370) patients. Figure 2 provides the prevalence of frailty indicators. Depression was by far the most prevalent recorded ICD-based frailty indicator (64%), with smoking (17%), dyspnea (11%), and loss of weight (11%) following. All other ICD-based frailty indicators had prevalence of 6% or less. The average FRS was 1.5 (*SD,* 1.5; range 0-11). The prevalence of frailty based on a FRS-26-ICD score of 2 or more frailty indicators present was 34.8%.

Frailty increased with age from an average of 1.4 frailty indicators (*SD*, 1.4) in patients 50-54 years of age to 3 frailty indictors (*SD*, 2.0) in patients 80-84 years old.

During the 5-year study time frame, there were 114 hospital readmissions. Table 3 gives estimated readmission rates based on multivariable Cox regression modeling. Here, approximately 3.6% of patients with an initial behavioral health hospital admission were readmitted at 30 days (95% CI=(2.4%, 4.7%)). Of these 30-day readmissions, 24 were readmitted to the behavioral health hospital at 30 days and 12 were readmitted to a non-behavioral health hospital within the health system at 30 days. Rates for 3-day readmission were 0.4% (95% CI=(<.01%, 0.8%) and for 7-day readmission were 1.3% (95% CI=(0.6%, 2.0%)).

Table 4 presents results from Cox regression modeling of time to readmission for combinations of included covariates for demographic characteristics, emergent admission, ECI, and FRS-26-ICD frailty. Here, modeling demographics to predict time to 30-day readmission was only slightly better than chance (iAUC = 0.554), and no demographic characteristic was statistically significant without adjusting for ECI or FRS-26-ICD. FRS-26-ICD frailty alone was significantly associated with increased hazard of readmission (adjusted (adj.) HR = 1.23, p<0.001; iAUC = 0.598) as well as ECI (adj.HR = 1.34, p<0.001; iAUC = 0.660). In a final model with demographics, emergent admission, ECI, and FRS-26-ICD frailty, prediction of time to readmission was improved (iAUC=0.671). Here, only the ECI was significantly related to hazard of readmission adjusting for the other included model factors (adj.HR = 1.26, 95% CI=(1.17, 1.37), p<0.001) while FRS-26-ICD frailty became non-significant (p = 0.455).

Discussion

Reducing unplanned 30-day hospital readmission is a quality of care imperative (Bailey et al., 2019). In this study of 1,063 adults 50 years of age and older with an index admission for psychiatric illness to a behavioral health hospital we found that comorbidity as measured by the ECI was a significant independent predictor of 30-day readmission and remained the only significant predictor in

the final model that included demographic data, emergent index admission, and the FRS-26-ICD (adj. HR = 1.26, p<0.001; iAUC = 0.671). These findings align with other evidence that links comorbidity and readmission in the behavioral health population, although this evidence is equivocal. In the general hospital population, comorbidity has been found to have variable performance in readmission risk models, with c-statistics ranging from 0.21 to 0.88 (Kansagara et al., 2011; Zhou et al., 2016). Among patients hospitalized with psychiatric disorders, a systematic review found that comorbidity was significantly associated with readmission in 12 of 17 included studies (Šprah et al., 2017). We found that on average patients were diagnosed with three chronic conditions, a finding that points to the salience of comorbid mental and physical diseases in hospitalized adults (Burke et al., 2013; Sartorius, 2013). Indeed, epidemiological surveys reveal that the cooccurring medical and psychiatric disorders is the rule rather than the exception (Šprah et al., 2017). Our findings suggest that individuals who are hospitalized with psychiatric disorders experience acute mental health challenges in tandem with chronic health conditions which contributes to complexity of care and greater readmission risk (Germack et al., 2019).

