ICU Recovery Clinic Attendance, Attrition, and Patient Outcomes: The Impact of Severity of Illness, Gender, and Rurality

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Objectives: The primary purpose is to characterize patients attending ICU recovery clinic and then describe their trajectory of cognitive and emotional health in 1 year.

Design: Retrospective observational study to assess attendance, attrition, and patient outcomes.

Setting: ICU Recovery Clinic.

Patients: Adult patients recently admitted to ICU for sepsis or acute respiratory failure and who were referred to clinic.

Interventions: None.

Measurements and Main Results: Thirty-eight patients (63%) attended ICU recovery clinic with a mean age of 53.2 ± 16 years (range, 20–82 yr), 42% female and mean Sequential Organ Failure Assessment scores at an ICU admission of 9.4 ± 2.9 participated in outcomes. Twelve patients (32%) were lost to follow up and 12 patients (32%) were transferred to different providers before the end of 1 year. Sequential Organ Failure Assessment scores were negatively associated with health-related quality of life at baseline ($r = -0.41$; $p = 0.033$; $n = 28$) and short term ($r = -0.40$; $p = 0.037$; $n = 27$). Male patients had higher Sequential Organ Failure Assessment scores (mean difference $= 2.4$; $t = 2.779$; $p = 0.008$) and longer hospital length of stay (mean difference $= 9.3$; $t = 2.27$; $p = 0.029$). Female patients had higher scores on Hospital Anxiety and Depression Scale (mean difference $= 7.2$; $t = 2.74$; $p = 0.01$) and Impact of Events Scale-Revised (mean difference $= 18.9$; $t = 2.74$; $p = 0.011$) at the initial follow-up visit. Patients never attending clinic were more likely to live further away, have a tracheotomy, and spent longer time in the ICU.

Conclusions: Attendance and attrition in ICU recovery clinic are related to patient factors (living in rural area) and ICU factors. Data suggest different recovery trajectories exist based on gender, severity of illness, and self-reported outcomes.

Key Words: critical illness; follow-up clinic; patient outcomes; postintensive care syndrome; quality of life

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Five to 6 million Americans require an admission to the ICU every year for acute critical illnesses such as sepsis and acute respiratory distress syndrome (1–3). Reductions in ICU mortality rates combined with increased admissions for critical illness equate to millions of survivors (4–8). Survival is an important outcome in critical care, but significant data demonstrate that surviving critical illness is not without consequences including a high risk of long-term disability and subsequent mortality (9–15). Physical, psychologic, or emotional, and cognitive impairments emerging as the direct result of critical illness are a clinical syndrome known as postintensive care syndrome (PICS) (16). As estimated, 25–66% of patients surviving critical illness will develop at least one symptom of PICS (17, 18). The heterogeneity and complexities of critical illness lead to diverse clinical manifestations of PICS with patients frequently suffering from one or multiple symptoms such as neuromuscular weakness, anxiety, depression, posttraumatic stress disorder (PTSD), and cognitive impairment (19).

The prevention or mitigation of PICS starts with structured care in the ICU targeting risk factors by minimizing sedation, encouraging early active mobilization, and providing psychologic therapies such as ICU diaries, nutritional support, and sleep hygiene (20, 21). Despite practice guidelines such as the ICU Liberation Bundle (A–F), patients surviving critical illness continue to suffer from long-term impairments that compromise reintegration into society
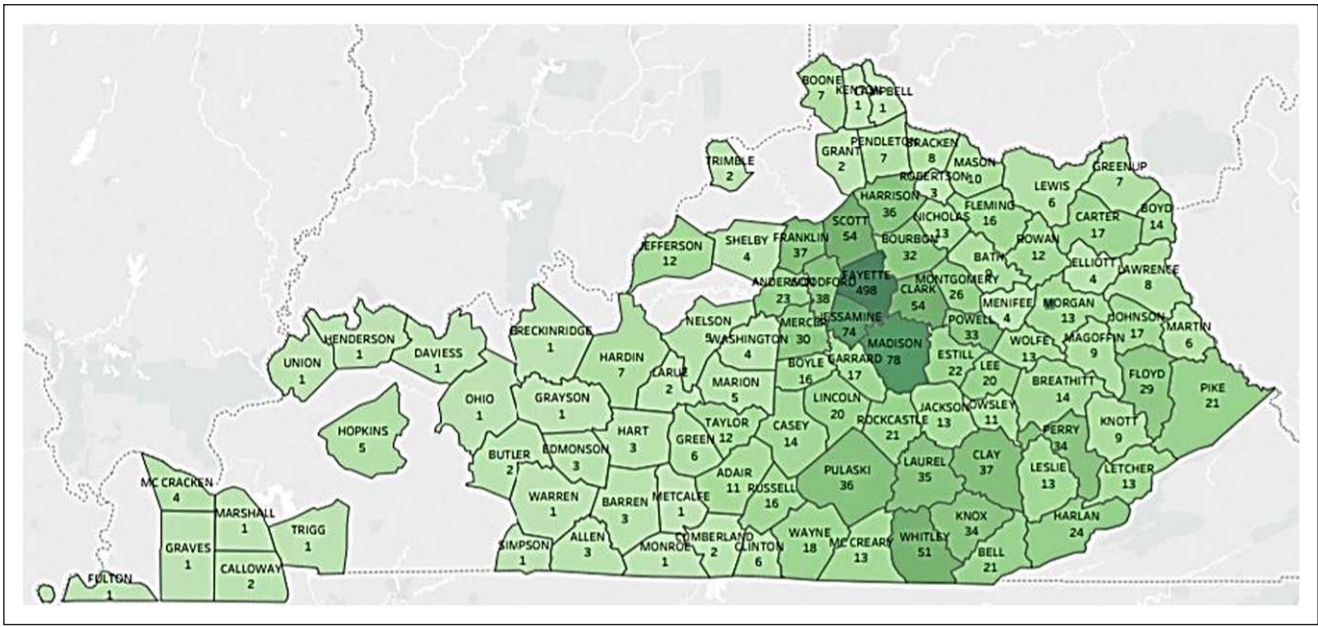
Figure 1. Admission to University of Kentucky Medical ICU stratified by the county of residence for 2018.

