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REVIEW ARTICLE

Intensive care unit follow-up clinic activities: a scoping review

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Abstract

The importance of ongoing post-discharge follow-up to prevent functional impairment in patients discharged from intensive care units (ICUs) is being increasingly recognized. Therefore, we conducted a scoping review, which included existing ICU follow-up clinic methodologies using the CENTRAL, MEDLINE, and CINAHL databases from their inception to December 2022. Data were examined for country or region, outpatient name, location, opening days, lead profession, eligible patients, timing of the follow-up, and assessment tools. Twelve studies were included in our review. The results obtained revealed that the methods employed by ICU follow-up clinics varied among countries and regions. The names of outpatient follow-up clinics also varied; however, all were located within the facility. These clinics were mainly physician or nurse led; however, pharmacists, physical therapists, neuropsychologists, and social workers were also involved. Some clinics were limited to critically ill patients with sepsis or those requiring ventilation. Ten studies reported the first outpatient visit 1–3 months after discharge. All studies assessed physical function, cognitive function, mental health, and the health-related quality of life. This scoping review revealed that an optimal operating format for ICU follow-up clinics needs to be established according to the categories of critically ill patients.

Keywords Post-intensive care syndrome · PICS clinic · Recovery center · Critical illness · Functional impairment

Introduction

In aging societies, the number of patients with acute critical illnesses admitted to intensive care units (ICUs) has been increasing [1, 2]. With developments in medical science, the ICU mortality rate due to acute critical illnesses has decreased, thereby increasing the number of ICU survivors [3, 4]. The physical, mental, and cognitive impairments that occur after ICU discharge are known as post-intensive care syndrome (PICS) [5]. More than 60% of patients who survive a critical illness will develop at least one of the symptoms of PICS [6–8]. Clinical manifestations vary, and patients have been reported to exhibit one or more of the following symptoms: neuromuscular weakness, anxiety, depression, post-traumatic stress disorder (PTSD), cognitive dysfunction, and executive dysfunction, with an associated decrease in quality of life (QOL) [6, 9, 10]. No effective intervention has been established for PICS, and its onset is difficult to prevent; nevertheless, its prevention and alleviation are crucial [11–14].

Survivors of severe diseases live with aftereffects and functional disabilities for years [15, 16]. However, since

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current interventions, such as early rehabilitation, ABCDEF bundles in the ICU, and ward rounds after ICU discharge, are not sufficient to prevent PICS [17–19], the practice of ongoing follow-ups after discharge is becoming increasingly crucial. This has highlighted the importance of establishing ICU follow-up clinics that provide ongoing interventions to evaluate and treat PICS after discharge [20]. Outpatient clinics for ICU survivors are referred to as "PICS clinics", "ICU follow-up clinics", or "ICU recovery centers", and their overarching goal is to identify, assess, and treat medical, physical, mental health, and cognitive issues following critical illnesses [20–22]. Follow-up outpatient care after ICU discharge began in the UK approximately 30 years ago as "intensive aftercare after intensive care" [20]. In 2009, NICE guidelines recommended follow-ups after ICU discharge or after discharge [23]. In 2012, the Society of Critical Care Medicine proposed the concept of PICS and promoted research and dissemination activities based on ICU follow-up clinics and peer support, which are now used worldwide [24]. In a 2021 cross-sectional survey in the UK [18], ICU follow-up clinic support was offered to 74% of cases. However, even within the UK, an optimal method has not yet been established for ICU follow-up clinic care because eligible patients, access to ICU follow-up clinic services, outcome measures, and the duration and tools for PICS assessments and interventions vary by institution [25, 26]. Site-specific barriers to implementing ICU follow-up clinics exist and include the financial support needed to establish an outpatient clinic, concerns about resource allocation and benefits, and discussions about which the provider needs to lead the effort [27, 28].

