Published in final edited form as:

Am Heart J Plus. 2024 February ; 38: . doi:10.1016/j.ahjo.2024.100363.

Post-intensive cardiac care outpatient long-term outreach clinic (PICCOLO clinic): Defining health care needs and outcomes among coronary care unit survivors

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Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Andrea D. Thompson reports financial support was provided by National Heart Lung and Blood Institute. Andrea D. Thompson reports financial support was provided by University of Michigan - Protein Folding Disease Initiative and Michigan Biology of Cardiovascular Aging (M-BoCA). This material is the result of work supported with resources and use of facilities at the Ann Arbor VA Medical Center.

Dr. Thompson receives compensation as editor for Merck Manuals. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Ethical approval

The University of Michigan Institutional Review Board reviewed this study and deemed it to be exempt from IRB approval (HUM 00203544).

Informed consent

Informed for patient information to be published in this article was not obtained because this was a secondary use study performed retrospectively on data collected during clinical care. Waiver for HIPAA authorization and informed consent was granted because it involved patients CICU patients retrospectively, including patients who ultimately die, there is no way to feasibly get the HIPAA authorization form from all such patients going forward.

1. Animal Welfare

This research did not involve the use of animals.

2. Conflict of Interest and Funding is provided in the attached Declaration of Interest Statement

Disclosures

Dr. Thompson receives compensation as editor for Merck Manuals.

CRediT authorship contribution statement

Christopher K. Mason: Conceptualization, Data curation, Formal analysis, Writing – original draft, Writing – review & editing, Investigation, Visualization. **Sara K. Adie:** Conceptualization, Data curation, Writing – review & editing, Validation. **Michael J. Shea:** Conceptualization, Writing – review & editing. **Matthew C. Konerman:** Conceptualization, Writing – review & editing. **Michael P. Thomas:** Conceptualization, Writing – review & editing. **Jakob I. McSparron:** Conceptualization, Writing – review & editing. **Theodore J. Iwashyna:** Conceptualization, Formal analysis, Writing – review & editing. **Hallie C. Prescott:** Conceptualization, Writing – review & editing. **Andrea D. Thompson:** Conceptualization, Data curation, Formal analysis, Investigation, Supervision, Validation, Visualization, Writing – review & editing.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ahjo.2024.100363.

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Abstract

Objective: Patients who survive critical illness endure complex physical and mental health conditions, referred to as post-intensive care syndrome (PICS). The University of Michigan's post-intensive cardiac care outpatient long-term outreach (PICCOLO) clinic is designed for patients recently admitted to the coronary care unit (CCU). The long-term goal of this clinic is to understand post-CCU patients' needs and design targeted interventions to reduce their morbidity and mortality post-discharge. As a first step toward this goal, we aimed to define the post-discharge needs of CCU survivors.

Design, setting, particpants: We retrospectively reviewed case-mix data (including rates of depression, PTSD, disability, and cognitive abnormalities) and health outcomes for patients referred to the PICCOLO clinic from July 1, 2018, through June 30, 2021 at Michigan Medicine.

Results: Of the 134 referred patients meeting inclusion criteria, 74 (55 %) patients were seen in the PICCOLO clinic within 30 days of discharge. Patients seen in the clinic frequently screened positive for depression (PHQ-2 score ≥3, 21.4 %) and cognitive impairment (MOCA <26, 38.8 %). Further, patients also reported high rates of physical difficulty (mean WHODAS 2.0 score 28.4 %, consistent with moderate physical difficulty). Consistent with medical intensive care unit (ICU) patients, CCU survivors experience PICS.

Conclusion: This work highlights the feasibility of an outpatient care model and the need to leverage information gathered from this care model to develop treatment strategies and pathways to address symptoms of PICS in CCU survivors, including depression, cognitive impairment, and physical disability.

Keywords

Critical care; Transitions of care; Post intensive care syndrome; Recovery

1. Introduction

Over the last several decades, advancements in critical care have significantly reduced intensive care unit (ICU) mortality [1]. However, patients who survive critical illness endure increasingly complex physical and mental health conditions, often referred to as post-intensive care syndrome (PICS) [2,3]. Thus, there is an increasing effort to understand the stages of ICU illness and recovery [2]. These stages are subdivided as acute illness, hospital recovery, early post-discharge recovery, and late post-discharge recovery. The early post-discharge stage carries notable risk, as disjointed care after discharge can contribute to preventable disease [2].

Despite an increased appreciation of challenges faced by survivors of critical illness, post-discharge outcomes in coronary care unit (CCU) survivors are not well defined. However, long-term outcomes in certain disease states common in CCU survivors, such as heart failure and cardiac arrest survivors, highlight high rates of morbidity and mortality [4–8]. Further, while there has been significant interest in post-discharge care models for ICU survivors, the ideal care model remains unknown [2,3,9,10]. A 2018 Cochrane review was unable to determine the effect of post-ICU discharge programs for medical ICU patients [3], while a subsequent randomized trial for medical ICU patients did show improvement in composite 30-day death and readmissions [11]. Much of this work has been done in the medical ICU population, and it may be possible that CCU survivors have different care needs that are best met by unique interventions [12,13]. Prior post-discharge programs have shown efficacy in improving health outcomes for patients admitted with congestive heart failure; however, these patients were not necessarily admitted to a cardiac ICU [4,14].