and reduce quality of life (22–24). Subsequently, interventions and initiatives to treat PICS have led to an emphasis on establishing post-ICU follow-up clinics (25–27). The overarching goals of ICU follow-up clinics are to identify, assess, and treat medical, physical, emotional, and cognitive issues following critical illness. However, there are barriers to implementing an ICU recovery clinic including high attrition, necessary financial support to develop a clinic, and concerns about resource allocation versus profit, as well as discussions around which providers should lead these initiatives (26, 28, 29). Additionally, tertiary-care and academic medical centers that treat patients from outside communities lead to complexity of providing in-person follow-up care, for example, patients required to travel back to center for their follow-up appointment.

In 2013, the ICU recovery clinic at the University of Kentucky (UKY) was established to care and support patients surviving critical illness in the state of Kentucky. Since inception, the clinic has undergone multiple periods of transition evolving to the current transdisciplinary model with involvement from five disciplines. Providers participating in this clinic work collaboratively to manage and optimize PICS complications through routine assessments, follow-up communications, and regularly scheduled visits. A primary focus of the UKY ICU recovery clinic is defining baseline cognitive and psychologic function and monitoring change over the first year following ICU discharge. The primary purpose of this study is to characterize patients attending ICU recovery clinic and then describe their trajectory of cognitive and emotional health over the first year of recovery. We will explore relationships between the demographics including geographic location and clinical variables with attendance to clinic as well as scores on cognitive and emotional health outcome.

STUDY DESIGN AND METHODS

This is a retrospective descriptive study designed to describe the characteristics of patients receiving care in an ICU recovery clinic

and elucidate the change in PICS specific outcome measures in patients treated for up to 1 year in the ICU recovery clinic.

Ethical Considerations

This study was approved by the Institutional Review Board of the UKY. Informed consent was waived due to retrospective design of this study.

ICU Recovery Clinic Population: Regional Problem

The University of Kentucky Healthcare (UKHC) includes a level 1 academic trauma center with nearly 38,000 independent admissions in 2019. UKHC includes three distinct medical ICUs (MICUs) with the capacity for 56 critical care beds. In 2019, the MICU provided care for 2,618 independent admissions with 20% of patients (498) living in Lexington and Fayette County, Kentucky. UKHC is a regional center providing treatment for patients across the Commonwealth of Kentucky, including more than 25% of patients (640) living in rural Southeastern Kentucky (**Fig. 1**). For all patients in the MICU in 2019, the mean Sequential Organ Failure Assessment (SOFA) score is 6.3, mean duration of mechanical ventilation (MV) is 3.8 days, mean ICU length of stay (LOS) is 4.9 days, and all-cause mortality is 21.2%.

ICU Recovery Clinic: Transdisciplinary Team

Prior to 2012, patients admitted for critical illness to the MICU would not receive specialized care after discharge from the hospital. Due to the nature of critical illness with risk of readmission and high risk for PICS, the ICU recovery clinic was developed early in 2013 as a physician-driven model. In 2016, the clinic transitioned to a transdisciplinary approach with the addition of a pharmacist, a physical therapist (PT), and an advanced practice provider (APP). A social worker was added in 2019 to complete the current transdisciplinary team.

ICU Recovery Clinic: Implementation and Operations

The ICU recovery clinic was initiated to offer coordinated outpatient care to MICU patients at risk for PICS with eligibility summarized in **Supplemental Table 1** (http://links.lww.com/CCX/A296). Patients are identified by ICU providers or primary team members during ICU admission. The goal of early referral is to establish contact prior to discharge and provide educational materials about PICS and the ICU recovery clinic along with contact information. The overarching goal of the ICU recovery clinic is to maximize quality of life with an emphasis on preventing, mitigating, and treating symptoms related to PICS. The clinic is designed with intent to transition medical care back to patient's primary care provider by the end of 1 year. The clinic is open at a minimum of bimonthly and frequently open weekly with capacity to treat up to six patients per session. The preferential timeline to promote and achieve patient goals includes scheduled appointments 1-week and 1-, 3-, 6-, and 12-month postinstitutional discharge. This general timeline serves as a framework that is individualized per patient needs and goals. Patients identified as low risk of PICS during clinic visits may be transitioned to their primary care provider (PCP) or different subspecialty (e.g., cardiology) before completion of the full-year post-ICU timeline.

