Symptoms, Mobility and Function, and Quality of Life in Adults With Acute Leukemia During Initial Hospitalization

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OBJECTIVES: To examine longitudinal symptoms, mobility and function, and quality of life (QOL) in adults newly diagnosed with acute leukemia.

SAMPLE & SETTING: 55 adults undergoing induction chemotherapy at the University of North Carolina Lineberger Comprehensive Cancer Center and the Duke Cancer Institute.

METHODS & VARIABLES: A prospective, longitudinal study with measures of mobility and function, global physical and mental health, cancer-related fatigue, anxiety, depression, sleep disturbance, pain intensity, and leukemia-specific QOL was conducted. Data were analyzed using descriptive statistics, linear mixed modeling, and one-way analysis of variance.

RESULTS: 49 adults with acute leukemia completed assessments during hospitalizations. Global mental health and pain intensity did not change significantly. Global physical health significantly improved. Fatigue, anxiety, depression, and sleep disturbance decreased significantly. QOL increased significantly.

IMPLICATIONS FOR NURSING: The significant decrease in anxiety and fatigue during hospitalization may be attributable to understanding of the disease process, familiarity with the staff, and ability to communicate concerns.

KEYWORDS acute leukemia; PROMIS; mobility; function; quality of life; hospitalization; symptoms

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Acute leukemias are hematologic cancers of the bone marrow and blood (Sekeres & Stone, 2002). The three most common acute leukemias are acute myeloid leukemia (AML), acute promyelocytic leukemia (APML), and acute lymphocytic leukemia (ALL). In 2018, an estimated 25,480 people will be diagnosed with AML and ALL, and more than half will die from the disease (American Cancer Society, 2018). Newly diagnosed acute leukemia is usually treated in a specialized cancer care center with an average stay of four to six weeks (Sekeres & Stone, 2002). Although various treatments exist for AML, intensive chemotherapy is the treatment of choice to achieve remission and prolong survival (Alibhai et al., 2015; Ghodraty-Jabloo, Alibhai, Breunis, & Puts, 2015, 2016). Chemotherapy treatment has two phases: (a) induction to put the disease into complete remission (typically 30 days) and (b) consolidation to kill any remaining leukemia cells that cannot be seen (four to six subsequent monthly cycles) (Stone, 2008). Patients with AML typically receive aggressive inpatient induction chemotherapy for one week and then remain hospitalized for at least one month because of treatment-associated complications, such as neutropenic fever, anemia, and thrombocytopenia (Sekeres & Stone, 2002). Patients with acute leukemia are particularly vulnerable during induction chemotherapy because they are at high risk for symptom toxicities. It is common for patients to have fluctuating symptoms associated with the disease and its treatment, such as myelosuppression, stomatitis, and nausea, throughout hospitalization (Albrecht, 2014; Bryant, Walton, Shaw-Kokot, Mayer, & Reeve, 2015).

Symptom management is the foundation of oncology nursing care. One way to assess symptoms is through patient-reported outcomes (PROs),

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which has been defined as "a measurement based on a report that comes directly from the patient about the status of a patient's health condition without amendment or interpretation of the patient's response by a clinician or anyone else" (U.S. Food and Drug Administration, 2009, p. 2). Illuminating the patient's voice through PROs allows for symptoms and physical impairments that may go undetected to be shared with the oncology provider (Basch, 2017). A variety of tools have been used to measure health outcomes, but no acute leukemia studies have measured symptoms, physical and mental health, and quality of life (QOL) using the Patient-Reported Outcomes Measurement Information System (PROMIS). The National Institute of Nursing Research (2018) encourages the use of common measures to facilitate effective and broader use of data, regardless of condition or age group. PROMIS is a tool with which common data elements can be measured and analyzed; it includes a set of person-centered measures that help monitor and evaluate physical, mental, and social health in adults and children.