In the present study we also found that frailty was a significant predictor of 30-day readmission (adj.HR = 1.23, p<0.001; iAUC = 0.598) and remained a significant predictor in models adjusted for demographic data and emergent index admission but not when comorbidity was added to the model. One explanation for this finding is the younger age of the sample (mean, 57 years), greater comorbidity, and lower prevalence (34.8%) and severity of frailty (mean FRS-26-ICD = 1.5 indicators; *SD*, 1.5). The lower frailty prevalence contrasts with findings from a study of 120 patients hospitalized with acute psychiatric illness on geriatric wards (mean age, 74.6 years) in which half were frail (Benraad et al., 2020). The lower prevalence and severity of frailty among patients in our study may also be due to limitations of the FRS-26-ICD, which is based on ICD codes and laboratory data. Deficits in the completeness and accuracy of EHR data and under-coding are recognized as caveats in research using EHR data. For example, under-coding of frailty indicators (e.g., fatigue, weakness, and delirium) and

coding that preferentially lists medical diagnoses (e.g., COPD and dyspnea) is possible since these phenomena may be attributed to disease that is already coded. Since frailty ideally requires subjective and objective assessment, reliance on proxies derived from ICD-10 coding that is completed for clinical and not research purposes is less than optimal. Coding practices may also be subject to bias which may result in omission of all relevant ICD-10 codes for the patient problem list (Kim, 2020). In a retrospective study of Medicare Advantage Plan beneficiaries using administrative claims and EHR data, the prevalence of geriatric syndromes increased after adding unstructured EHR data (e.g., text, images) (Kan et al., 2018). Lastly, a minority of patients in our study had most or all seven blood biomarkers for the FRS-26-ICD. Collectively, abnormal biomarkers represent a physiologic signature of dysregulation and impaired homeostasis. Patients hospitalized for acute psychiatric illness may not need laboratory tests and cost containment strategies discourage routine testing, thus limiting the utility of these indicators.

We found that when the FRS-26-ICD was added to the adjusted model, performance improved which suggests that frailty contributes additional information about patient health status and risk not explained by comorbidity and other covariates. Despite limitations of a frailty score derived from ICD-10 codes, this approach is increasingly used in large datasets based on efficiencies in identifying high risk patients for population health programs, targeted interventions, public reporting, and risk adjustment (Shashikumar et al., 2020). Although the FRS-26-ICD was a significant predictor of readmission, it demonstrated less than desirable accuracy (iAUC = 0.598; 0.620 in adjusted model). This finding aligns with systematic reviews that report variable performance in the predictive validity of frailty tools for 30-day hospital readmission (AUC ranges from 0.56 to 0.72 (Lim et al., 2019; Shashikumar et al., 2020; Theou et al., 2018; Warnier et al., 2016). Similarly, Wou et al.'s (2013) study of five frailty tools and their ability to predict readmission at 90 days in hospitalized adults 70 years of age and older found that the predictive properties of the scales was poor to modest (AUC, 0.44-0.69). Model comparisons are hindered by diversity in frailty tools and populations studied, lack of consistency in the variables

included in models, and incomplete data on the accuracy of measures. Given scant research on frailty in patients who are hospitalized with psychiatric illness, this study provides a promising approach to identifying patients who may require intensified interventions and strategies to prevent readmission.