In this context, the post-intensive cardiac care outpatient long-term outreach (PICCOLO) clinic at the University of Michigan was established. The PICCOLO clinic is a targeted intervention for the early post-discharge stage for patients recently admitted to the CCU. The clinic encompasses a telephone visit and medication review with a clinical pharmacist and a one-time follow-up with a cardiologist as the patient is re-establishing long-term care with outpatient primary care and specialty providers [15]. Psycho-social needs are evaluated, and patients have access to a social work consultation. The long-term goal of this clinical model is to reduce readmissions, morbidity, and mortality post-discharge. To improve on these health outcomes, however, we must first understand the needs of patients recently admitted to the CCU. Toward this goal, we defined health outcomes for those referred to the PICCOLO clinic between 07/1/2018 and 06/30/2021. We also defined the case-mix data (including rates of depression, PTSD, IADL difficulty, cognitive abnormalities, and caregiver burden) for patients seen in the PICCOLO clinic.

2. Methods

2.1. Study population and design

We evaluated consecutive adult patients who were admitted to the University of Michigan CCU and were referred to the PICCOLO clinic, from July 1, 2018, through June 30, 2021. Patients were identified for our study using PICCOLO referral logs. To understand our referral process we utilized DataDirect (progress Software; Bedford, MA) and Clarity (EPIC; Madison, WI) to define the number of patients eligible for referral to the PICCOLO clinic during the study period and the basic demographic information for referred and not referred patients. The University of Michigan Institutional Review Board reviewed this study and deemed it to be exempt from IRB approval (HUM 00203544).

Patients were referred at the discretion of inpatient providers. Referrals to the PICCOLO clinic were placed via the electronic medical record (EMR, EPIC: Madison, Wisconsin) and scheduled by the cardiovascular call center. Referral logs included a review of referred patients that was performed at >30 days post-discharge by the clinic. For patients not seen within 30 days of discharge, the reason they were not seen was recorded.

Criteria for patients to be referred to the PICCOLO clinic included: admission to the CCU, age ≥ 18 years, CCU length of stay ≥48 h in the CCU, and survival to hospital discharge. Patients were excluded from referral if they were discharged against medical advice (AMA), to hospice, or transferred to another hospital. We also excluded patients who underwent a heart/lung transplantation or insertion of a durable left ventricular assist device (LVAD), as these patients had an established transitional care pathway. During the COVID pandemic, the CCU cared for medical ICU overflow patients with COVID ARDS. These patients were referred to a pulmonary/critical care post-discharge care clinic and we exclude these patients from referral to the PICCOLO clinic. Patients who underwent other cardiac surgeries or cardiac procedures were eligible for referral. Further details regarding the referral process are provided in the Supplemental Material.

The primary focus of our study was to evaluate the health outcomes and case-mix for patients referred to the PICCOLO clinic. For referred patients (seen within 30 days of discharge and not seen within 30 days of discharge), demographic data, LACE scores, and post-discharge outcomes (emergency room visits occurring 31–90 days post-discharge, readmissions occurring 31–90 days post-discharge, and deaths occurring >30 days post-discharge) were abstracted by chart review to evaluate post-clinic outcomes. The encounter and note sections of the University of Michigan EMR were reviewed while filtering for emergency department, admission, inpatient, and discharge notes. The University of Michigan's EMR includes a chart sharing system with numerous other healthcare systems, sometimes allowing for review of outside hospital notes and inclusion in this study's analysis. Time to mortality after 30 days post-discharge was calculated from the date of hospital discharge to the date of death (up to 12/12/2022). LACE scores were recorded by reviewing the discharge notes. LACE scores estimate the risk for 30-day unplanned readmissions or mortality events and further details regarding this scoring system is provided in the Supplemental Materials [16]. We also report 30-day outcomes, to quantify potential barriers to clinic attendance.

To provide information regarding CCU course, primary CCU admission and hospital discharge diagnosis was abstract via physician chart review of CCU admission H&P and hospital discharge summary respectively and the physician selected (cardiac arrest, unstable arrhythmia, cardiogenic shock, non-cardiogenic shock, heart failure, ACS, respiratory failure, valvular heart disease, post-procedure monitoring/complication, other). Progress notes and procedure notes were reviewed to identified patients who underwent intubation, dialysis initiation, pulmonary artery catheter placement, transvenous pacemaker placement, coronary angiogram, arterial line placement, central venous catheter placement. Inpatient flowsheets, and labs for the first 24 h of a patient's CCU stay and use of vasopressors and/or inotropes (norepinephrine, vasopressin, phenylephrine, dopamine, angiotensin II, dobutamine, milrinone) and maximum lactic acid were recorded.

Patient attendance at the PICCOLO clinic was documented by reviewing the PICCOLO telephone and clinic encounters. Patients are seen in the PICCOLO clinic by the clinic's cardiologist once, as a single translational care visit typically 7–14 days post discharge. Before this appointment patients have a telephone encounter with the clinic's pharmacist for medication reconciliation and counseling. For patients seen in the PICCOLO clinic,

the following data was obtained via chart review of the PICCOLO clinic note; Patient's activities of daily living (Supplemental Table 1), functional status (WHODAS 2.0) [17], cognitive impairment screening (MoCA) [18], depression screening (PHQ-2) [19], with reflex to Patient Health Questionnaire-9 (PHQ-9) for PHQ-2 scores ≥3 [20], and post-traumatic stress disorder screening (PC-PTSD-4) [21], with reflex to the PTSS-14 if the score was ≥3 [22]. Additionally, if a caregiver is available, the caregiver's activities of daily living and Caregiver burden (ZBI-12) is assessed [23]. The PICCOLO clinic provider also document whether the patient had an established PCP and cardiologist, the length of recent hospital admission, the length of recent CCU admission, the number of hospitalizations for the patient in the past year (including the recent admission), and the number of ICU admissions in the past year (including the recent admission). Further details regarding the structure of the PICCOLO clinic are provided in Supplemental Materials.