Studies have reported that patients with AML have high symptom burden (Rodin et al., 2013; Storey, Gray, & Bryant, 2017; Zimmermann et al., 2013) and are more likely to experience functional decline while hospitalized (Klepin et al., 2016; Storey et al., 2017). Short-term effects of intensive chemotherapy, including cancer-related fatigue (CRF), physical function, and QOL, have been reported to be stable over time, regardless of age (Mohamedali et al., 2012). Survivors of acute leukemia experience increased symptoms and are at risk for functional decline (Albrecht, 2014; Bryant, Walton, Shaw-Kokot, et al., 2015). In a systematic review, Bryant, Walton, Shaw-Kokot, et al. (2015) found that acute leukemia and its treatment have a significant effect on all QOL domains. Research has shown that a history of psychological illness, such as general anxiety disorders, depression, and bipolar disorder, is associated with higher levels of anxiety in early AML (Albrecht, 2014; Zimmermann et al., 2013). In addition, symptoms of acute distress disorder often persist following a new diagnosis (Nissim et al., 2013; Rodin et al., 2018). Depression, anxiety, and CRF have been found to be the most prominent symptoms that interfere with QOL and activities of daily living (Bryant, Walton, & Phillips, 2015; Bryant, Walton, Shaw-Kokot, et al., 2015). CRF is a distressing, persistent symptom that is experienced by survivors during and after treatment (Bryant, Walton, Shaw-Kokot, et al., 2015). Prior studies of people with acute leukemia have assessed symptoms and QOL concerns; however, they have had limited data points, lack longitudinal symptoms and functional assessments, have less than optimal racial composition/diversity, and have used a variety of symptom and functional measures.

This study addresses the gap in literature by assessing symptom burden, mobility and function, and QOL weekly in a diverse population of newly diagnosed patients with AML and patients with ALL until they are discharged from the hospital. This longitudinal study evaluates global physical and mental health, CRF, leukemia-specific QOL, mobility and function, anxiety, depression, sleep disturbance, and pain intensity. The authors hypothesized that symptoms (CRF, anxiety, depression, sleep disturbance, and pain intensity) would be highest at the time of admission and decrease by the time of discharge and that functional abilities would decline during hospitalization and improve by the time of discharge.

Methods

Design

This prospective, longitudinal study recruited patients from May 2015 to August 2017. Adults with acute leukemia were recruited at two National Cancer Institute (NCI)–designated comprehensive cancer centers, the University of North Carolina (UNC) Lineberger Comprehensive Cancer Center and the Duke Cancer Institute, within four days of admission for induction treatment. When a patient demonstrated interest in participating, the charge nurse was consulted and asked to evaluate the patient's eligibility to enroll in the study based on the study inclusion and exclusion criteria. Inclusion criteria were adults aged 21 years or older who had been newly diagnosed with AML, APML, or ALL; had been admitted to the hospital for induction chemotherapy with an expected stay of at least three weeks; and were able to speak and understand English. Patients with previous cancers were excluded. The focus on de novo AML, APML, and ALL was of interest based on understanding the weekly symptom experience of those with a new acute leukemia diagnosis. All individuals with acute leukemias were included because they had a prolonged hospitalization, high risk for symptom toxicities, and risk for functional decline. Patients were approached by the study coordinator, and those who were interested were asked to sign an informed consent form. Once the patients consented, they completed baseline measures. This study was approved by the UNC Lineberger Comprehensive Cancer Center Protocol

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Review Board, UNC Institutional Review Board, and Duke University Institutional Review Board prior to patients participating in any study activities.

Procedure

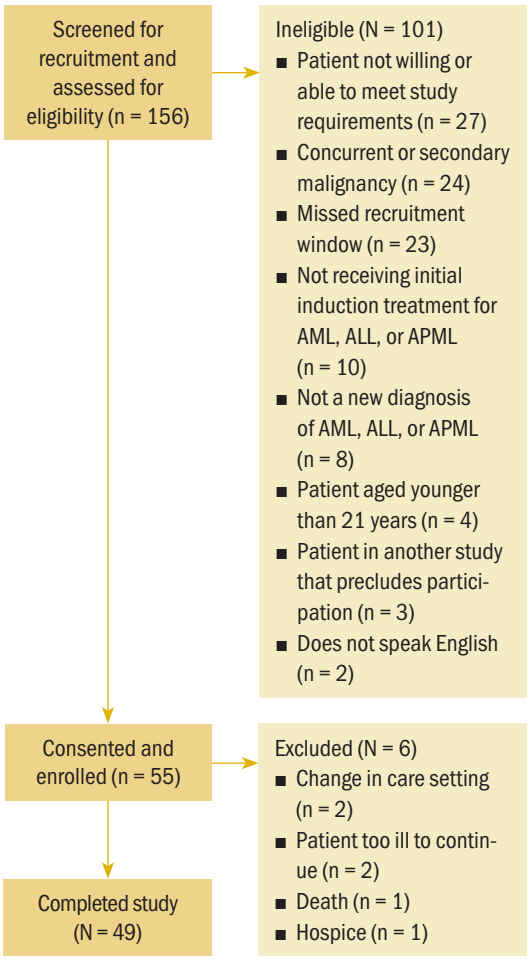
Overall, 156 patients were screened for participation in the study, and 101 were ineligible (see Figure 1) because of exclusion criteria. In total, 55 patients were recruited on a rolling, first-come, first-served basis. Six patients did not finish the study because they were too ill to participate, transferred to hospice, changed institutional or clinical care setting, or died. They were compared to the completers using baseline characteristics. Only data for completers were used in longitudinal analyses. After researchers received informed consent, baseline demographic and patient-reported measures were obtained using paper versions of the measures. Follow-up assessments were completed for PROs and mobility at baseline and every week until patients were discharged. If patients were discharged within four days of their anticipated discharge date based on the trend of their white blood cell count and absolute neutrophil count, that assessment was counted as their discharge assessment. On average, it took 15–20 minutes to complete baseline assessments. The weekly and discharge assessments took 10–15 minutes to complete.