ICU Recovery Clinic: Assessment of PICS

In addition to treatment for ongoing medical issues, patients complete a battery of outcome measures to assess physical, emotional, and cognitive health, which assist in the plan of care including referral for treatment. Physical disability is assessed by the team PT. Anxiety and depression are assessed with the Hospital Anxiety and Depression Scale (HADS), a 14-item scale with subset scores of greater than eight of 21 indicating anxiety or depression (30, 31). Distress and PTSD are captured through the Impact of Events Scale-Revised (IES-R), a 22-item self-report measure, with score greater than 33 of 88 recommending provisional diagnosis of PTSD (32). Health-related quality of life (HRQoL) is assessed by 5D Euro-Quality of Life (EQ-5D-5L), a self-report instrument including five questions and a visual analog scale (0–100) (33). Cognitive function is assessed by the Montreal Cognitive Assessment (MOCA) administered by the APP or PT, with less than 23 of 30 distinguishing mild cognitive impairment (34, 35). Social determinants of health, caregiver resources, and treatment for mental and emotional health are commonly assessed by the social worker.

ICU Recovery Clinic: Data Collection

Demographic and clinical data were extracted from the electronic medical records for patients scheduled to have their first follow-up appointment in the ICU Recovery from September 2018 to June 2019. Specifically, age, gender, geographic location of home defined by continuous variable (miles from clinic) and binary yes or no for home in rural area designated by Health Resources and Services Administration (36), body mass index (BMI), Charlson comorbidity index (CCI), and clinical data of SOFA at ICU admission, MV days, ICU LOS, hospital LOS, and discharge destination were extracted.

Patients attending ICU recovery clinic and participating in outcomes of HADS, IES-R, EQ-5D-5L, and MOCA were assessed over time to track progress in PICS-related symptoms over the first year of clinic care. Three timepoints were included: first appointment (baseline) with outcomes completed prior to 1-month postinstitutional discharge, short-term follow-up (short) occurring 1- to 8-month postinstitutional discharge, and long-term follow-up (long) greater than 9 months. Secondary indicators of clinic impact included the occurrence of readmissions up to 90 days and transition to PCP or different providers before 12-month visit.

Statistical Analysis

Continuous variables (age, BMI, CCI, SOFA, MV days, ICU LOS, and hospital LOS) were reported as median and interquartile range (IQR) or mean and sd according to data distribution. Binary and categorical variables were reported as counts and proportions (gender and discharge destination). Independent *t* tests (Mann-Whitney *U* tests for nonparametric data) and chi-square test were performed to determine the differences in patients attending their first follow-up visits in comparison with patients never attended (no-show or canceled). For patients completing outcomes in clinic, the mean (sd) for continuous cognitive, emotional, and HRQoL outcomes was described based on trajectory of recovery across the first year with paired changes in scores on outcomes reported with median and IQR (25–75%). For patients completing all timepoints, the change was assessed by repeated-measures analysis of variance (RM ANOVA). Correlative tests were performed to assess the relationship between the demographic and clinical variables with continuous patient outcomes. Emotional, cognitive, and HRQoL were reported based on the cutoff defined above. Differences in outcomes due to gender (0 = female, 1 = male) were assessed with independent *t* test. In addition, independent *t* test were performed with patients grouped based on completion of the 12-month follow-up visit or transitioned to PCP/subspecialty prior to long-term visit. Risk of readmission and mortality was not assessed due to sample size and low incidence of occurrences in this cohort.

RESULTS

Demographics and Clinical Variables

Attendance. Fifty-nine patients were referred to ICU recovery clinic for the first time from September 2018 to June 2019 with 38 patients attending their appointment (64%). Twenty-one patients (36%) did not attend their scheduled appointment: four died before appointment date, 10 patients did not show, and seven patients cancelled without scheduling a follow-up. There were an additional 16 patients with appointments during the timeframe that was established prior and thus not included in this study. For all 59 patients in this study, the mean SOFA score at the ICU admission is 9.4 ± 2.8 with a median duration of MV of 7.9 days (IQR, 4.3–13.8 d) and an ICU LOS of 11 (IQR, 7.2–18.3). Statistically, there were no differences in age, BMI, sex, CCI, SOFA scores, hospital LOS, or discharge destination in patients attending versus patients not attending ICU recovery clinic (Table 1). Patients that did not attend their appointment lived further away from clinic with a median distance of 123 miles (IQR, 36–150) compared with a median distance of 33 miles (IQR, 3–79) away from clinic