2.2. Statistical analysis

Continuous variables are reported as mean (standard deviation); in data tables, median and interquartile ranges are also reported. Categorical variables are reported as counts with percentages. Statistical analysis was performed using Prism (Graph-Pad Software, San Diego, California). Demographic and clinical data of patients referred/seen in the PICCOLO clinic versus patients referred/not seen were compared using Fisher's exact or Chi-squared tests for categorical variables and Mann-Whitney *U* tests for continuous variables.

3. Results

There were 1257 consecutive CCU admission in patients age ≥ 18 years of age with a CCU length of stay of ≥48 h, representing 1182 patients from July 1, 2018, through June 30, 2021. Of these 183 patients experienced in hospital mortality, 115 patients were discharged AMA, to hospice, or were transferred to another hospital, and 79 patients had a history of heart transplantation or underwent heart transplantation or LVAD placement (representing 95 encounters). This left 864 encounters, and 805 unique patients who were eligible for PICCOLO referral during the study period (Fig. 1).

Review of referral logs revealed that in total 151 patients were referred to PICCOLO clinic from July 1, 2018, through June 30, 2021. These referrals were made primarily during the patient's CCU stay. Of these, sixteen did not survive to discharge, and one patient was discharged to hospice, resulting in 134 patients who were referred to the PICCOLO clinic and met referral criteria. In total 17 % of eligible patients were referred to PICCOLO (Fig. 1). We were not able readily evaluate which patients may have been MICU overflow during the COVID pandemic, so this likely is an underestimate of the referral rate. Demographic characteristics of age, gender, self-reported race, and ethnicity were similar among eligible patients referred and not referred to PICCOLO (Supplemental Table 2).

Of the 134 referred patients meeting inclusion criteria, 74 (55.2 %) were seen in PICCOLO clinic within 30 days of discharge. Common reasons patients were not seen within 30 days of referral included: the appointment was canceled because of alternative follow-up with cardiology ($N = 22$), the patient declined appointment ($N = 12$), no show to appointment (N

= 9), unable to reach the patient to schedule (*N* = 7), readmission or death prevented visit (*N* = 6), seen in PICCOLO clinic >30 days post-discharge (N = 1), or reason unknown (*N* = 3).

Demographics of patients seen and not seen in the clinic within 30 days of discharge were similar regarding age at hospital discharge, self-reported race, ethnicity, marital status, and insurance status (Table 1). Patients seen in the clinic were less likely to be female (24.0 % vs 45.0 %, *p*-value 0.026) and exhibited a lower LACE score (11.9 vs 13.0, p-value = 0.028) compared to referred patients who were not seen in the clinic (Table 1). Patients seen and not seen in the clinic had similar rates of CCU procedures and markers of CCU severity (Table 2). Patients seen in the PICCOLO clinic were more likely to have a hospital discharge diagnosis of cardiac arrest, unstable arrhythmia, and cardiogenic shock and less likely to experience heart failure and respiratory failure compared to patients not seen (Table 2).

The discharge outcomes occurring >30 days post-discharge are similar among patients both seen and not seen in the clinic within 30 days post-discharge. This includes ED visits (30–90 days post-discharge), hospital readmissions (30–90 days after discharge), and mortality (>30 days after discharge) (Table 2). While referral follow-up only identified six patients where hospital readmission or mortality was a barrier to clinic attendance, we also evaluated 30-day ED visits and 30-day readmissions, to identify potential barriers to being seen in the clinic. Indeed, we found that patients seen in the clinic had a lower rate of 30-day emergency department visits (0.26 vs 0.47 visits/patient, *p*-value 0.028) (Table 2). Patients seen in the clinic also had a lower number of readmissions per patient (0.23 vs 0.52 at 30 days, p-value 0.004). The percentage of patients with at least one 30-day readmission was also lower in patients seen in the clinic (15/74, 20.3 % vs 25/60, 41.7 %, p-value 0.008).

We focused our attention next on the medical needs of the seventy-four patients seen in the PICCOLO clinic. First, we aimed to understand the chronicity of their medical problems. For many patients, the recent admission was their only ICU admission, with the average number of ICU admissions in the year prior (including the recent admission) of 1.3 [standard deviation (stdev) 0.6]. The average number of hospitalizations in the year prior (including the recent admission) was 2.1 [stdev 1.5]. On average, PICCOLO patients spent 16.5 [stdev 11.0] days in the hospital and 7.8 [stdev 5.7] days in the ICU, for the pertinent admission. They were also frequently establishing cardiology care in the outpatient setting, with seventy patients (94.6 %) having an identified primary care physician at the time of their PICCOLO appointment but only 42 (56.8 %) with an identified primary cardiologist (Table 3).