Although ICU follow-up theoretically appears to be beneficial as a PICS measure, evidence and recommendations are low because ICU follow-up systems vary and are highly heterogeneous across countries and regions; the optimal methodology for outpatient follow-up as a PICS measure is still under debate [29, 30]. Therefore, we posed the following research question: "What type of ICU follow-up clinic operation is effective and has evidence?" We subsequently conducted a scoping review of ICU follow-up clinics to accelerate future PICS prevention measures and accumulate further evidence on ICU follow-ups.

Methods

Study design and protocol registration

The present study aimed to reach a consensus about ICU follow-up clinics. The study design was based on a scoping review. This scoping review, based on Arksey and O'Malley's five-step framework and Preferred Reporting Items for a Systematic Review and Meta-Analysis (PRISMA) [31, 32], was searched with respect to ICU follow-up clinics. Due to the study design, ethics committee approval was not required. This study was registered as a clinical trial (UMIN Clinical Trials Registry: 000049683).

Eligibility criteria

Observational and interventional studies discussing follow-up outpatient visits after ICU discharge were included; studies restricted to patients with coronavirus disease 2019, studies evaluating post-ICU follow-up models without at least one face-to-face appointment, studies in which an ICU follow-up clinic was not originally established, studies that investigated the long-term outcomes of clinical studies, study protocols, studies not published in peer-reviewed journals (i.e., conference abstracts, commentaries, and reviews), and studies reported in non-English languages were excluded.

Search strategy

We searched the Cochrane Central Register of Controlled Trials (CENTRAL) in the Cochrane Library, Medical Literature Analysis and Retrieval System Online (MEDLINE) via PubMed, and Cumulative Index to Nursing and Allied Health Literature (CINAHL) databases from their inception to December 2022. Additionally, reference lists for the retrieved articles were hand searched to detect other potentially eligible studies. We did not ask the authors of original studies for unpublished or additional data.

Data extraction and study selection in the scoping review

After the identification of records, data were imported into Rayyan and duplicates were removed [33]. Four reviewers (HS, NN, DK, and SK) conducted the primary and secondary screenings. Primary screening was performed for the title and abstract of each retrieved data set. Studies discussing follow-up outpatient care for adult ICU survivors ($\geq$ 18 years) after discharge were included. After reconciling disagreements among reviewers, a third reviewer (JH) made judgments as needed. The secondary screening was performed for the full text. We selected studies investigating the epidemiology, methodology, and effectiveness of outpatient ICU follow-up visits after discharge. Only studies that discussed existing ICU follow-up clinics were included. The reviewers (JH and HS) extracted data from eligible articles into a data collection format. Data were examined for country or region, the study design, locations and names of the outpatient facilities, the estimated average number of patients per month, who led the study, eligible patients, exclusion criteria, timing of the follow-up,

assessment tools, outcomes, and basic information on and patient backgrounds in the ICU.

Results

The PRISMA flow diagram in Fig. 1 shows the article selection process in the scoping review. The search strategy identified 2,863 records, of which 2,583 were eligible for the first screening. After excluding 2,458 records following the first screening, 125 were included in the second screening. After excluding 115 records following the second screening, 10 were included in the analysis [22, 34–42]. Two other records from the reference list of retrieved articles were included in the analysis [43, 44].

Study characteristics are summarized in Table 1 and Supplementary Table S1. The 12 studies included two randomized controlled trials [36, 42], 4 retrospective observational studies [34, 35, 40, 43], 5 prospective observational studies [22, 37–39, 41], and 1 observational study [44], with 4, 3, 2, 2, and 1 reported from the USA [22, 34, 37, 43], Portugal [38–40], the UK [41, 42], Australia [36], and Japan [35], respectively. One study was a multicenter study [42], while the remaining 11 were single-center studies.

Locations and names of outpatient facilities

Although the "ICU recovery clinic", [34, 43] "PICS clinic", [35] "follow-up clinic", [38, 41] and other names varied, outpatient facilities were located within the hospital.