TABLE 1. Patient Demographic and Clinical Data

Variable	ICU Recovery Clinic (Attended) ($n = 38$)	Referred (Did Not Attend/ No Show) ($n = 21$)	z ($p = 0.05$)
Age, yr, mean (SD)	53.2 (16)	51 (14.9)	0.44 (0.66)
Female, n (%)	16 (42)	5 (27)	0.35 (0.38)
Body mass index, kg/m^2, mean (SD)	33.5 (9.4)	32.7 (7.6)	0.08 (0.94)
Residence in miles from clinic, median (IQR)	33 (3–79)	123 (36–150)	3.11 (0.002)
Residence designated rural area, n (%)	19 (50)	15 (71)	1.58 (0.11)
Charlson comorbidity index, median (IQR)	2 (1–4.5)	2 (1–4)	0.25 (0.80)
Sequential Organ Failure Assessment score at ICU admission, mean (SD)	9.4 (2.9)	9.3 (2.5)	0.11 (0.91)
Mechanical ventilation, d, median (IQR)	7.1 (4.3–13)	16 (6–18)	1.99 (0.046)
Tracheostomy, n (%)	8 (21)	10 (48)	5.99 (0.008)
ICU stay, d, median (IQR)	9.6 (7–16)	18 (11–21)	2.08 (0.038)
Hospital stay, d, median (IQR)	14 (11–22)	18 (13–31)	1.17 (0.24)
Discharge destination, n (%)			
Home	22 (58)	7 (33)	0.73 (0.20)
Rehabilitation facility, skilled nursing facility/long-term acute care hospital	16 (42)	14 (67)	

IQR = interquartile range.

for patients attending their appointment ($z = 2.73$; $p = 0.002$). Patients not attending ICU recovery clinic were more likely to live in a rural designated area (71% vs 50%), although not statistically significant. In addition, patients not attending sessions had a longer ICU LOS (mean 17.8 ± 7.8 vs 13.7 ± 11.6; $z = 2.08$; $p = 0.038$), more days on MV (12.6 ± 6.5 vs 9.1 ± 7.4; $z = 1.99$; $p = 0.046$), and more likely to have a tracheostomy (58% vs 21%; $x^2 = 5.99$; $p = 0.008$). Discharge destination also influenced attendance with patients requiring higher level of care in a secondary facility not attending clinic (67% vs 42%) (Table 1).

Attrition. Scores on outcome measures were analyzed using available assessment scores obtained during each clinic visit. Not all patients completed each assessment at every clinic visit, due to patient refusal, provider judgment that outcomes were overburdening or not clinically appropriate, and due to patients transitioning before 12-month visit. Of the 38 patients attending appointments in the ICU recovery clinic, three patients did not complete baseline testing: two patients refused and one patient the clinic provider did not perform testing, as the patient presented only for tracheostomy care from an acute rehab facility. At the short-term visit, 28 patients (74%) completed outcome testing with nine patients (24%) not attending their second appointment: seven patients were lost to follow up and two patients transitioned to primary care provider. Only 24% ($n = 9/38$) completed outcomes at long-term follow-up with an additional five patients lost to follow up, 10 patients transitioned to PCP or different subspecialties, and five timepoints not completed due to delaying appointments related to coronavirus disease 2019. In total, 12 patients of initial 38 were lost to follow up (36%) and 12 patients transitioned to PCP or another subspecialty (36%).

PICS Recovery Trajectory. The average time to baseline study outcome measure was 2.5 ± 1.4 week postinstitutional discharge ($n = 38$), average time for short-term follow-up assessment scores was 14 ± 6.5 weeks ($n = 29$), and 42.4 ± 10.5 weeks for the long-term appointment ($n = 9$) (Table 2).

Psychologic Assessments, Cognitive Function, and Quality of Life

HADS. Thirty-five subjects completed baseline assessments for anxiety/depression scoring (HADS) with a mean score of 15.1 ± 8.2 including a mean of 6.5 ± 3.8 for depression and 8.8 ± 4.8 for anxiety subcategories. Twenty-eight patients completed HADS at short term with a mean total of 14.1 ± 6.5. For 28 patients completing HADS at baseline and short term, the median change was –0.5 (IQR, –4 to 2) with an absolute range of –19 to 14. Nine patients completed HADS at long-term follow-up with a mean total of 18.3 ± 11.9, with median change from baseline to long-term follow-up was –3 (IQR, –4 to 7) with an absolute range of –9 to 11 (RM ANOVA $F = 0.465$; $p = 0.637$).

IES-R. The mean IES-R scores at baseline, short-term, and long-term follow-up were 28.2 ± 21 ($n = 35$), 26.8 ± 21 ($n = 28$), and 28.2 ± 20 ($n = 9$), respectively. Twenty-eight patients complete IES-R at baseline and short term with a median change of –3 (IQR, –9.5 to 4) from baseline to short term. Nine patients performed IES-R at all three timepoints with a median change of 0 (IQR, –5 to 14) from baseline to long term (RM ANOVA $F = 0.225$; $p = 0.801$).