Measures

Patient-reported measures: PROMIS is a National Institutes of Health Roadmap initiative to provide access to self-reported QOL measures with strong evidence of validity and reliability (Yost, Eton, Garcia, & Cella, 2011). The PROMIS measures are scored on a t-score metric with a mean of 50 and standard deviation of 10 in the U.S. general population. Higher PROMIS symptom scores indicate increased symptom burden. This study included PROMIS short-form measures of fatigue (8 items), anxiety (6 items), depression (6 items), pain intensity (3 items), sleep disturbance (8 items), and global physical health and global mental health (10 items). The recall period is the past seven days. The authors compared mean scores using the recommended t-score minimally important differences (MID) ranges for PROMIS scales in adults with acute leukemia undergoing induction chemotherapy: eight-item fatigue (3–5), six-item anxiety (3–4.5), and six-item depression (3–4.5) (Yost et al., 2011). In the absence of study-specific information on the MID for the eight-item sleep disturbance and three-item pain intensity PROMIS measures, the authors used the 0.5 standard deviation estimate (5 points) (Yost et al., 2011). MIDs are also referred to as clinically meaningful differences.

The Functional Assessment of Cancer Therapy–Leukemia (FACT-Leu), version 5.0, is another patient-reported 44-item scale (the FACT-General has 27 items). The FACT-Leu uses a five-point Likert-type scale ranging from 0 (not at all) to 4 (very much). The authors used only the 17 leukemia-specific questions (leukemia subscale) to measure symptom concerns (the PROMIS Global Health measure was used for physical and mental QOL). Scores were obtained by summing item responses coded so that larger scores indicated better QOL. The leukemia subscale has been validated (Cella et al., 2012). A meaningful clinical change for the FACT-Leu is a 13- to 17-point difference out of a maximum score of

FIGURE 1. Flowchart of Sample



ALL—acute lymphoblastic leukemia; AML—acute myeloid leukemia; APML—acute promyelocytic leukemia

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176 (Cella et al., 2012). Because the authors used only the leukemia subscale, the point difference was 4–7 (Trask et al., 2012).

Physical function measures: Physical function measures were performed to evaluate patient independence and physical mobility. Physical function measurements were taken at baseline (within four days of admission), weekly, and at the time of discharge.

TABLE 1. Sample Characteristics (N = 49)

Characteristic	$\bar{X}$	SD	Range
Age (years)	51.6	15.8	21–88
Characteristic			**n**
Gender			
Male			36
Female			13
Race			
White			39
African American			8
Native Indian or Alaskan			1
Other			1
Ethnicity			
Non-Hispanic			47
Hispanic or Latino			2
Education			
Less than high school			3
High school graduate or GED			17
Associate degree or some college			12
Bachelor's degree			8
Advanced degree			8
Missing data			1
Household income ($)			
Less than 20,000			13
20,001–40,000			7
40,001–60,000			7
60,001–80,000			7
80,001–100,000			3
More than 100,000			8
Missing data			4
Marital status			
Single or never married			9
Married or partnered			30
Separated or divorced			9
Widowed			1

Functional data included the patient-rated Karnofsky Performance Status scale (KPS) score (Karnofsky, 1949), clinician-rated KPS score (Karnofsky, 1949; Schag, Heinrich, & Ganz, 1984), and Timed Up and Go Test (TUG) score. The KPS is a general measure of patient independence and ability to carry out normal activities and self-care needs. KPS scores range from 0–100, with higher scores indicating better functional status. The KPS and TUG were administered by the study coordinator at each site. The study coordinator asked each patient before each TUG assessment about his or her ability to complete the TUG and looked at the medical record to make sure the patient had not recently fallen. The TUG is a performance timed test of physical mobility and measures how long (in seconds) it takes a patient to stand up from a standard arm chair, walk 10 feet, turn around, walk back to the chair, and sit down (Podsiadlo & Richardson, 1991). The cutoff point is less than 13.5 seconds; a higher score (longer time) indicates lower functioning.