Finally, in the present study, 3.56% of patients were readmitted within 30 days of discharge. National figures estimate that almost one in seven persons hospitalized for psychiatric reasons are readmitted within 1 month of discharge (OECD, 2013). Findings from the HCUP database for 30-day all-cause readmissions for persons with a principal diagnosis of mental and behavioral disorders at the index admission using the 2010-2016 Nationwide Readmission Database (NRD) determined the readmission rate was 16.9% (Bailey et al., 2019). The HCUP database representing over 1 million adults 18 years of age and older in U.S. hospitals differs from our study sample of adults 50 years and older although readmissions were not analyzed by age group. Other analyses from HCUP database found that the 30-day readmission rate for mood disorders for age 45-64 years was 14.5% and for 65 years of age and older, 12.6%; similarly, for schizophrenia, the 30-day readmission rate was 19.7% for 45-64 years and 12.3% for 65 years and older (Heslin & Weiss, 2015). Given the low readmission rate in the present study, and organizational quality improvement goals to reduce readmissions, identifying factors that may be successful in the prevention of readmission would be as important as identifying deficits in the inpatient or transitional care processes. In the present study, we found that almost half (39%) of readmissions occurred earlier (e.g., 3-day, 7-day) in the 30-day window. Readmissions that occur earlier may be due to different factors compared to readmission later in the 30-day window; for example, earlier readmissions may reflect organizational deficits related to inpatient care and transitional care processes, and patient factors such as medical instability and chronic disease exacerbation, each requiring different targeted strategies (Burke et al., 2013; Burke et al., 2016; Graham et al., 2015).

Implications for Mental Health Nursing

Nurses in behavioral health hospital settings need to consider the patient's cooccurring medical conditions as well as their primary psychiatric disorders in the nursing assessment and care plan and in transition from hospital to home. Because psychological factors play a prominent role in many disease manifestations, nurses need to carefully assess symptom presentation to identify exacerbation of underlying conditions. Comorbidity is more than the simple addition of two or more conditions that independently follow a predictable trajectory with the appropriate medical treatment; the presence of multimorbidity plus psychiatric illness worsens the prognosis of all of the diseases that are present, increases the risk for complications, and makes treatment of each of them more difficult and potentially less effective (Sartorious, 2013). Further, medical complexity is often associated with symptom clusters. For example, in a retrospective study, Borkenhagen et al. (2018) found that a panel of symptoms that included drowsiness, depression, dyspnea, and anxiety were strong predictors of 30-day hospital readmission. The FRS-26-ICD may be helpful in identifying symptom clusters in patients and prompt measures for medical treatment (pharmacotherapy, symptom management) to reduce risk for readmission. Interprofessional collaboration to address comorbidity and related symptom clusters is vital to ensuring comprehensive holistic care and medical treatment optimization for recovery.

Nurses in behavioral health settings should also consider frailty in their nursing assessments and care planning. Frailty is a relevant construct in the behavioral health population as it represents vulnerability to adverse outcomes based on complex systems and failing compensatory mechanisms to maintain homeostasis when exposed to physiological, psychological, and environmental stressors. The biopsychosocial framework of the FRS-26-ICD helps focus attention away from disease-based treatment toward a holistic person-centered approach, underscores relationships between physical and mental health, and aligns with contemporary frameworks on frailty (Ding et al., 2017). Nurses should also be mindful of frailty in middle-aged as well as older adults. While frailty is often viewed as a condition of the very old, our findings and other research notes frailty prevalence ranges from 4% to 27.3% in

middle-aged inpatients (Hanlon et al., 2018). Frailty may be especially consequential in middle-age adults with long-standing psychiatric illness and chronic stress which exerts deleterious effects leading to neuroendocrine dysregulation, allostatic load, and increased risk for frailty (Szanton et al., 2009). Precursors to frailty tend to arise earlier in life; thus, interventions targeted to this population may delay or mitigate frailty in later life (Ding et al., 2017; Hanlon et al., 2018).

Most frailty tools require subjective evaluation and face-to-face assessments by trained staff, special equipment, time for analyses, and completion of questionnaires by patients (Warnier et al., 2016). When additional assessments are needed, frailty classification will be limited to certain departments or specialized clinicians. As a result, patients who are frail are not identified for interventions to address frailty nor can system wide quality improvements be developed. Using readily available EHR data as described in the present study helps identify frail patients for population-based programs and to formulate individually tailored care plans (Hao et al., 2019).