MOCA. The mean MOCA scores at baseline, short-term, and long-term follow-up were 23.9 ± 3.2 ($n = 30$), 25.8 ± 2.5 ($n = 23$), and 26.1 ± 3.2 ($n = 8$), respectively. Twenty-four patients completed MOCA at baseline and short term with a median change of +1

TABLE 2. Emotional, Cognitive, and Health-Related Quality-of-Life Outcomes

Outcome Measure	ICU Recovery Follow-Up Timepoints		
	Baseline (< 1 mo), n = 35	Short (1–8 mo), n = 29	Long (> 9 mo), n = 9
Hospital Anxiety and Depression Scale			
Anxiety, mean (SD)	8.8 (4.8)	7.5 (5.2)	9.4 (6.8)
> 8/21, n (%)[a]	19 (55)	12 (41)	3 (33)
Depression, mean (SD)	6.5 (3.8)	7.0 (5.2)	8.9 (5.6)
> 8/21, n (%)[b]	10 (29)	9 (31)	5 (55)
Total	15.1 (7.8)	14.5 (9.9)	18.3 (12)
Impact of Events Scale-Revised			
Total, mean (SD)	28.2 (21)	26.8 (21)	28.2 (20)
> 33/88, n (%)[c]	13 (37)	12 (41)	3 (33)
Montreal Cognitive Assessment			
Total, mean (SD)	23.9 (3.2)	25.8 (2.5)	26 (3.2)
≤ 23/30, n (%)[d]	13 (37)	3 (10)	1 (11)
5D Euro-Quality of Life Visual Analog Scale			
Total, mean (SD)	64.6 (16)	70.8 (20)	68.5 (18)

[a]Subcategory of Hospital Anxiety and Depression Scale (HADS) displaying the percentage of patients meeting the suggested cutoff score greater than eight of 21 leading to provisional diagnosis of anxiety (29).

[b]Subcategory of HADS displaying the percentage of patients meeting the suggested cutoff score greater than 8 of 21 leading to provisional diagnosis of depression (29).

[c]Percentage of patients meeting the suggested cutoff score of greater than 33 of 88 on Impact of Event Scale-Revised leading to provisional diagnosis of post-traumatic stress disorder (30).

[d]Percentage of patients meeting the suggest cutoff score of less than or equal to 23 of 30 for diagnosis of mild cognitive impairment (33).

(IQR, 0–2.5). MOCA improved at a median rate of +2 (IQR, 1–3) from baseline to long term for eight patients completing all three timepoints (RM ANOVA $F = 4.577$; $p = 0.031$) (**Fig. 2**).

EQ-5D-5L. The mean EQ-5D-5L Visual Analog Scale (VAS) at baseline, short-term, and long-term follow-up was 65 ± 16 ($n = 31$), 71 ± 20 ($n = 25$), and 69 ± 18 ($n = 9$), respectively.

Twenty-five patients completed scores at baseline and short term had a median change of 5 (IQR, 0–18). Eight patients performed VAS at all three timepoints with a median change of 17 (IQR, 5–23) from baseline to long term. In nine patients completed all timepoints, EQ-5D VAS improved significantly over the first year (RM ANOVA $F = 11.24$; $p = 0.001$) (**Fig. 3**).
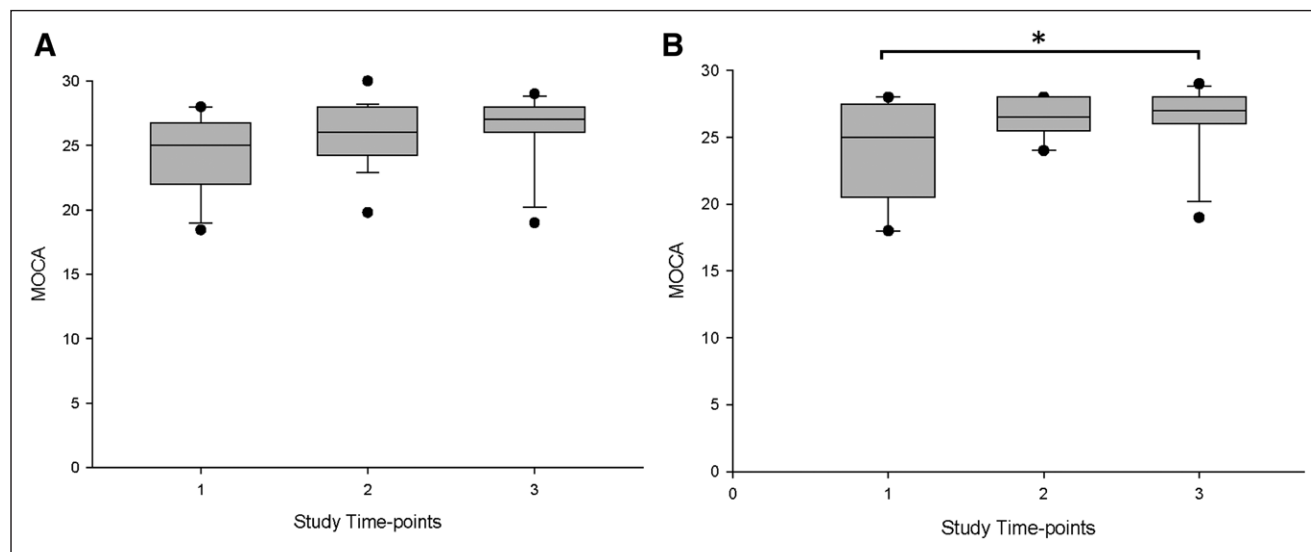