Data Analysis

Descriptive statistics were computed for baseline demographic and clinical characteristics. Completers and dropouts were compared using t tests for continuous characteristics and chi-square tests or Fisher's exact test (FET) as appropriate for categorical characteristics. Patient-reported outcomes and mobility and physical function measures were analyzed using standard linear mixed models with fixed effects (i.e., means) as a function of proportional time from admission to discharge from the hospital. Proportional time was used rather than absolute time because patients' hospitalizations varied in duration. Regression models in proportional time were first used to test for changes in mean outcomes over all time. Analysis of variance models in categorized proportional time (i.e., 0%–20%, 21%–40%, 41%–60%, 61%–80%, and 81%–100%) were then used to compare mean outcomes at later times to initial values. KPS scores were available only at two times (baseline and discharge), so these cases were tested for a change in mean from baseline to discharge. The advantages of linear mixed models are that data for patients with partial sets of outcomes do not have to be dropped and the missing values do not have to be imputed. The covariance structure was initially based on a random intercept along with a random time effect, but in all cases, the random time effect was nonsignificant. Consequently, reported results used only a random intercept, which generates the compound symmetry covariance structure with constant

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correlations between measurements at two distinct times and constant variances at all times. As a conservative assessment of power, a sample size of 49 is sufficient to detect a moderate effect size of 0.57 at 5% significance with 80% power for a change in the mean of any one outcome from baseline to discharge.

Results

Sample Characteristics

Forty-nine adults aged 21–88 years were included in the sample (see Tables 1 and 2). Thirty-six were male, 39 were White, 28 had studied beyond a high school diploma, and 33 had AML. On average, length of stay was 33.2 days (SD = 10.2 days). The mean body mass index was 30.8 (SD = 6.7), indicating overweight or obese status for these patients. Most patients had a clinician KPS score of 70 or higher at baseline; only four patients were rated less than 70 at baseline. The most common treatments were cytarabine and daunorubicin or idarubicin for AML and dexamethasone or prednisone, cyclophosphamide, L-asparaginase, and etoposide for ALL. The 49 completers and six dropouts did not show significant differences in all the baseline characteristics in Table 1 and 2 except that dropouts were more likely to have high blood pressure (6 of 6 compared to 21 of 48, FET p = 0.01) and diabetes (4 of 6 compared to 8 of 38, FET p = 0.021).

Analyses of Patient-Reported Outcomes

Table 3 reports on changes from baseline through discharge for weekly assessed PROs. Global mental health and pain intensity did not change significantly. Mean global physical health improved significantly ($p = 0.028$) by 2.5 units, mean fatigue decreased significantly ($p < 0.001$) by 4.5 units, mean anxiety decreased significantly ($p < 0.001$) by 6.6 units, mean depression decreased significantly ($p = 0.004$) by 2.9 units, and mean sleep disturbance decreased significantly ($p = 0.005$) by 3.6 units. Mean scores on the leukemia subscale increased significantly ($p < 0.001$) by 5.6 units.

Mobility and physical function measures are presented in Table 4. Patients' TUG scores improved by 4.8 seconds ($p < 0.001$). TUG scores were measured less often than weekly assessed PROs for various reasons, including missing data, worsening of function, patients not feeling well, and patients being out of the hospital room. Patient-rated KPS scores improved significantly ($p = 0.015$) by 6.8 units, whereas coordinator-rated KPS scores did not change significantly.

Table 5 contains results for models in terms of categorical proportional time. Because the length of stay varied from 12–63 days, with an average of 33.2 days, each 20% of proportional time corresponds to 2.4–12.6 days and 6.96 days on average. For each outcome measure, four tests were conducted, so in these cases, a Bonferroni correction would consider a p value to be significant if it were less than 0.05/4 = 0.0125. Except for global mental health, the authors observed at least a trend toward an improvement later in percent time during hospitalization. A significant improvement was observed at 81%–100% for fatigue, FACT-Leu, and TUG scores, and a significant improvement was observed at 61%–80% and 81%–100% for anxiety.