One third of the readmissions in the study were to a non-behavioral health hospital in the health system. Here, the primary reason for these readmissions would be a medical or surgical problem. In this context, nurses should take into account the patient's recent psychiatric illness hospitalization and pay attention to their mental health needs in conjunction with their medical treatment. Treatment of cooccurring medical conditions may adversely interact with psychiatric treatment. Stressors associated with hospitalization and hospital-acquired morbidity (e.g., delirium, falls, pressure ulcers, infections) may exacerbate psychiatric illness and increase the likelihood of poor outcomes (Germack et al., 2019).

Finally, nurses should identify interventions that can improve transitions in care and facilitate recovery in the community. One systematic review found that transitional care strategies to reduce 30-day readmission rates should include routine monitoring of symptoms using a standardized tool with medication tracking and activating liaisons with community partners to ensure care continuity so that

mental health symptoms of discharged patients are assessed and addressed (Benjenk & Chen, 2018). It would also be important to assess the adequacy and availability of the patient's social support networks.

Future Research

There is a need for research on frailty in adults with psychiatric illness since understanding of frailty and its assessment in this population is inconclusive (Kelaiditi et al., 2013; Vella Azzopardi et al., 2018). A recent systematic review of 95 studies and 48 frailty assessment tools found that only 20 of these tools incorporated psychologic assessment, and of these, 17 included depressed mood or anxiety as a frailty indicator (Sutton et al., 2019). The study authors concluded that no tool had been developed or validated in older adult populations with psychiatric disorders. Investigations in this area should include qualitative research to identify frailty indicators that are important in this population.

The present study suggests that improvements in the FRS-26-ICD is needed. The use of nursing documentation in the EHR instead of ICD-10 diagnosis codes for the FRS may provide a more comprehensive, holistic appraisal of the patient's health status and more accurate data points for an EHR-based frailty assessment. Data science methods such as data mining, machine learning, and natural language processing can be used to manage data volume and complexity and to identify novel predictors (Jeffrey et al., 2019). Future research should also focus on the development of clinical decision support systems for frailty. The FRS indicators provide potential targets for care planning through identification of single or cooccurring indicators (e.g., weakness, fatigue, chronic pain, and high WBC). As health informatics advances to provide timely information retrieval and clinical decision support, generation of a FRS could be incorporated into the EHR and created on admission, during hospitalization, and at discharge and made available to clinicians.

Limitations

There are several limitations to the present study. The study was conducted in one behavioral health hospital in the U.S. and readmissions could only be ascertained within the health system. The

retrospective design prohibits assumptions of causality between model variables and outcomes. The small number of readmissions and the overall sample size for this secondary analysis limited analysis approaches since findings are likely to be spurious, although from an organizational perspective, examination on a case-by-case basis may provide meaningful insights for quality improvement. Caution is also urged for non-significant findings as reduced power to detect their associations due to the low number of readmissions is an alternative explanation. The present findings cannot be extended to other populations or settings with different healthcare models and should be interpreted with caution.

Conclusion

Frailty as measured by the FRS-26-ICD is a significant predictor of readmission of patients 50 years and older hospitalized for psychiatric illness until comorbidity (i.e., ECI) is accounted for. The ECI contributes decent predictive accuracy for behavioral health admitted patients for 30-day readmission. In behavioral health settings, risk prediction models that incorporate patient factors such as frailty and comorbidity using EHR data will facilitate targeting and delivery of enhanced care processes to patients at greatest risk to improve quality of care and to reduce unplanned hospital readmissions. Future studies should investigate whether results replicate in larger diverse samples with more readmissions.