Figure 2. Change in Montreal Cognitive Assessment (MOCA). **A**, No change over time in all patients enrolled ($F = 0.48$, $p = 0.624$). **B**, Improvement in eight patients across three timepoints (repeated-measures analysis of variance $F = 4.6$; $p = 0.031$) with pairwise comparison (Bonferroni t test), demonstrating significantly improved from baseline to long term (mean difference = 2.25; $t = 2.94$; $p = 0.034$).
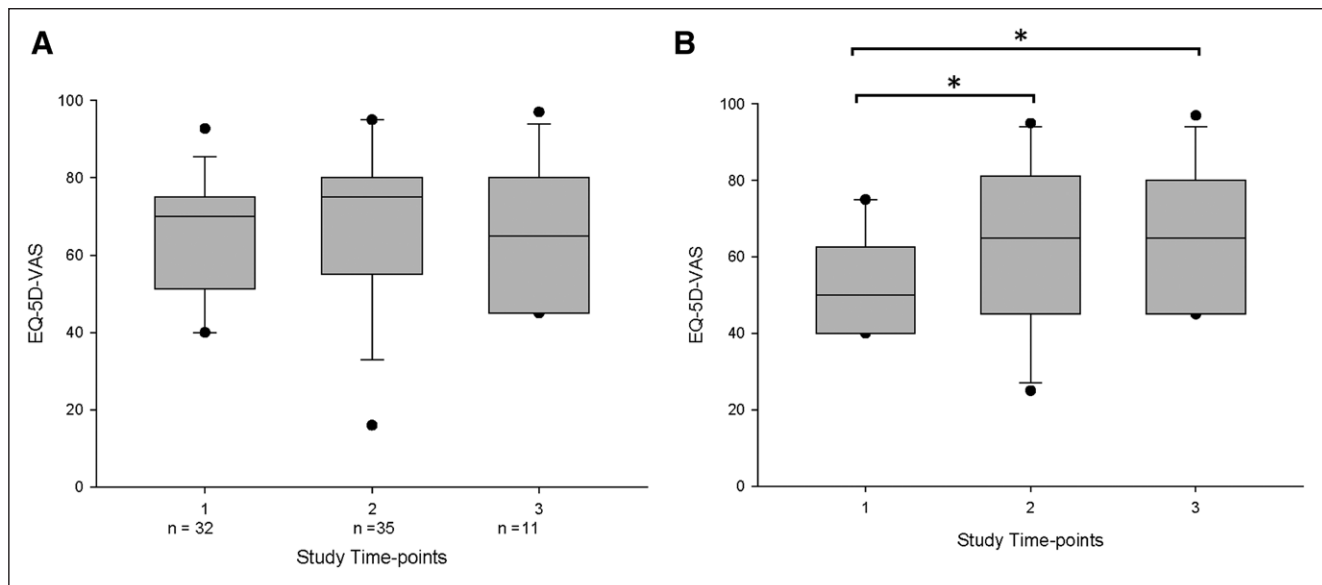
Figure 3. Change in 5D Euro-Quality of Life Visual Analog Scale (EQ-5D-VAS). **A**, All patients enrolled demonstrating minimal difference in outcomes per time-point ($F = 0.19$, $p = 0.827$). **B**, Improvement in eight patients self-reporting quality of life at all three timepoints with improvements over time ($F = 11.2$; $p = 0.001$), with multiple comparisons demonstrating improved from baseline to short term (*mean difference = 15.6; t = 3.96; $p = 0.004$) and baseline to long term (**mean difference 17.2; $t = 4.12$; $p = 0.002$).

Association Between Patient Variables and PICS Outcomes. Age, CCI, BMI, geographic residence, and SOFA scores were not associated with HADS, IES-R, MOCA, or EQ-5D-5L at any time-point in this cohort. MV duration and hospital LOS were weakly correlated with HADS at baseline timepoint ($rs = -0.35$; $p = 0.04$ and $rs = -0.47$; $p = 0.004$) and approaching relationship with IES-R (Table 3). Percentages of patients meeting criteria for diagnosis of anxiety, depression, and PTSD as defined by cutoff scores are summarized in Table 2. SOFA scores were negatively associated with EQ-5D at baseline ($r = -0.42$; $p = 0.02$; $n = 31$), but not short term ($r = -0.33$; $p = 0.01$; $n = 25$).