Occupations involved in outpatient clinics

In addition to physicians and nurses, pharmacists, physical therapists, and social workers were involved. There were nine studies involving physicians [22, 34–38, 42–44], with four specifying them as intensivists [22, 36, 37, 42], and six involving nurses [22, 35, 37, 38, 42, 44], with two specifying them as ICU nurses [35, 44]. Pharmacists were involved in four studies [22, 34, 37, 43], physical therapists in four [34, 35, 37, 43], and administrative staff, including social workers, in four [22, 34, 37, 43]. Only three studies specified the job title that led the outpatient operation [34, 42, 43]. When nurses were involved, two studies clarified whether they were ICU or outpatient nurses [35, 44]. A few details were reported on the different occupational roles. Some studies reported that physicians conducted detailed interviews about symptoms after ICU discharge or assessed physical function, cognitive function, and mental health, while others reported that nurses performed cognitive function and mental health assessments and interventions. Physical therapists assessed

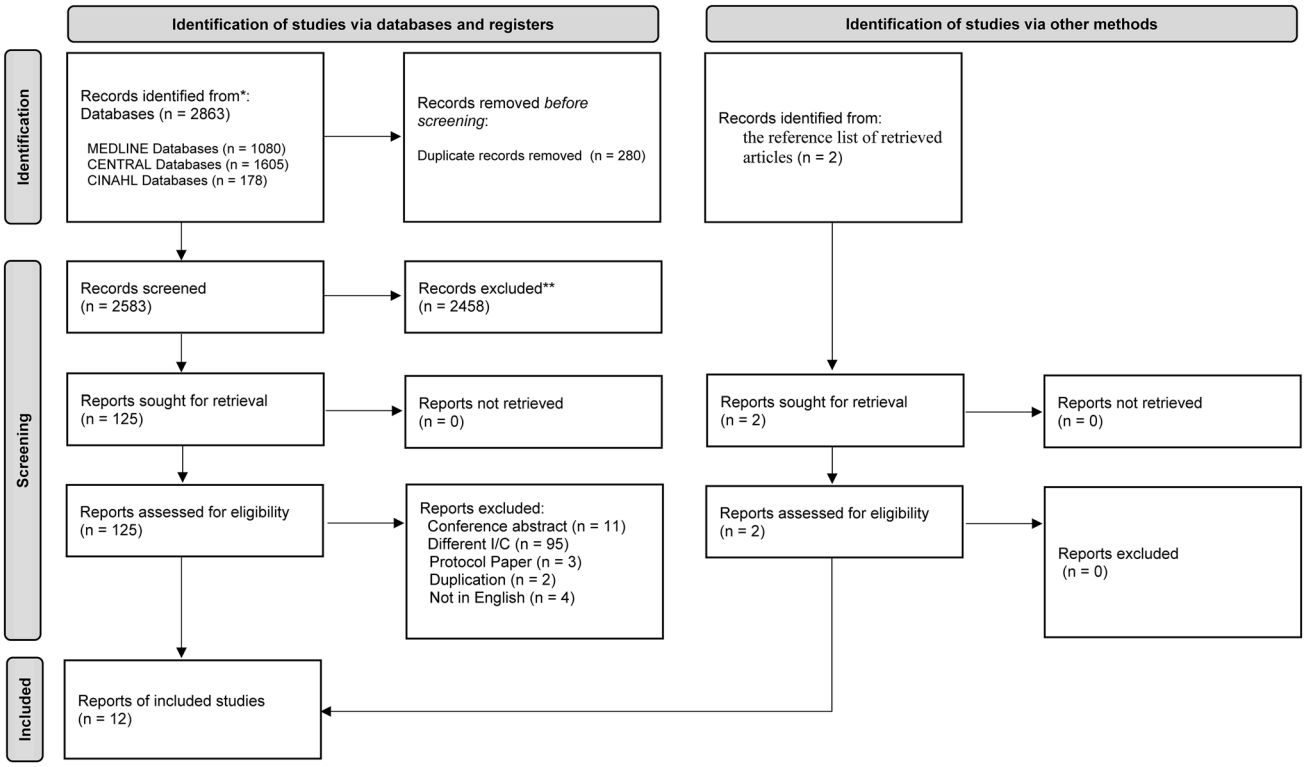

Fig.1 Preferred Reporting Items for a Systematic Review and Meta-Analysis diagram