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Figure 1

Study Flowchart

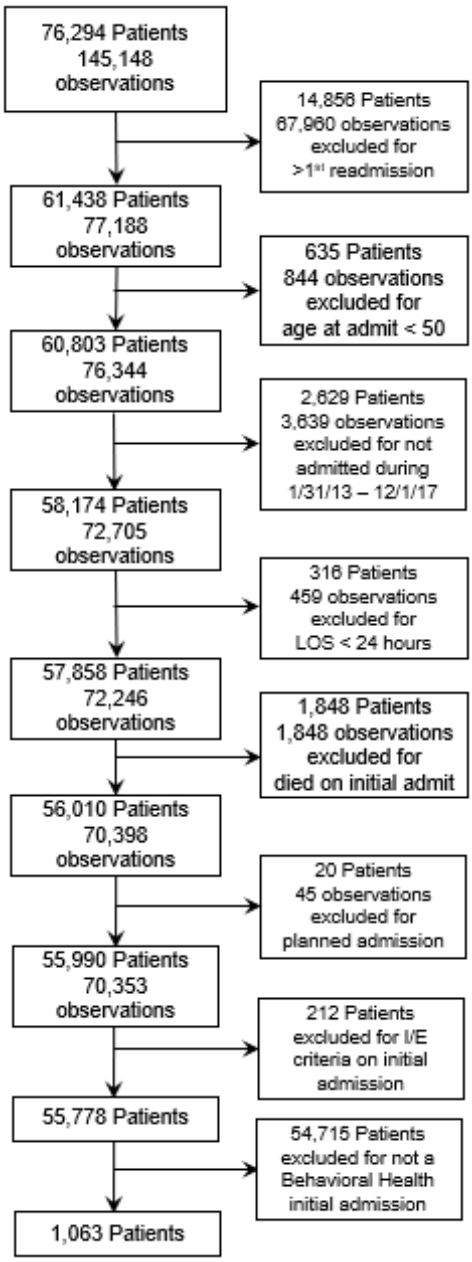

Table 1

The Frailty Risk Score (FRS) Risk Factors and Indicators

	Risk Factors	Examples of Indicators*
1	Malnutrition	Nutritional marasmus, anorexia, feeding difficulties or problems protein calorie malnutrition, emaciation, cachexia
2	Abnormal weight	Abnormal weight loss, underweight, overweight, obesity, BMI ≤19.9
3	Weakness	Muscle weakness, sarcopenia, physical deterioration, physical decline, debility
4	Fatigue	Fatigue any etiology, lethargy, exhaustion
5	Dyspnea	Dyspnea, shortness of breath, acute respiratory distress, orthopnea, hyperventilation
6	Dysphagia	Dysphagia any type
7	Chronic pain	Chronic pain any cause, chronic pain syndrome
8	Difficulty walking	Difficulty walking, ataxia, staggering gait, unsteadiness, imbalance, impaired mobility
9	Vision problems	Low vision, blindness, cataracts, glaucoma, macular degeneration, retinopathy
10	Urine incontinence	Incontinence without sensory awareness, nocturnal enuresis, continuous leakage
11	Fecal incontinence	Anal sphincter incontinence or rectal incontinence
12	Decubitus ulcer	Pressure ulcer any type and any location
13	Falls	Fall, any type, history of falls
14	Smoking	History of nicotine /tobacco dependence, tobacco use, chewing tobacco
15	Delirium	Delirium, changes in mental status, alcohol or opioid intoxication with withdrawal delirium
16	Depression	Depression, any etiology, moderate or severe
17	Dementia	Dementia any type
18	Social support	Social isolation, exclusion, family discord or disruption, problems related to family or primary support group, conflict, other psychosocial problems, dependence on care provider or no household member able to render care, illiteracy or low literacy
19	Material resources	Homelessness, inadequate housing or food supply, insufficient social insurance and welfare support, problems related to living alone
	Blood biomarkers	
20	Albumin, low	3.5-5.0 g/dL
21	Creatinine, high	0.6-1.24 mg/dL
22	Glucose, abnormal	65-99 mg/dL
23	Hemoglobin, low	female 12-15 g/dL male 13-17 g/dL
24	Sodium, high or low	135-145 mmol/L
25	WBC, high or low	4-10.5 K/uL
26	C-reactive protein, high**	< 1 mg/dL

Note. *The indicators were ICD-10-CM codes; see Lekan et al. (in press) for details.
**CRP blood specimen prevalence in the study sample was insufficient for analyses.