We also evaluated rates of depression and post-traumatic stress disorder symptoms among patients at the time of their post-discharge appointment in our clinic. Of the seventy-four patients seen in the clinic, seventy patients (94.6 %) were evaluated by the PHQ-2 screening tool, and sixty-six patients (89.2 %) were evaluated by the PC-PTSD 4 screening tool (Table 4). A score of ≥3 on the PHQ-2 is considered a positive screen for depression warranting further evaluation and was noted in 15 (21.4 %) of patients screened. A score of ≥3 on the PC-PTSD screen is considered a positive screen for PTSD warranting further evaluation; this was noted in 7 (10.6 %) of patients screened. The clinic aimed to perform a more in-depth evaluation of patients screening positive by these tools. Of the five patients who underwent PHQ-9 screenings, 4 (80.0 %) met criteria for depression. Of the 5 patients who underwent

evaluation by the PTSS-14 screening tool, 2 patients (40 %) had a score of ≥34, suggesting they were at risk of PTSD.

We also evaluated for potential cognitive impairment by performing the MoCA with fifty-four patients (73.0 %) seen in the PICCOLO clinic (Table 4). Of those fifty-four patients, 21 (38.9 %) screened positive for cognitive impairment. Most patients (18/21, 85.7 %) screening positive for cognitive impairment exhibited mild cognitive impairment. Notably, patients were also screened for a prior history of cognitive impairment, and none of the patients reported a history of cognitive impairment prior to their CCU admission.

We further evaluated patients for evidence of physical disability. The WHODAS 2.0 survey was completed by sixty-five patients seen in the PICCOLO clinic (87.8 %) (Table 5). The average WHODAS 2.0 score was 28.4 % [stdev 18.3], consistent with moderate physical difficulty. A ten-question IADL screen was completed by sixty-nine patients (93.2 %) (Table 5). The average number of IADL difficulties was 1.5 [stdev 2.2]. Of the sixty-nine patients who completed IADL screening, 16 (23.2 %) had difficulty with three or more listed IADLs.

Finally, we aimed to evaluate caregivers' IADLs and caregiver burden. Of the seventy-four patients seen in PICCOLO, 49 (66.2 %) had a caregiver who completed the IADL survey, and 45/74 (60.8 %) patients had a caregiver who completed the Caregiver Burden ZBI-12 survey (Table 5). The average number of IADL difficulties reported was 0.2 [stdev 0.9]. The average caregiver burden was 7.5 [stdev 6.5]. A cutoff score of 12 has been shown to have strong validity for distinguishing low versus high caregiver burden [18]. Of the forty-five caregivers, who completed the survey, 12 (26.7 %) caregivers reported a high caregiver burden.

4. Discussion

We aimed to understand the needs of patients recently admitted to the CCU. With this goal in mind, the PICCOLO clinic was developed to aid patients recently admitted to the CCU. We found that CCU survivors, like other ICU survivors, suffer from PICS. Further research is needed to understand what interventions may help these patients navigate functional limitations and new onset cognitive difficulties [13,24,25].

We found that CCU survivors seen in PICCOLO have lengthy hospital courses with an average length of stay of 16.5 days in the hospital and 7.8 days in the ICU. This duration is consistent with a prior study within this CCU, which showed an average hospital and ICU LOS of 14 days and 5 days respectively [26]. PICCOLO patients are often new cardiology patients. They were not frequently hospitalized or admitted to ICUs prior to their most recent admission (Table 3). Further 43.2 % of patients seen in PICCOLO clinic had not yet established outpatient cardiology care. Thus, the post-discharge period represents a key moment in establish outpatient cardiology care.

It is also important to understand patients' needs post-discharge, which may include PICS. PICS has been well-defined within the medical ICU population [27]. CCU patients represent a distinct patient population, with an increasing number of intensive care needs and noncardiac comorbidities [28,29]. Thus, while it is reasonable to assume CCU survivors also

suffer from PICS, this has been understudied. Among patients who underwent screening, 21.4 % had depression symptoms (PHQ-2 score ≥ 3), 10.6 % had PTSD symptoms (PC-PTSD-4 score ≥ 3), 52.2 % reported at least one IADL difficulty, and 92 % at least mild disability (WHODAS 2.0). This work supports the idea that CCU survivors suffer from PICS. Overall, the rates of depression and PTSD symptoms were lower in PICCOLO patients than the rates reported within medial ICU survivors (depression 21.4 % vs 33 %; PTSD 10.6 % vs 22 %), but still represent a significant symptomatic burden [30,31]. Anxiety was not evaluated in this population formally and represents a major area of mental health to evaluate within this population in the future.

We also evaluated cognitive function among our CCU survivors. We observed a high rate of impaired cognitive function, with 38.8 % of patients evaluated meeting criteria for at least mild cognitive impairment. This result is consistent with prior studies involving medical ICU patients [32]. Navigating the complexities of the healthcare system after an ICU admission can be daunting, let alone for patients experiencing cognitive impairment. Notably this result represents newly detected cognitive impairment, as none of the patients endorsed a diagnosis of cognitive impairment prior to their admission. This study demonstrates the significant cognitive burden that post-CCU patients experience. We do not currently understand if this is indicative of long-term cognitive impairment or a transient change in cognition. Future work that focuses on developing follow-up and treatment approaches for CCU survivors with cognitive impairment is needed.