Table 1 Summary of studies identified during the literature search

Author, year	Country/region	Design	Locations and names of outpatient facilities	Occupations involved in outpatient	Eligible patients	Timing of the follow-up	Assessment tools
Mayer KP, et al. 2022 [34]	USA	Retrospective cohort study	ICU recovery clinic at the University of Kentucky Hospital	Physician-driven model Physician Pharmacist Physical therapist Advanced practice provider Social worker-assessed social factors affecting health, caregiver resources, and treatment for mental and emotional health	≥ 18 years Acute respiratory failure and/or sepsis	3 months after hospital discharge	Physical function: 6MWD, SPPB, the MRC score HRQOL: EQ-5D, self-reported return to work, hobbies, and return to driving Cognitive function: MOCA Emotional health: HADS, IES-R
Mayer KP, et al. 2020 [43]	USA	Retrospective cohort study	ICU recovery clinic at the University of Kentucky Hospital (at a minimum of bimonthly and frequently open weekly with the capacity to treat up to six patients per session)	Physician-driven model Physician Pharmacist Physical therapist Advanced practice provider Social worker-assessed social factors affecting health, caregiver resources, and treatment for mental and emotional health	One or more of the following: MV > 48 h Tracheostomy Septic shock MOF ICU-AW development Delirium onset in the ICU ARDS onset in the ICU ECMO for more than 48 h	1 week and 1, 3, 6, and 12 months after discharge	HRQOL: EQ-5D-5L Cognitive function: MOCA Emotional health: HADS, IES-R

Table 1 (continued)

Author, year	Country/region	Design	Locations and names of outpatient facilities	Occupations involved in outpatient	Eligible patients	Timing of the follow-up	Assessment tools
Nakamura K, et al. 2021 [35]	Japan	Single-center retrospective study	PICS clinic (every Thursday evening) in Hitachi General Hospital	Physicians: assessed physical function (walking disability, muscle volume loss, and respiratory dysfunction), mental status (depression, anxiety, and sleep disorders), and cognitive function (memory impairment and executive dysfunction) ICU nurses: assessed cognitive function using MMSE and SMQ Physiotherapists: assessed physical performance using BI, FSS-ICU, the MRC score, and digital grip dynamometer	Patients discharged from medical and surgical ICU and who had stayed in the emergency ward for ≥ 5 days	Approximately 1 month after discharge	Physical function: grip strength, BI, FSS-ICU, the MRC score Cognitive function: MMSE, SMQ Mental health: HADS, IES-R HRQOL: EQ-5D
Ali Abdelhamid Y, et al. 2021 [36]	Australia	Prospective, parallel-group, randomized pilot trial	Shared-care intensivist–endocrinologist clinic	Intensivist: systematically interviewed about problems that developed since ICU admission, including pain, airway complications, cosmetic changes, sensory changes, and impairments in swallowing, cognition, or communication Endocrinologist: evaluated blood glucose and adjusted oral hypoglycemic agents and/or insulin; other medication review; and cardiovascular risk assessment	Patients with type 2 diabetes who were discharged from the ICU after ≥ 5 days	6 months after discharge	Systematically interviewed about problems, including pain, airway complications, cosmetic changes, sensory changes, and impairments in swallowing, cognition, or communication Physical function: the modified Rivermead Mobility Index Mental health: HADS HRQOL: EQ-5D-5L, SF-36

Table 1 (continued)

Author, year	Country/region	Design	Locations and names of outpatient facilities	Occupations involved in outpatient	Eligible patients	Timing of the follow-up	Assessment tools
Bottom–Tanzer SF, et al. 2021 [37]	USA	Prospective, observational feasibility study	Critical care outpatient clinic (CCOC) in Tufts University School of Medicine (level I trauma and academic medical center) A weekly dedicated clinic and 75-min visit	Intensivist Acute care surgeon Nurse coordinator Critical care pharmacist: medication reconciliation at every visit, interviews regarding adherence and compliance patterns, and counseling on drug therapies Physical therapist Social worker	Age ≥ 18 years and length of stay ≥ 72 h	2 weeks, 12, and 24 weeks after hospital discharge	Physical function: AM-PAC, 6MWT, TUG Cognitive function: clinical examination of executive function with the patient or their family reporting perceived difficulties in memory or concentration Mental health: PHQ-9, PCL-5 Others: medication reconciliation at every visit, questionnaire about their experience in their rehabilitation center if applicable, their ability to return to work, functional limitations, sleep disturbances, and capacity to live independently and to participate in prior hobbies