Discussion

This is the first study to longitudinally explore symptoms, mobility and function, and QOL in those with acute leukemia using PROMIS measures until patient discharge. The current findings support extant literature of physical and psychological symptoms that fluctuate during hospitalization and trend back to baseline before discharge (Albrecht, 2014; Albrecht, Boyiadzis, Elswick, Starkweather, & Rosenzweig, 2017; Albrecht, Lee Walton, & Leak Bryant, 2015); patients experience functional decline earlier in their hospitalization and start to improve midway to near discharge (Bryant et al., 2017; Bryant, Walton, Shaw-Kokot, et al., 2015; Storey et al., 2017), and QOL improves during

TABLE 2. Clinical Characteristics

Characteristic	$\bar{X}$	SD	Range
Body mass index (N = 45)	30.8	6.7	20.5–48
Height (cm) (N = 45)	173.8	11	150–193
Length of stay (days) (N = 49)	33.2	10.2	12–63
Weight (kg) (N = 45)	92.4	10	52.2–143.1
Characteristic			**n**
Type of leukemia (N = 47)			
AML			33
ALL			9
APML			5
Comorbidities			
High blood pressure (N = 49)			21
Arthritis (N = 49)			17
Depression (N = 48)			10
Diabetes (N = 46)			8
GI disorders (N = 48)			8
Heart disease (N = 48)			7
Circulation issues (N = 48)			5

ALL—acute lymphoblastic leukemia; AML—acute myeloid leukemia; APML—acute promyelocytic leukemia; GI—gastrointestinal

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hospitalization and beyond treatment (Zimmermann et al., 2013). The current study contributes by examining symptoms, function and mobility, and QOL from baseline to discharge and categorical proportional time (e.g., weekly). The current findings are the first step toward more widespread use of PROMIS measures in this population to better understand the symptom experience, which may lead to early use of palliative care and/or psychosocial services.

Some important clinical implications warrant further discussion. For example, when compared at baseline and discharge, patients improved in all but one patient-reported domain (pain intensity). One plausible reason for pain intensity not being statistically significant could be related to broad pain intensity questions versus specific pain intensity questions related to mucositis or joints. A specific pain intensity measure may provide more details that would elicit a more comprehensive response. Pain and fatigue have strong associations with sleep disruption, and a statistically significant association was found between pain and QOL ($p < 0.001$) in a cross-sectional study of 406 patients with acute leukemia during the first year after diagnosis (Miladinia, Baraz, Ramezani, & Malehi, 2018).

Leukemia-specific symptoms decreased from baseline to discharge, indicating improved leukemia QOL symptoms, which may be due to the initiation of chemotherapy ($\bar{X} = 43.5$ at baseline; increase of 5.4, $p < 0.001$). The current authors used the leukemia subscale, which focuses on 17 symptoms experienced by patients with leukemia (versus the entire 47-item FACT-Leu scale), because of patient burden. Therefore, caution should be taken when interpreting the leukemia subscale findings.

In addition, specific PROMIS measure scores were higher than the mean of 50 at baseline (fatigue, anxiety, and sleep disturbance), indicating a higher symptom score than the general U.S. population. These findings are similar to those of breast and prostate cancer studies that have higher means. Other scores were about 50 or less, indicating a lower symptom level of that construct (PROMIS global physical and mental health scores, depression, pain intensity, and leukemia symptoms) (Jensen et al., 2017).

TABLE 3. Patient-Reported Symptoms From Baseline to Hospital Discharge

Self-Report Measure[a]	Measurements Over Time[b]	Est Baseline $\bar{X}$[c]	Est Change by Discharge[c]	p[c]	MID
PROMIS[d]					
Global physical health	246	42.2	2.5	0.028	*
Global mental health	249	48.5	0.2	0.847	*
Fatigue	248	58.2	−4.5	< 0.001	3–5
Anxiety	246	55.8	−6.6	< 0.001	3–4.5
Depression	247	50	−2.9	0.004	3–4.5
Sleep disturbance	247	52.8	−3.6	0.005	*
Pain intensity	246	44.1	−2.1	0.084	*
FACT-Leu					
Leukemia subscale	246	43.5	5.4	< 0.001	4–7[e]