Table 2

Characteristics of the Sample (*N* = 1,063)

Characteristic	***n* (%) or *M ± SD* (*Min, Max*)**
Age (years)	56.6 ± 5.2 (50, 84)
Sex	
Female	537 (51)
Male	526 (49)
Race/ethnicity	
American Indian	2 (<1)
Asian	4 (<1)
Black/African American	308 (29)
Hispanic/Latino	13 (1)
White/Caucasian	711 (67)
Other/Two or more	20 (2)
Declined	4 (<1)
Missing	1 (<1)
Marital status	
Married, partnered/significant other	358 (34)
Single	368 (35)
Divorced/separated	248 (23)
Widowed	59 (6)
Unknown/missing	30 (3)
Living status-lives alone	347 (33)
Insurance payor	
Private insurance	741 (70)
Medicare	151 (14)
Medicaid (primary/secondary)	151 (14)
Free care/self-pay	20 (2)
Length of stay (days) of initial admission	5.6 ± 3.4 (1, 49)
Emergent admission	35 (3)
Pre-admission residence	
Home	849 (80)
Assisted living/group home	13 (1)
Skilled nursing facility/nursing home	0
Shelter/homeless	107 (10)
Other	47 (4)
Multiple	5 (<1)

Characteristic		***n* (%) or *M ± SD* (*Min, Max*)**
missing		42 (4)
Initial discharge disposition		
Home, no services		1,022 (96)
Home, with services		3 (<1)
Skilled nursing facility		5 (<1)
Rehabilitation hospital		17 (2)
Other hospital		14 (1)
Hospice		1 (<1)
Other		1 (<1)
Primary problem (top 5)	ICD-10	
1. Major depressive disorders	F33.2, F32.2, F33.3, F32.9, F33.9, F33.1, F32.3	262 (25)
2. Alcohol dependence related	F10.20, F10.230	63 (6)
3. Bipolar disorders	F31.30, F31.4, F31.9, F31.64	55 (5)
4. Schizoaffective disorders	F25.0, F25.9	36 (3)
5. Chest pain	R07.9	25 (2)
FRS-26-ICD frailty score		1.5 ± 1.5 (0, 11)
Elixhauser Comorbidity Index		2.5 ± 1.8 (0, 11)