Table 1 (continued)

Author, year	Country/region	Design	Locations and names of outpatient facilities	Occupations involved in outpatient	Eligible patients	Timing of the follow-up	Assessment tools
Sevin CM, et al. 2018 [22]	USA	Prospective, observational feasibility study	The ICU recovery center in Vanderbilt University Medical Center	Intensivist Innovative independent nurse practitioner team: detailed history and a physical examination Critical care pharmacist: medication review, interview, and counseling Neuropsychologist: screening for cognitive impairment, PTSD, anxiety, and depression Case manager: request for medical devices, support services, or monitoring equipment	Critically ill adults ≥ 18 years with one or more risk factors for the development of PICS, including sepsis, delirium, or respiratory failure requiring mechanical ventilation	2–4 weeks after the patient had returned home	Physical function: spirometry, 6MWT Cognitive function: MoCA, trail-making tests A and B, the Mini-Mental Status Assessment Mental health: HADS, PCL
Torres J, et al. 2016 [38]	Portugal	Prospective observational study	Follow-up clinic in Hospital Pedro Hispano in a mixed surgical–medical adult ICU	Physician Nurse	Stayed in the ICU for at least 2 days	At ICU discharge In their first week on the ward 1 month after or at hospital discharge 3 months after discharge	Physical function: MRC score Mental health: HADS, PTSS-14
Sacanella E, et al. 2011 [39]	Portugal	Prospective observational study	Geriatric clinic in Hospital Clínic of Barcelona	Geriatric clinic member: CGA evaluation	≥ 65 years living at home with full autonomy (BI ≥ 70), without cognitive impairment, and who were non-electively admitted to the ICU for a medical condition	At ICU and hospital discharge 3, 6 and 12 months after hospital discharge	ADL: Lawton Index, BI Cognitive function: IQCODE, MMSE QOL: EQ-5D
Ferrão C, et al. 2015 [40]	Portugal	Retrospective cohort study	Hospital de Santoantónio–Centro Hospitalar, university-affiliated, tertiary care hospital	N/A	All patients admitted to the ICU	2–6 months after hospital discharge	QOL: EQ-5D-3L, EQ VAS

Table 1 (continued)

Author, year	Country/region	Design	Locations and names of outpatient facilities	Occupations involved in outpatient	Eligible patients	Timing of the follow-up	Assessment tools
Young E, et al. 2005 [41]	UK	A single measurement point matched group comparison study	ICU follow-up clinic	N/A	ICU patients	3 months after ICU discharge	Mental health: HADS
Cuthbertson BH, et al. 2009 [42]	UK	A pragmatic, non-blinded, multicenter, randomized controlled trial	3 UK hospitals 2 teaching hospitals 1 district general hospital	Nurse-driven model Intensivist Nurses: introduction of a manual-based, self-directed, physical rehabilitation program	ICU patients with level three dependency	3 and 9 months after discharge	Mental health: HADS, the Davidson trauma score HRQOL: SF-36 Others: structured case review, discussion of experiences of intensive care, formal assessment of requirement for specialist medical referral
Daffurn K, et al. 1994 [44]	Australia	Observational study	Outpatient clinic attached to the ICU	Physicians An ICU clinical nurse consultant	Length of ICU stay > 48 h	3 months after ICU discharge	Questions regarding their present health, employment, and functional state; referral patterns since discharge; and recollection of their ICU stay