* SD = 0.5, which is 5 points
[a] A positive change in global physical and mental health indicates improved health or functioning from admission to discharge. Negative changes in symptoms (fatigue, anxiety, depression, sleep disturbance, pain intensity) indicate reduced symptom burden from baseline to discharge. A positive change in scores on the leukemia subscale (range = 0–68) indicates improved quality of life from baseline to discharge.
[b] N = 49, with 1–9 measurements per patient
[c] Estimates and p values were computed using linear mixed models with fixed effects (i.e., means) as a function of proportional time between admission and discharge and compound symmetry covariance matrix.
[d] Mean t scores are presented for each PROMIS domain. Higher t scores reflect a greater level of the construct measured. PROMIS values 0.5–1 less than the mean in the general U.S. population ($\bar{X} = 50$, SD = 10) indicate mild symptoms or impairment, values 1–2 less than the mean indicate moderate symptoms or impairment, and values 2 or more less than the mean indicate severe symptoms or impairment.
[e] Trask et al., 2012
est—estimated; FACT-Leu—Functional Assessment of Cancer Therapy–Leukemia; MID—minimally important difference; PROMIS—Patient-Reported Outcomes Measurement Information System

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TABLE 4. Mobility and Physical Function From Baseline to Hospital Discharge

Measure	N	Measurements Over Time	Est Baseline $\bar{X}$	Est Change by Discharge	p[b]	MID
Timed Up and Go Test[a]	48	207	16.4	–4.8	< 0.001	≤ 13.5 seconds
Patient-rated KPS[b]	49	89	76.1	6.8	0.015	*
Coordinator-rated KPS[b]	49	94	83.1	–1.5	0.371	*

* No MID or clinical significance
[a] 1–8 measurements per patient; estimates and p values were computed using linear mixed models with fixed effects (i.e., means) as a function of proportional time between admission and discharge and compound symmetry covariance matrix. Negative change indicates improved mobility from admission to discharge.
[b] 1–2 measurements per patient; estimates and p values were computed using linear mixed models with fixed effects (i.e., means) as a function of the indicator for measurement at discharge and compound symmetry covariance matrix. Positive change indicates improved function from baseline to discharge.
est—estimated; KPS—Karnofsky Performance Status scale; MID—minimally important difference

Global physical and mental health scores improved from baseline to discharge. Fatigue, one common symptom experienced by this population (Bryant, Walton, Shaw-Kokot, et al., 2015), decreased on average by 4.5 units, which is clinically significant (MID = –5). Fatigue is a multifactorial symptom with fluctuating severity during and beyond treatment (Bryant, Walton, & Phillips, 2015). These findings are consistent with those of other acute leukemia studies about fatigue being problematic at various points during the disease process. Fatigue improves just by treating patients for their disease. There is no one way to decrease fatigue levels; however, Putting Evidence Into Practice guidelines may be used to improve fatigue (Mitchell et al., 2014). To date, a paucity of studies have followed acute leukemia survivors for more than two years to help elucidate the late effects treatment has on fatigue and other physical symptoms (Lowe, Yu, Wolf, Samsa, & LeBlanc, 2018).

Anxiety and depression are often combined for a total score but are two distinct psychological concepts with different supportive treatments. The mean anxiety score at baseline was 55.8 (with a decrease of –6.6, $p < 0.001$). The current study has shown a decrease or a statistically significant finding related to anxiety and depression during hospitalization, consistent with findings in other studies of patients with acute leukemia (Alibhai et al., 2012; Battaglini et al., 2009; Chang et al., 2008; Klepin et al., 2011). Klepin et al. (2011) found no statistical changes in depressive symptoms of older adults receiving intensive chemotherapy for AML. No statistical change may be related to an older population that presented with lower depression scores compared to younger adults. In Gheihman et al. (2016), clinically significant depressive symptoms related to high symptom burden were common in early hospitalization. Depressive symptoms may be related to disease progression, symptom burden, and reality of the prognosis.

Sleep disturbances and irregular sleep patterns are common among patients in hospitals. Sleep scores decreased (sleep improved) from overall baseline to discharge, which may be related to patients becoming more aware of and anticipating disruptions, such as vital signs every four hours, ongoing assessments by nurses and the medical team, medication administration, and concerned visitors and family (Hacker, Kapella, Park, Ferrans, & Larson, 2015; Hacker, Patel, & Stainthorpe, 2013). Inadequate sleep has serious consequences, including slowed recovery from illness, changes in mental status, and decreased QOL (Cohen et al., 2012; Hublin, Partinen, Koskenvuo, & Kaprio, 2007). Factors that may contribute to sleep disturbances include multiple treatment side effects, such as diarrhea, nausea, and vomiting, leading to decreased quality of sleep.