Another aspect of recovery that is important to understand is the role of caregivers in the patient's recovery. Overall, the caregivers did not report functional limitations, with only 8 % of caregivers reporting difficulty with any IADL, but 26.7 % did experience high caregiver burden. The average ZBI-12 score for caregivers was 7.5 (stdev 6.5), which is lower than what was found in a 2014 longitudinal study of post-ICU patients (15.1) [33]. Overall, the caregiver burden reported remains significant, and further work evaluating contributors to caregiver burden as well as methods to alleviate or reduce this burden would benefit this population.

A potential advantage of the PICCOLO clinic is that it provides a comprehensive evaluation of a patient's needs post-discharge (Fig. 2). Conversely, a subspeciality care appointment (such as appointments with a heart failure, electrophysiology, or general cardiology provider) may primarily focus on one medical domain. Evaluating multiple domains (Fig. 2) allows the clinic's cardiologist to respond to identified issues using current standards in care. We did not track or monitor interventions in this study, but interventions may include physical therapy, occupational therapy, or cardiac rehabilitation [26] for deficits in functional domains. Referrals to mental health providers, social work and/or medication initiation can be pursued if symptomatic depression or PTSD is identified. This requires close coordination of care with the patient's primary care physician and other relevant subspeciality providers. The PICCOLO clinic and other acute care recovery clinics provide needed infrastructure to enable future trials testing targeted interventions to address PICS related symptoms.

One barrier to care within the PICCOLO clinic observed was a low referral rate, with only 17 % of eligible patients referred to the PICCOLO clinic (Fig. 1). There are several possible reasons this may be the case. High acuity, alternative follow-up plans, patient's or inpatient provider's preferences, lack of knowledge regarding the PICCOLO clinic may all contribute to low referral rates. Future work should evaluate if admission diagnosis or certain CCU procedures are associated with likelihood of referral [28]. Going forward, designing an automated referral prompt that screens for eligibility and suggests referral to inpatient providers using the EHR could improve advertising of the PICCOLO clinic and increase referrals rates. Further, this referral prompt could be designed to allow inpatient providers to give feedback regarding reasons eligible patients are not referred via a free text response.

Another potential barrier to patient's receiving care in the PICCOLO clinic is clinic attendance. Overall, a low rate of no-shows was noticed. The most common reason patients were not seen in the clinic was that they were able to follow-up in a timely manner with their long-term care providers. The second most common reason patients were not seen in the clinic was that they declined an appointment. We were also surprised to find that female patients were less likely to be seen in the clinic. Qualitative patient interviews are needed to better understand these findings and potential barriers to being seen in the clinic.

The acute nature of their needs may also be a reason that some patients are not seen in the clinic. We noticed that patients not seen had higher LACE scores, higher rates of 30-day ED visits and readmissions. Six patients were not seen in the clinic because of readmission or mortality that prevented their scheduled clinic visit. A high rate of readmissions and ER visits were observed in patients referred to PICCOLO, both seen and not seen (Table 2). These results highlights the need for A&R clinics serving the CCU population to consider interventions at the time of discharge. To improve post discharge morbidity and mortality the timing of designed interventions will likely be of utmost importance, with some interventions potentially needed prior to discharge.

Clearly, challenges remain in designing the optimal acute care and recovery model for CCU survivors. There are opportunities to improve low referral rates and address barriers to clinic attendance as discussed above. Still, the PICCOLO clinic represents an important first step and demonstrates feasibility of this post-discharge model for CCU survivors. Of the 134 referred patients meeting inclusion criteria, 74 (55.2 %) were seen in the PICCOLO clinic within 30 days of discharge. Other ICU recovery clinics, serving the medical ICU population, have reported a broad range of attendance rates of 12.6 %–52 % [11,34]. Interestingly the only other ICU recovery clinic seeing CCU patients, such as ours, also saw a high rate of outpatient clinic attendance at 78.1 % [12].

This study has several limitations to acknowledge when interpreting the results reported herein. This is a retrospective study and thus cannot ascertain causality. Since this is a single-center study, it has limited generalizability. Regarding the chart review for post-discharge outcomes, the University of Michigan EMR has access to some outside hospital records, but not all, meaning some post-discharge events were likely not reported (Table 6).

5. Conclusion

Understanding patient and caregiver psycho-social needs is integral to improving post-CCU outcomes. This study demonstrated PICS among CCU survivors with significant rates of cognitive impairment and disability. It also highlighted potential barriers to patients being seen in the clinic post-discharge and a need to focus on pre-discharge and post-discharge interventions.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgements

Dr. Thompson is supported by NIH-NHLBI [K08HL163328]. Dr. Thompson is supported by the protein folding disease initiative and Michigan Biology of Cardiovascular Aging (M-BoCA) at the University of Michigan. This material is the result of work supported with resources and use of facilities at the Ann Arbor VA Medical Center.

Sources of funding

Dr. Thompson is supported by NIH-NHLBI [K08HL163328]. Dr. Thompson is supported by the protein folding disease initiative and Michigan Biology of Cardiovascular Aging (M-BoCA) at the University of Michigan. This material is the result of work supported with resources and use of facilities at the Ann Arbor VA Medical Center.