6MWD 6-min walking distance, *6MWT* 6-min walking test, *AM-PAC* activity measure for post-acute care, *ARDS* acute respiratory distress syndrome, *BI* the Barthel Index, *CGA* comprehensive geriatric assessment, *ECMO* extracorporeal membrane oxygenation, *EQ-5D* EuroQol 5-dimensions, *EQ-5D-3L* EuroQOL 5-dimension 3-level, *EQ-5D-5L* EuroQol 5-dimension 5-level, *FSS-ICU* functional status score for the ICU, *HADS* hospital anxiety depression scale, *HRQOL* health-related quality of life, ICU intensive care unit, *ICU-AW* ICU-acquired weakness, *IES-R* Impact of Event Scale-Revised, *IQCODE* Informant Questionnaire on Cognitive Decline in the Elderly, *MMSE* Mini-Mental Status Evaluation, *MoCA* Montreal Cognitive Assessment, *MOF* multiple organ failure, *MRC* Medical Research Council, *MV* mechanical ventilation, *N/A* not applicable, *PCL* Post-Traumatic Stress Checklist, *PCL-5* PTSD Checklist, *PHQ-9* Patient Health Questionnaire, *PICS* post-intensive care syndrome, *PTSD* post-traumatic stress disorder, *PTSS-14* Post-Traumatic Stress Syndrome 14 Questions Inventory, *QOL* quality of life, *SF-36* Short-Form-36, *SMQ* Short-Memory Questionnaire, *SPPB* short physical performance battery, *TUG* timed get up and go, *VAS* visual analog scale

physical function and proposed appropriate rehabilitation programs, while pharmacists provided medication guidance and counseling. Neuropsychologists conducted cognitive and mental health screenings. Social workers not only provided public services, but also assessed social factors affecting health, caregiver resources, and treatment for mental and emotional health.

Eligible patients

Four studies examined all patients who entered the ICU [35, 40–42]. In seven studies, the target patients were limited to critically ill patients, including those requiring mechanical ventilation, staying in the ICU for several days, and showing risk factors for PICS development, such as sepsis [22, 34, 36–38, 43, 44]. Follow-up outpatient visits were not mandatory for very elderly patients, patients who were not expected to survive long term, patients who were too far away to receive outpatient visits, patients with pre-existing dementia, patients with cognitive dysfunction due to head trauma, and patients who already experienced physical dysfunction or psychiatric disorders.

Timing of follow-ups

The time when the first outpatient visit was scheduled varied among the studies examined. The earliest initial follow-up was at the time of discharge from the hospital, while the longest was 6 months later. Eleven studies reported their first outpatient visit 1–3 months after discharge [22, 34, 35, 37–44]. Five studies had multiple outpatient follow-up visits [37–39, 42, 43], while two had follow-up visits up to 1 year later [39, 43]. In nine studies, the date of the first outpatient visit was based on the date of hospital discharge, not the date of ICU discharge [34–40, 42, 43].

Assessment tools and outcomes

Physical function, cognitive function, mental health, and health-related QOL (HRQOL) were assessed and all were evaluated in two studies [34, 35]. Two studies assessed the following three components of PICS: physical function, cognitive function, and mental health [22, 37]. Physical function [22, 34–39], cognitive function [22, 34, 35, 37, 39, 43], mental health [22, 34–38, 41–43], and HRQOL [34–36, 39, 40, 42, 43] were evaluated in seven, six, nine, and seven studies, respectively. Some studies also documented the living environment using questions. Assessments of physical function varied among studies and included measures of muscle strength, such as grip strength and the Medical Research Council (MRC) score; the Barthel Index (BI), a measure of activities of daily living (ADL), was used as a proxy for physical function. Furthermore, 6-min walking distance (6MWD) [22, 34, 37] and the MRC score [34, 35, 38] were used in three studies each, and BI in two [35, 39]. Cognitive function was assessed using the Montreal Cognitive Assessment (MoCA) [22, 34, 43] and Mini-Mental Status Evaluation (MMSE) [22, 35, 39] in three studies each; mental health focusing on depression and anxiety was assessed using the hospital anxiety and depression scale (HADS) in eight studies [22, 34–36, 38, 41–43]; and PTSD was measured using the Impact Event Scale-Revised (IES-R) in three studies [34, 35, 43]. Two and three studies used the Short-Form 36 (SF-36) [36, 42] and the EuroQol 5 Dimension (EQ-5D) [34, 35, 39], respectively, to assess HRQOL, while two examined EQ-5D-5 levels (EQ-5D-5L) [36, 43] and one assessed EQ-5D-3L [40]. Some studies also used brief questions about pain and sleep disturbances.