Most patients had a coordinator-rated KPS score of 70 or higher at baseline, indicating an ability to care for themselves. Other acute leukemia studies revealed similar functional decline from baseline to one month, with gradual improvement toward baseline over time (Alibhai et al., 2007). Overall, patients' TUG scores decreased by 4.8 seconds, indicating that their function and mobility had improved during hospitalization (more than 13.5 seconds indicates lower functioning). This may be attributable to oncology nurses encouraging patients to get out of bed, consulting physical and occupational therapy services, and treating the acute leukemia. Longitudinal studies with larger samples are needed to detect changes in function and QOL during hospitalization.

Ultimately, PROs help to determine more appropriate times to test symptom and functional

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TABLE 5. Results for Patient-Reported and Mobility Outcomes in Terms of Categorized Percentage Time During Hospitalization

	Time During Hospitalization (%)									
	0–20		21–40		41–60		61–80		81–100	
Outcome Measure Y[a]	$\bar{X}$	p[b]	$\bar{X}$	p[b]	$\bar{X}$	p[b]	$\bar{X}$	p[b]	$\bar{X}$	p[b]
PROMIS										
Global physical health	55.4	–	53.6	0.073	51.6	0.001	50.6	< 0.001	50.3	< 0.001
Global mental health	49.7	–	49.2	0.799	47.9	0.087	48	0.112	47.4	0.015
Fatigue	52.2	–	51.9	0.755	51.1	0.392	49.8	0.067	49.6	0.026
Anxiety	44.4	–	42.5	0.114	43.2	0.33	43.4	0.415	41.9	0.028
Depression	44.5	–	45.8	0.393	46	0.354	44.6	0.996	49.4	0.001
Sleep disturbance	15.2	–	14.9	0.66	13.2	0.014	13.6	0.051	11.8	< 0.001
Pain intensity	44.4	–	42.5	0.114	43.2	0.33	43.4	0.415	41.9	0.028
Other										
FACT-Leu	44.5	–	45.8	0.393	46	0.354	44.6	0.996	49.4	0.001
Timed Up and Go Test	15.2	–	14.9	0.66	13.2	0.014	13.6	0.051	11.8	< 0.001

[a] Numbers of patients and measurements are reported in Tables 3–4. Results were generated using linear mixed models with one-way analysis of variance fixed effects and compound symmetry covariance. Larger values indicated better global physical health, global mental health, and FACT-Leu (Leukemia subscale only) scores (range = 0–68). Smaller values indicated less fatigue, anxiety, depression, sleep disturbance, and pain intensity, as well as better mobility.
[b] p values for the t test of difference in means for the current percent time range were compared to 0%–20%.
FACT-Leu—Functional Assessment of Cancer Therapy–Leukemia; PROMIS—Patient-Reported Outcomes Measurement Information System
Note. PROMIS values 0.5–1 less than the mean in the general U.S. population ($\bar{X}$ = 50, SD = 10) indicate mild symptoms or impairment, values 1–2 less than the mean indicate moderate symptoms or impairment, and values 2 or more less than the mean indicate severe symptoms or impairment.
Note. For the Timed Up and Go Test, 10 seconds or less indicates normal function, 11–29 seconds indicates good mobility, and 30 seconds or more indicates problems. A score of 14 seconds or more has been shown to indicate high risk for falls.

management interventions in hospitalized adults newly diagnosed with acute leukemia. Clinically, this study helped answer the authors' question about how symptoms, functional status, and QOL change during weekly hospitalization. For example, patients were admitted with high levels of anxiety ($\bar{X}$ = 55.8), which decreased as they become more familiar with the disease process, nursing and medical staff, and articulation of their concerns. Patients also physically and psychologically prepared to have their bone marrow biopsy around day 14, and they may have anticipated discomfort and the negative results from the bone marrow biopsy.

This study provides insight as to when extra diligence in preventing, monitoring, and intervening with specific leukemia symptoms could exacerbate other symptoms in this population. The current findings demonstrate that a similar pattern of symptoms (except pain intensity) is high at baseline, decreases after being in the hospital for more than two weeks, and continues to decrease near time of discharge (Albrecht et al., 2017).