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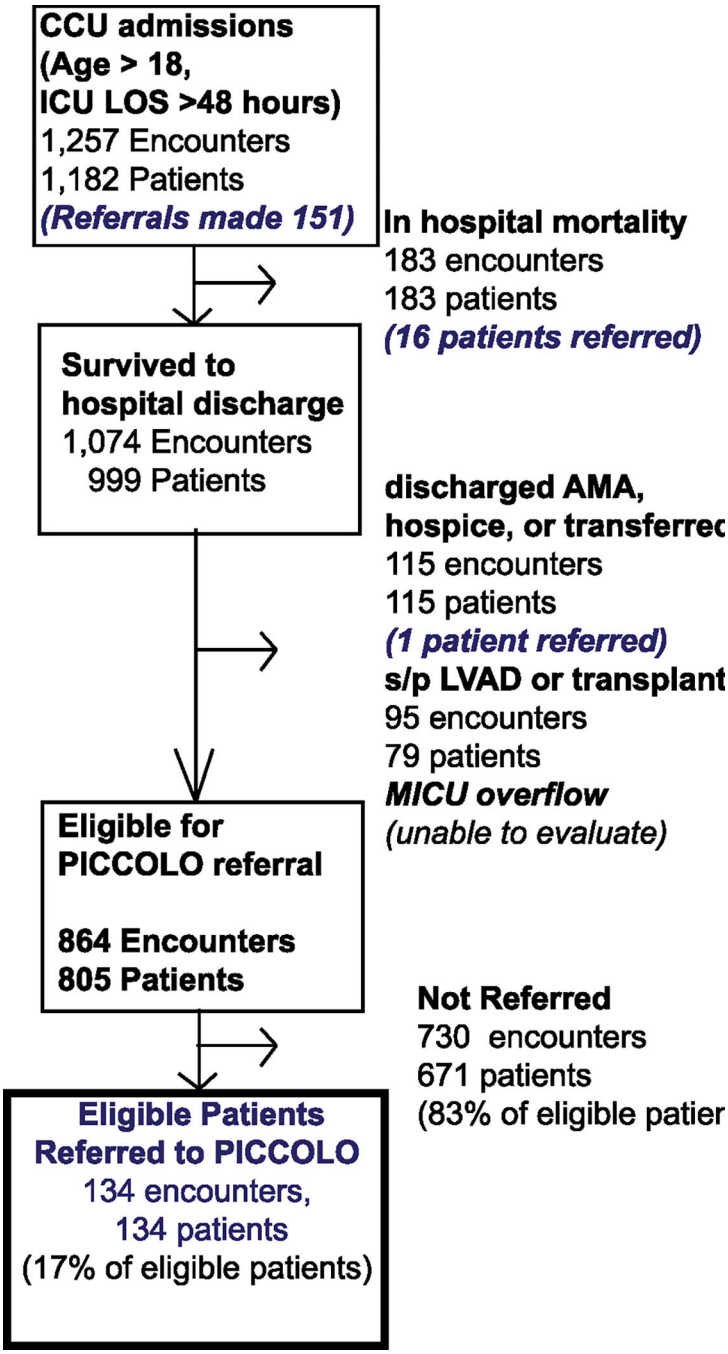

Fig. 1.
A consort diagram defining referral criteria and referral rate for the PICCOLO clinic.

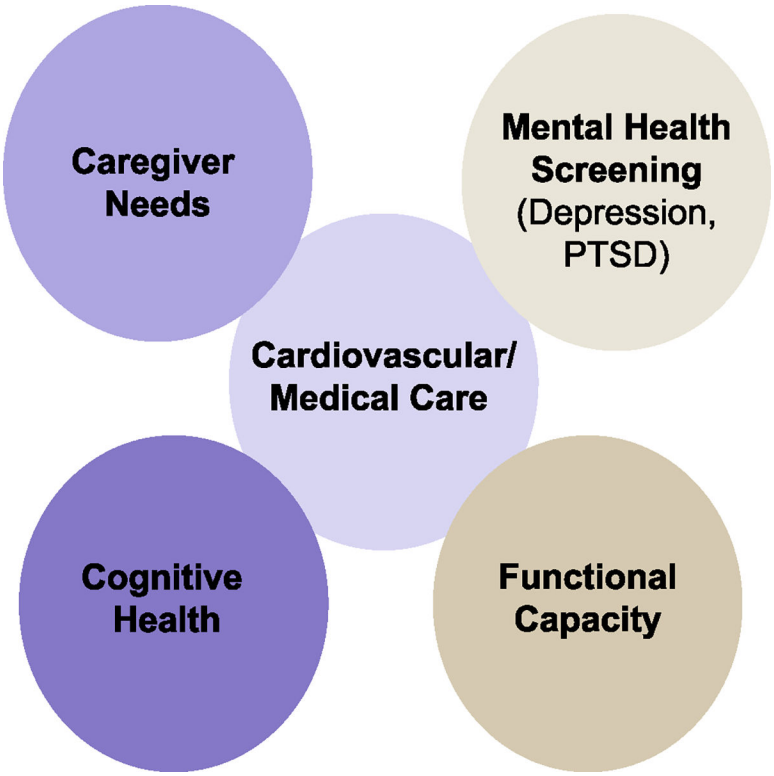

Fig. 2.
A schematic of domains evaluated during a PICCOLO clinic visit.

Table 1

Patient Characteristics for those Seen vs. Not Seen after Referral to PICCOLO clinic.