Differences Based on Gender. Male patients attending ICU recovery clinic had a higher SOFA at ICU admission (10.4 ± 3.6 vs 8.6 ± 2.1; $t = 1.81$; $p = 0.080$) and longer times in the hospital (24 ± 17 vs 16.4 ± 11.1; $t = 1.68$; $p = 0.10$). Female patients

had higher scores on HADS (mean difference [MD] = 9.2; $t = 2.8$; $p = 0.009$) at the baseline visit and long-term visit (MD = 15.3; $t = 2.75$; $p = 0.029$), but these differences were not consistent at short-term follow-up. Female patients also had higher scores on IES-R at baseline (MD = 8.62; $t = 2.85$; $p = 0.008$) and short-term follow-up (MD = 7.8; $t = 2.74$; $p = 0.012$), but not long term. EQ-5D and MOCA were not different based on gender at any timepoint.

Transition to PCP/Subspecialty Prior to Long-Term Visit. Although not statistically significant, patients attending long-term visits ($n = 14$) were more likely to live close to clinic compared with patients ($n = 24$) that were transitioned or lost to follow up (MD = 22.7 miles; $t = 1.76$; $p = 0.09$). SOFA scores at ICU admission were slightly higher in the patients attending long-term visit (10.5 ± 2.7 vs 8.8 ± 2.8; $t = 1.8$; $p = 0.078$). Patients that

TABLE 3. Relationship (Spearman Rho Correlations) Between Demographic and Clinical Variables, and Patient Outcomes During the Baseline ICU Recovery Clinic

Independent Variables	Dependent Outcomes (r; $p = 0.05$)			E5 Euro-Quality of Life (Visual Analog Scale)
	Hospital Anxiety and Depression Scale ($n = 32$)	Impact of Events Scale-Revised ($n = 30$)	Montreal Cognitive Assessment ($n = 29$)	5D Euro-Quality of Life ($n = 28$)
Age	0.17; $p = 0.32$	0.26; $p = 0.14$	−0.08; $p = 0.69$	−0.16; $p = 0.38$
Body mass index	0.10; $p = 0.57$	0.13; $p = 0.49$	0.08; $p = 0.66$	−0.35; $p = 0.06$
Sequential Organ Failure Assessment	−0.02; $p = 0.92$	−0.07; $p = 0.69$	0.04; $p = 0.85$	−0.42; $p = 0.02$
Mechanical ventilation days	−0.35; $p = 0.04$	−0.29; $p = 0.10$	−0.13; $p = 0.49$	−0.11; $p = 0.58$
ICU LOS	−0.36; $p = 0.04$	−0.34; $p = 0.05$	−0.17; $p = 0.38$	−0.12; $p = 0.52$
Hospital LOS	−0.48; $p = 0.004$	−0.32; $p = 0.07$	−0.11; $p = 0.56$	0.05; $p = 0.79$

LOS = length of stay.

transitioned prior to long-term visits had statistically better scores on EQ-5D VAS (70 ± 16 vs 59 ± 15; t = 2.1; p = 0.043), HADS (12.1 ± 6.5 vs 19.7 ± 7.4; t = 3.31; p = 0.002), and IES-R (22 ± 19.9 vs 37 ± 19.7; t = 2.25; p = 0.031) at the baseline visit.

DISCUSSION

Patients surviving critical illness in this cohort have high rates of anxiety, depression, and cognitive impairments as well as suffer from high levels of distress and report poor quality of life, which is consistent with previously published data (13, 14, 18, 19, 27, 37). ICU Recovery or follow-up clinics are designed to manage the complexity of ICU after care and treat symptoms of PICS. We demonstrate attendance to the first appointment is influenced by patient-related and illness-related factors. Specifically, patients that lived the greatest distances away from the ICU recovery clinic were less likely to follow up. Additionally, patients that required longer MV, required a tracheostomy, or discharged to secondary facility were less likely to come back to clinic, thus suggesting different pathways existing for survivors of critical illness. The results demonstrate that personal and circumstantial factors may prevent follow-up with an emphasis on patients' geographic location, for example, patients living in rural areas were less likely to travel back to clinic. This trend was also reported in patients that attended their first appointment but were lost to follow up before their long-term visit.

Data from patients receiving care in the ICU recovery clinic demonstrate that cognitive function and quality of life gradually improve in the first year of recovery, but levels of anxiety, depression, and PTSD remain relatively high. Statistically, these relationships are limited by very small sample of patients completing all three timepoints. Due to the focus on attendance, retrospective design, and the overarching goal of clinic to help patients transition back to their PCP as soon as possible, we could not control for missing data. This is a barrier to tracking outcomes across the first year, but clinically, this may be an indication of the functionality and purpose of the UKY ICU recovery clinic with the goal of restoring quality of life and helping patient reintegrate back to their routine medical care. The underlying goal of ICU recovery clinic is not to become a primary care provider, but rather manage the complexity of critical illness with a transition period back to patient's PCP or establish a new long-term provider. This clinical approach is confirmed with the differences noted between the patients attending long-term visits compared with patients lost to follow up and those transitioned. Patients with lower self-reported stress, lower self-reported anxiety and depression, and higher self-reported HRQoL at the baseline ICU recovery clinic appointment were less likely to attend the final appointment potentially supporting our clinic model.

