Application of a Researcher-Derived Frailty Index with Existing Electronic Health Record data in Older Adults Hospitalized with *Clostridium difficile* infection.

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Background and Significance

The world's population is aging as longevity increases, with approximately 22.5% of the North American population ages 65 and older by 2050 (Federal Interagency Forum on Aging Related Statistics, 2019). Hospitalized frail older adults are at increased risk for mortality and acuity of care (Hatheway et al., 2017). The severity of baseline frailty has been independently associated with inpatient survival in acute care settings (Turcotte et al., 2021). *Clostridium difficile* infection (CDI) can lead to adverse outcomes in frail older adults, with the risk of recurrent CDI in older adult more prevalent than younger counterparts (Sams & Kenney Malone, 2017). Previously, an electronic frailty index for CDI (FI-CDI) was applied to adults ages 55 and older in the inpatients setting who had been hospitalized for CDI, with frailty scores significantly related to CDI recurrence after adjusting for sociodemographics (Boone et al., 2018). Frailty recognition through operationalization of the FI-CDI provides opportunities for intervention and prediction of adverse outcomes including inpatient mortality and readmissions.

Study Purpose

The purpose of this study was to perform a secondary data analysis by applying a researcher-derived frailty index to hospitalized patients with *Clostridium difficile* (CDI) ages 55 and older with an aim of investigating frailty index score and prediction of in-hospital mortality and re-admission for non-related CDI occurrences within one year of initial presentation.

Design and Methods

Guided by the Accumulation of Deficits approach (Rockwood and Mitniski, 2011), the FI-CDI-39 was created per standard guidelines (Searle et al., 2008). All admissions (24 hours or greater) were included for patients 55 and older hospitalized with CDI, indicated by ICD-9 and 10 codes.

The FI-CDI-39 estimated frailty for adults ≥ 55 years hospitalized for CDI between December 2013 through December 2015. FI-CDI-39 variables included laboratory abnormalities, diseases, functional status, and psychosocial indicators.

Laboratory	*Albumin, ALT, Alk Phos, Hgb, Creatinine, BUN, WBC count, Glucose, Sodium, Platelets*
Chronic Disease	*Vit D deficiency, Arthritis, Hypertension, Stroke, Cancer, Diabetes mellitus (Type 1 and 2), COPD, Asthma, BMI, CKD, Depression, Dementia, Heart Failure*
Functional Status and ADLs	*Independently performs ADLs, Total Braden Scale, sensory perceptions, moisture, activity, mobility, nutrition, friction and shear, urinary incontinence, falls, Fall Risk, polypharmacy*
Psychosocial	*Physical Abuse, Verbal Abuse, Sexual Abuse, Self-Neglect*

Binary form was used to code deficits, with "1" identifying deficit presence and "0" identifying deficit absence. The FI-CDI-39 was calculated by dividing number of deficits present in an individual by total number of deficits measured (39), with frailty defined as ≥ 0.25. The FI-CDI-39 was applied to 454 patients who had complete admission data for the 39 deficits.

Data were analyzed with descriptive statistics, bivariate hypothesis tests, and logistic regression. A two-sided p-value < 0.05 was considered statistically significant.

Results

Table 1. Background characteristics and frailty among the study patients

Characteristic	*n* (%) or *Mean* ± *SD*
Overall	*N* = 871
Age (years)	73.6 ± 10.7
Female gender	510 (58.6%)
White race/ethnicity	609 (69.9%)
FI-CDI-39 frailty index (*n* = 454)	0.42 ± 0.11
Frailty on admit (FI-CDI-39 ≥ 0.25)	418 (92.1%)

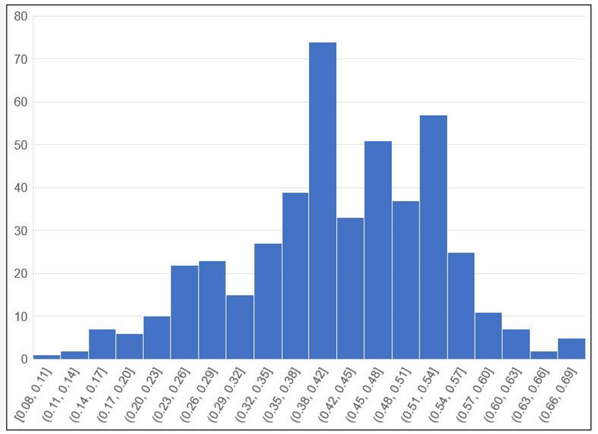

Figure 1. Histogram of patient counts by FI-CDI-39 frailty index interval ranges

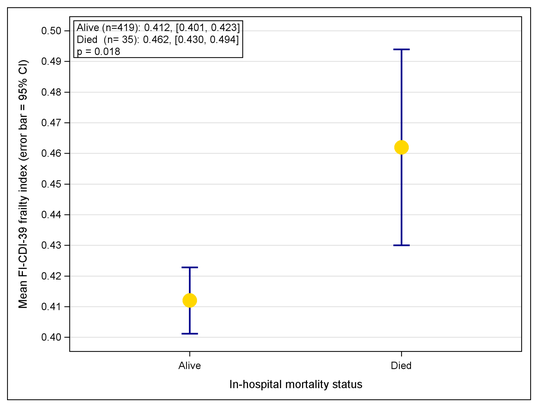

Figure 2. Error-bar plot of FI-CDI-39 frailty by in-hospital mortality status

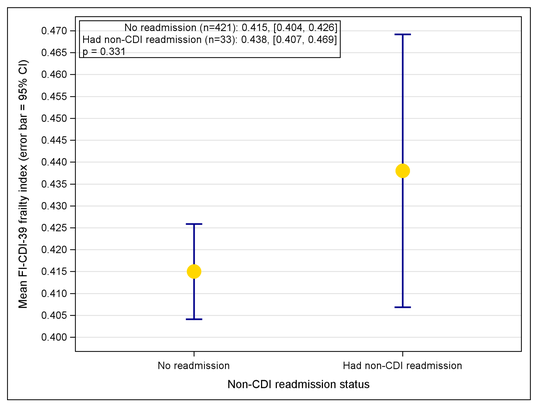

Figure 3. Error-bar plot of FI-CDI-39 frailty by non-CDI readmission status

Application to Practice

The FI-CDI-39 provides opportunity to identify multiple potential deficits that contribute to the frailty trajectory. Identification of frailty during hospitalization is imperative due to already known risk for prolonged stays, increased mortality rate, and also supported by this research that increasing frailty status is associated with inpatient mortality.

Identifying at risk patients during acute illnesses assists in streamlining care, interventions, multidisciplinary approaches, and discussion with family members regarding care. Care must be taken to remember frailty does not equate to age.

Existing electronic medical record data can be used for frailty assessment throughout the hospital course with goals of decreasing length of stay, adverse outcomes, morbidity, and mortality.

Understanding frailty and identifying those frail leads to support beyond discharge, incorporating targeted education for patient, family members, skilled nursing facilities, and home health post-discharge, with goals of decreasing risk of CDI recurrence and non-CDI readmissions.

Further Research

Although readmission within one year for those frail vs non-frail was not significant in this study, frailty is already known to be associated with increased risk of readmission. Prospective studies with the FI-CDI-39 would be beneficial, as retrospective studies are limited by nature.

Frailty and risk of mortality post-discharge could also be explored at set time intervals such as 1 month, 3 months, 6 months, 9 months, and 1 year.

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