Patient characteristic	Seen (n = 74)	Not Seen (n = 60)	p Value
Age at Hospital Discharge in Years	65.2 (13.9) [67.8, 15.9]	61.3 (14.0) [60.9, 18.1]	0.110
LACE Score at Time of Discharge	11.9 (2.9) [12.0, 5.0]	13.0 (2.8) [13.0, 4.0]	0.028
Legal Sex			
Male	56 (76.0 %)	33 (55.0 %)	0.026
Female	18 (24.0 %)	27 (45.0 %)	
Self-Reported Race			
White	60 (81.1 %)	44 (73.3 %)	
Black or African American	10 (13.5 %)	12 (20.0 %)	0.351
Native Hawaiian & Other Pacific Islander	0 (0.0 %)	1 (1.7 %)	
Multiple Races Listed	2 (2.7 %)	0 (0.0 %)	
Other, Unknown or Not Listed	2 (2.7 %)	3 (5.0 %)	
Ethnicity			
Non-Hispanic	70 (95.0 %)	56 (93.3 %)	0.084
Hispanic	0 (0.0 %)	3 (5.0 %)	
Not Listed	4 (5.0 %)	1 (1.7 %)	
Insurance on File?			
Yes	71 (95.9 %)	58 (96.7 %)	>0.999
No	3 (4.1 %)	2 (3.3 %)	
Insurance Type			
Medicare	28 (37.8 %)	24 (40.0 %)	
Medicaid	5 (6.8 %)	11 (18.3 %)	0.094
Private	22 (29.7 %)	8 (13.3 %)	
Private + Medicare	16 (21.6 %)	15 (25.0 %)	
None	3 (4.1 %)	2 (3.3 %)	
Marital Status			
Married	28 (37.8 %)	20 (33.3 %)	
Divorced	3 (4.1 %)	3 (5.0 %)	0.682
Widowed or Single	22 (29.7 %)	22 (36.7 %)	
Significant Other	0 (0.0 %)	1 (1.7 %)	
Not Listed	21 (28.4 %)	14 (23.3 %)	

Continuous variables are reported as mean (standard deviation) [median, interquartile range]. Categorical variables are reported as count (percentage).

Table 2

CCU Course for those Seen vs. Not Seen after Referral to PICCOLO clinic.

Patient characteristic	Seen (n = 74)	Not Seen (n = 60)	p Value
CCU Admission Diagnosis			
Cardiac Arrest	20 (27.0 %)	9 (15.0 %)	
Unstable Arrhythmia	19 (25.7 %)	7 (11.7 %)	
Cardiogenic Shock	10 (13.5 %)	8 (13.3 %)	
Heart Failure	10 (13.5 %)	18 (30.0 %)	0.057
ACS	5 (6.7 %)	3 (5.0 %)	
Respiratory Failure	4 (5.4 %)	9 (15.0 %)	
Post-Procedure Monitoring/Complication	3 (4.1 %)	2(3.3 %)	
Other	3 (4.1 %)	4(6.7 %)	
Hospital Discharge			
Diagnosis			
Cardiac Arrest	11 (14.9 %)	4 (6.7 %)	
Unstable Arrhythmia	19 (25.7 %)	7 (11.7 %)	
Cardiogenic Shock	10 (13.5 %)	3 (5.0 %)	
Heart failure	11 (14.9 %)	15 (25.0 %)	0.028
ACS	9 (12.2 %)	7 (11.7 %)	
Respiratory Failure	3 (4.1 %)	7 (11.7 %)	
Valve Disease	7(9.5 %)	8 (13.3 %)	
Other	4(5.4 %)	9 (15.0 %	
CCU Course			
Intubation	32 (43.2 %)	31 (51.7 %)	0.386
Dialysis Initiation	6 (8.1 %)	8 (13.3 %)	0.399
Pulmonary Artery Catheter	25 (33.8 %)	31 (51.7 %)	0.052
Transvenous pacemaker	10 (13.5 %)	2 (3.3 %)	0.065
Coronary angiogram	43 (58.1 %)	25 (41.7 %)	0.082
Vasopressors/Inotropes (0–24 h)	33 (44.6 %)	21 (35.0 %)	0.291
Arterial line	46 (62.1 %)	44 (73.3 %)	0.198
Central venous catheter	44 (59.5 %)	40 (66.7 %)	0.473
Maximum Lactic Acid (0–24 h)	3.18 (2.62) [2.55,2.63]	3.11 (2.37) [2.25, 1.875]	0.892

Continuous variables are reported as mean (standard deviation) [median, interquartile range]. Categorical variables are reported as count (percentage).

Table 3

Post-Discharge Events for those Seen vs. Not Seen after Referral to PICCOLO clinic.