These data provide an understanding that different recovery trajectories exist in the first year of recovery following critical illness, thus supporting an individualized approach using cognitive and mental health outcomes to establish plan of care. ICU follow-up clinics should tailor care based on diagnosis and recovery trajectory of PICS. These data expand upon prior literature of ICU recovery clinics in the United States, which only report data at one follow-up about 1 month after discharge (15, 27). Patients in our cohort had similar age, sex, severity of illness, and LOS compared

with previously reported data (27). Thus, we conclude that patients surviving critical illness may require specialized follow-up care for at least a year after discharge. The retrospective design of our study prevents statistical analyses to determine if improvements in HRQoL and cognitive function over the first year were related to receiving treatment in our ICU recovery clinic, thus potentially limiting generalizability and introducing representation and selection biases.

There are important clinical relationships suggested by our data. Of interest, severity of illness defined by SOFA scores at ICU admission is significantly related to HRQoL at baseline and short-term follow-up for patients in this cohort. The sample size in the long-term cohort may have precluded this relationship. A pragmatic, randomized controlled trial previously demonstrated HRQoL was not better for patients enrolled in an ICU recovery clinic compared with patients with no follow-up (38). Theoretically, this may be contributed to differences in recovery trajectories with multiple phenotypes existing; thus, a heterogeneous sample would not promote the ability to determine differences in study endpoints (39).

Phenotypes or stratification of patients based on demographics and critical illness variables may improve how clinicians assess and treat patients surviving critical illness. Previously, research suggests age and ICU LOS can be used to stratify patients based on disability after critical illness (40). We demonstrate in our cohort that increased hospital LOS was associated with worse scores on the anxiety and depression scale and trending toward a relationship with IES-R. Additionally, a clear difference based on gender was observed. Male patients were more likely to score better on emotional and HRQoL outcomes despite having a higher severity of illness and longer time requiring MV. We suggest that male patients have a different recovery trajectory and clinical pathway, for example, only the very sick male patients will return to the UKY ICU recovery clinic for treatment, whereas female patients with the range of severity of illness will attend follow-up appointments. The data also suggest that female patients have a higher incidence of anxiety, depression, and stress with worse self-reported HRQoL regardless of clinical indicators of illness, which is consistent with prior literature (41). In our practice and similar to previous literature (27), we have observed and strongly suggest that survivors of critical illness require different services and interventions based on age, sex, social determinants of health, PICS severity, and status of recovery. Additionally, our cohort had a high prevalence of distress and PTSD-like symptoms measured by the IES-R (~33%). Previous literature suggests that 10–20% of survivors of critical illness have PTSD (42–44). We can only speculate that higher occurrence of stress is related to patient recruitment for the UKY ICU recovery clinic with team members attempting to identify patients for clinic with high severity of illness and complex clinical course in the ICU. Severity of critical illness, LOS data, and gender differences, again, support the need for individualized approach to ICU follow-up based on the recovery trajectories measured by change in cognitive, emotional, and HRQoL outcomes.

UKY ICU recovery clinic provides interdisciplinary care to Kentuckians surviving critical illness. Almost 50% of the patients in this cohort lived outside of the 40-mile driving radius including

30% living greater than 75 miles from Lexington. Geographic place of residence did not influence patient outcomes in this analysis. We were unable to assess fully the social determinants of health in this population due to the retrospective design and thus cannot conclude that the interactions between living further away from clinic and socioeconomic status did not affect outcomes. Hypothetically, it is likely that patients with transportation to clinic have the financial means and social support to attend appointments, therefore potentially biasing the sample. We demonstrated that patient living further away from clinic were less likely to return to clinic for their first appointment. It is possible that patients in rural Kentucky may benefit from a different model such as telemedicine to eliminate the need for transportation. These relationships should be explored to improve the delivery of care for all survivors of critical illness.

Primary limitations of this study are the design and small sample with missing timepoints due to clinical approach. Retrospective studies are at risk of selection and misrepresentation biases. For example, we were only able to assess retrospectively readmissions, secondary emergency room visits, and mortality in our closed network. Thus, these data could be underreported, subsequently, to reduce biases we decided not to perform statistical analysis predict readmissions in this cohort. The interdisciplinary design and the number of appointments in the first year of recovery in the UKY ICU recovery clinic are novel. We suggest that the comprehensive ICU recovery clinic team and care provided to patients in the commonwealth of Kentucky have a lasting impact on patient outcomes. As mentioned prior, the retrospective design of this study did not allow for assessment of comparative outcomes to understand if the clinic can reduce readmission, risk of mortality, and secondary hospitalization. Future research should focus on the comparison of patients not receiving care in ICU recovery clinic to understand the potential patient benefits.

CONCLUSIONS

Patients surviving critical illness have high incidence of emotional and cognitive impairments that reduce quality of life, up to 1 year after ICU admission. Our study suggests that patient and clinical-related factors influence attendance and attrition at an ICU recovery clinic. Additionally, different recovery trajectories exist based on gender, ICU severity of illness, and self-report scores on outcome measures. Preliminarily, these data support an individualized approach to ICU follow-up care with different timelines based on emotional and cognitive dysfunction with a significant percentage of patients requiring services 12 months after hospital discharge.

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