Figure 2

Prevalence of the Frailty Indicators

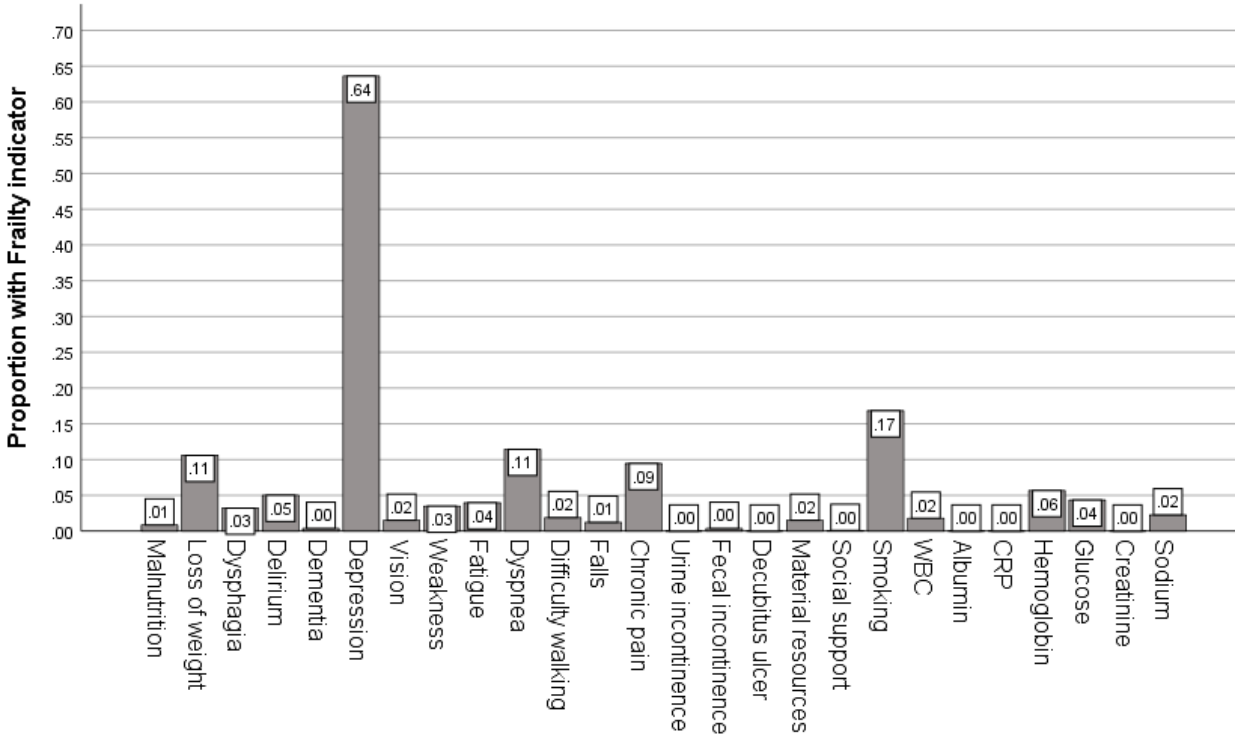

Table 3

Readmission Rates for Behavioral Health Initial Admissions (*n = 1,063)*

At 3 Days	At 7 Days	At 30 Days
0.40%	1.29%	3.56%
(<0.01%, 0.79%)	(0.59%, 1.99%)	(2.42%, 4.69%)

Note. Numbers are estimated % (95% CI), based on Cox regression final model.

Table 4

Cox Modeling of Time to Readmission

Adj. HR (95% CI) *P*-value	**Demo Only**	**Frailty Only**	**Comorbid only**	**Demo + Frailty**	**Demo + Comorbid**	**Demo + Comorbid + Frailty**
Model *n*	*n* = 1,028	*n* = 1,052	*n* = 1,020	*n* = 1,034	*n* = 994	*n* = 994
Age (years)	0.99 (0.97, 1.02) 0.545	-	-	0.98 (0.96, 1.01) 0.234	0.99 (0.96, 1.01) 0.371	0.99 (0.96, 1.01) 0.313
Sex: Male vs. Female	1.17 (0.89, 1.53) 0.262	-	-	1.38 (1.05, 1.82) 0.023	1.24 (0.94, 1.62) 0.128	1.27 (0.96, 1.68) 0.090
Race: Non-White vs. White	1.32 (0.99, 1.74) 0.052	-	-	1.37 (1.03, 1.81) 0.030	1.33 (1.01, 1.76) 0.045	1.30 (0.98, 1.73) 0.068
Emergent initial admission	0.90 (0.40, 2.02) 0.792	-	-	0.81 (0.36, 1.82) 0.607	0.86 (0.38, 1.94) 0.714	0.85 (0.38, 1.91) 0.688
Elixhauser Comorbidity Index	-	-	1.34 (1.25, 1.42) <0.001	-	1.33 (1.25, 1.43) <0.001	1.26 (1.17, 1.37) <0.001
FRS-26-ICD Frailty score	-	1.23 (1.15, 1.32) <0.001	-	1.28 (1.17, 1.36) <0.001	-	1.04 (0.94, 1.15) 0.455
Integrated AUC	0.554	0.598	0.660	0.620	0.669	0.671

Note. Demo (demographic); Comorbid (Elixhauser Comorbidity Index); Frailty (FRS-26-ICD frailty score);

HR = Hazard ratio.