Strengths and Limitations

To date, this is the largest study to measure symptoms, physical and mental QOL, and mobility and function in a sample of newly diagnosed adults with acute leukemia (all types) during hospitalization. Albrecht et al. (2017) assessed symptoms and QOL of 19 adults with AML from the time of diagnosis to six weeks postdiagnosis and reported similar findings (Albrecht et al., 2017). In addition, the sample included a racially and ethnically diverse representation (n = 10), most of whom were African American. This study also used valid and reliable measures, including PROMIS, to assess specific symptoms related to this population, global physical and mental health scores to assess overall physical and mental changes during hospitalization, and the leukemia subscale from FACT-Leu to assess leukemia-specific symptoms. The authors demonstrated the ability to recruit from two NCI–designated comprehensive cancer centers with diversity of age and race or ethnicity.

This study has several limitations. Patients with previous cancers were excluded, limiting the

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generalizability of the findings. The small sample size with minimal dropouts was also a limitation. No follow-up assessments were conducted after discharge to determine whether the symptoms continued to subside or remained stable. The authors did not account for previous anxiety or depression conditions that may have inflated these scores at baseline. The relatively small sample and the exclusion of patients with previous cancers and concurrent malignancies preclude the ability to evaluate the effects of these comorbidities on function and QOL. Other symptoms commonly associated with induction chemotherapy, such as nausea and vomiting, oral mucositis, and diarrhea, were not measured in this study. Also, only patients who were healthy enough to complete the weekly assessments were included in the analyses, which may have skewed the data. Patients with high blood pressure and diabetes were unable to complete the assessments because of symptom burden.

Additional objective mobility and functional assessments, including comorbidities, would provide a more comprehensive picture of patients who enter treatment (frail to healthy). Limited clinical data inclusive of tumor biology and specific treatment plans exist. Analyses considered only the effect of time during hospitalization, but the covariates of Tables 1 and 2 might influence the results; analyses considered only the effect of time during hospitalization.

Implications for Practice and Research

The results of this study suggest that oncology nurses can help to address specific symptoms, such as anxiety, fatigue, depression, and sleep disturbance, during hospitalization, particularly at the beginning of treatment before symptom- and treatment-related toxicities occur. Patients in this study are highly vulnerable to symptom burden and functional decline, warranting ongoing physical, psychological, and functional assessments, which are essential in identifying and intervening early for symptoms and decrements in function. Oncology nurses can support patients who experiences these unfavorable effects from treatment and disease by managing acute leukemia-specific symptoms and co-occurring symptoms from chronic illnesses.

Physical activity and mindfulness interventions could be incorporated into care during initial treatment to assist patients in self-management practices during treatment. This would allow patients to better manage their psychosocial issues that may impede engagement in activities, which may, in turn, improve their symptoms and function. Using the skills learned from the interventions for subsequent treatments (consolidation and hematopoietic stem cell transplantation) may contribute to better symptom management, improved function and mobility, and overall survival.

KNOWLEDGE TRANSLATION

- Anxiety is high at the time of admission and decreases significantly after the midpoint of hospitalization.
- Fatigue is a multifactorial symptom that decreases during hospitalization, which suggests that it can be appropriately managed in the inpatient setting.
- Patients with acute leukemia face a unique and often challenging situation because of high symptom burden that can affect their physical and mental health.

Future prospective, longitudinal studies that follow this population over time would be helpful to inform interventions. Studies investigating patients with high symptom burden are important to ensure that healthcare professionals are appropriately addressing their needs and concerns. The Cancer Moonshot Blue Ribbon Panel (2016) recommends the following:

> Systematically gathered patient-reported outcomes data and evidence-based symptom management for patients from diverse communities are needed to improve patients' quality of life and the likelihood that they will adhere to treatments that are effective rather than abandoning them because of intolerable side effects. (p. 3)

Future studies should broaden the eligibility criteria, including all adults with acute leukemia, such as those with previous cancers, to assess symptoms, function, and QOL.

Conclusion

Adults with acute leukemia who are treated in the hospital experience a high level of symptom burden at baseline. During the four- to six-week hospital stay, the symptoms start to decrease and patients become more comfortable with the hospital setting and oncology clinicians. Understanding the symptoms experienced by this population can help oncology nurses provide comprehensive strategies for management at baseline and throughout hospitalization.

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