Post-Discharge Event	Seen (n = 74)	Not Seen (n = 60)	p Value
30-day emergency department visits			
# of patients with visit	17 (23.0 %)	23 (38.3 %)	0.060
Total # of visits	19	28	–
# of visits per pt	0.26 (0.5) [0.0, 0.0]	0.47 (0.65) [0.0, 1.0]	0.028
30–90-day emergency department visits			
# of patients with visit	19 (25.7 %)	14 (23.3 %)	0.842
Total # of visits	24	25	–
# of visits per pt	0.32 (0.62) [0.0, 1.0]	0.42 (0.91) [0.0, 0.0]	0.452
30-day readmissions			
# of patients with readmission	15 (20.3 %)	25 (41.7 %)	0.008
Total # of admissions	17	31	–
# of readmissions per pt	0.23 (0.48) [0.0, 0.0]	0.52 (0.68) [0.0, 1.0]	0.004
30–90-day readmissions			
# of patients with readmission	18 (24.3 %)	16 (26.7 %)	0.8425
Total # of admissions	24	28	–
# of readmissions per pt	0.32 (0.64) [0.0, 0.3]	0.47 (0.89) [0.0, 1.0]	0.259
30-day deaths	1 (1.4 %)	3 (5.0 %)	0.320
30–90-day deaths	1 (1.4 %)	3 (5.0 %)	0.138
Known Mortality (up to 12/12/2022), >30 days post-discharge	18 (24.3 %)	17 (28.3 %)	0.3248
Time to mortality (days), >30 days post-discharge	502.7 (330.7) [437.5, 594.5]	361.9 (265.7) [311, 448.5]	0.176

Continuous variables are reported as mean (standard deviation) [median, interquartile range]. Categorical variables are reported as count (percentage).

Table 4

Patient admissions and outpatient continuity for PICCOLO patients.

PICCOLO Patients (n = 74)	
Hospitalizations Year Prior	2.1 (1.5) [1.5, 2.0]
ICU Admissions Year Prior	1.3 (0.6) [1.0, 0.0]
Recent Hospital Length of Stay	16.5 (11.0) [15.0, 12.0]
Recent ICU Length of Stay	7.8 (5.7) [6.0, 6.0]
PCP	
Need	4 (5.4 %)
Have	70 (94.6 %)
Cardiologist	
Need	32 (43.2 %)
Have	42 (56.8 %)

Continuous variables are reported as mean (standard deviation) [median, interquartile range]. Categorical variables are reported as count (percentage).

Table 5

Mood and cognition screenings for PICCOLO patients.

Depression Screening	
PHQ-2 Completion Rate	70/74 (94.6 %)
PHQ-2 Results (*n* = 70)	1.2 (1.6) [0,2]
# of PHQ-2 ≥ 3	15 (21.4 %)
PHQ-9 Completion Rate	5/15 (33.3 %)
PHQ-9 Results (*n* = 5)	10.4 (5.2) [10.0, 9.0]
PHQ-9 Breakdown	
No depression (<5)	1 (20.0 %)
Mild [5–9]	1 (20.0 %)
Moderate [10–14]	2 (40.0 %)
Moderately Severe [15–19]	1 (40.0 %)
Severe (≥20)	0 (0 %)
PTSD Screening	
PC-PTSD-4 Completion Rate	66/74 (89.2 %)
PC-PTSD-4 Results (*n* = 66)	0.68 (1.1) [0, 1.0]
# of PC-PTSD-4 Results ≥3 (*n* = 66)	7 (10.6 %)
PTSS-14 Completion Rate	5/7 (71.4 %)
PTSS-14 Results (n = 5)	30.6 (10.2) [32, 15.5]
# of PTSS-14 Results ≥34 (n = 5)	2 (40.0 %)
Cognitive Impairment Screening	
MoCA Completion Rate	54/74 (73.0 %)
MoCA Score (*n* = 54)	25.4 (3.6) [26, 5.0]
MoCA Breakdown (n = 54)	
Normal ≥26	33 (61.1 %)
Mild Cognitive Impairment 18–25	18 (33.3 %)
Moderate to Severe Cognitive Impairment <18	3 (5.5 %)

Continuous variables are reported as mean (standard deviation) [median, interquartile range]. Categorical variables are reported as count (percentage).

Table 6

Disability and caregiver burden screenings in PICCOLO Clinic.

Patient Disability Screening	
WHODAS 2.0 Completion Rate	65/74 (87.8 %)
WHODAS 2.0 Score (*n* = 65)	28.4 (18.3) [27.0, 27.0]
WHODAS 2.0 Breakdown (*n* = 65)	
No difficulty 0–4 %	5 (7.8 %)
Mild difficulty 5–24 %	26 (40.0 %)
Moderate difficulty 25–49 %	25 (38.5 %)
Severe difficulty 50–100 %	9 (13.8 %)
IADL Completion Rate	69/74 (93.2 %)
# of IADL Difficulties (*n* = 69)	1.5 (2.2) [1.0, 2.0]
Patient IADL Difficulty Breakdown	
0	33 (47.8 %)
1–2	20 (29.0 %)
>2	16 (23.2 %)
Caregiver Disability Screening	
Caregiver IADL Completion	49/74 (66.2 %)
Caregiver # of IADL Difficulties (*n* = 49)	0.2 (0.9) [0.0, 0.0]
Caregiver IADL Difficulty Breakdown (n = 49)	
0	45 (91.8 %)
1–2	3 (6.1 %)
>2	1 (2.0 %)
Caregiver Burden Screening	
Caregiver Burden ZBI-12 completion	45/74 (60.8 %)
Caregiver Burden ZBI-12 (*n* = 45)	7.5 (6.5) [6.0, 11.0]
Caregiver Burden ZBI-12 Breakdown (n = 45)	
Low Burden ≤12	33 (73.3 %)
High Burden >12	12 (26.7 %)

Continuous variables are reported as mean (standard deviation) [median, interquartile range]. Categorical variables are reported as count (percentage).