Three studies were comparative analyses [36, 41, 42], while two compared follow-up content [36, 42]. The primary outcome was participant recruitment and retention in one study [36] and HRQOL scores at 12 months measured with SF-36 in one [42]. An RCT comparing a shared-care intensivist–endocrinologist clinic to usual care found no benefits of specialist-led follow-ups because of poor outcomes after ICU discharge among eligible patients with type 2 diabetes and fewer outpatient visits [36]. In addition, an RCT comparing nurse-led follow-ups with usual care found no significant difference in HRQOL [42]. This study also discussed the cost-effectiveness of ICU follow-up clinics and found that the average cost of the nurse-led follow-up intervention was significantly higher in the intervention group than in the control group with follow-ups by a traditional primary care physician; the quality-adjusted life year, a measure of cost-effectiveness, averaged 0.423 for the intervention group and 0.426 for the control group, indicating that the intervention was unlikely to be cost-effective [42] (see Table 1 and Online Resource 1 [Supplementary Table 1] for detailed assessment tools and outcomes).

Others

Only three studies detailed the frequency of outpatient opening days [35, 37, 43]: every Thursday evening, once a week, and bimonthly. The time frame for clinic hours per patient was 75 min in one study [37]. No specific number of patients per month was reported; however, based on the duration of each study and the number of patients, it was estimated to be approximately five patients per month (minimum: 0.6, maximum: 10.2). Appointments for outpatient visits were made during hospitalization and explained using pamphlets. One study specified the job title of the person who made appointments (the coordinator) [22]; however, the others did not. One study included reminders for outpatient visits [36], and one stated that outpatient visits were optional [35]. Outpatient operations with interventions, such as physical

rehabilitation program interventions, referrals to mental health professionals, reviews of current medication, ICU visits, and review letters sent to each patient's primary care physician regarding patient progress, were reported in two studies [36, 42].

Discussion

The present study reviewed literature that specifically reported the operations of existing follow-up outpatient clinics after ICU discharge. The target patients, date of the first outpatient visit, and assessment and intervention items were described in the majority of studies. However, a few studies included more specific follow-up outpatient operations. Some studies provided detailed information on who obtained the initial outpatient appointment, who performed what type of functional assessment, whether patients were followed up if they did not make an outpatient visit, e.g., by telephone, and the cost-effectiveness of the program.

The follow-up system after ICU discharge includes the ICU follow-up clinic, visitations to the patient's home or facility, questionnaires posted by mail or in an e-mail to the patient's home, and telephone or Internet-based telemedicine [26, 45]. Since patients exhibit various symptoms after leaving the ICU, it is important to provide care by different healthcare professionals. The advantage of the ICU follow-up clinic is that it involves a multidisciplinary team approach with physicians, nurses, physical therapists, pharmacists, clinical psychologists, and dietitians. Furthermore, since face-to-face examinations may be conducted, more detailed functional evaluations are performed, which is primarily important when evaluating physical and cognitive functions [46].

An advantage of the ICU follow-up clinic is the ability to perform a direct functional assessment. In a scoping review [47] that investigated assessment tools for diagnosing PICS, 6MWD, the MRC score, grip strength, BI, MoCA and MMSE, HADS and IES-R, SF-36, and EQ-5D-5L were highly recommended with high scores based on the Delphi method, and these assessment tools were used in ICU follow-up clinics. A major advantage of the ICU follow-up clinic is that it performs most of the highly recommended PICS evaluations. However, a few studies assessed cognitive function as an outcome. We assume that this was because in contrast to HADS and IES-R, which are mainly used for mental health and patient self-report on paper, MoCA requires them to respond face to face with an assessor; the assessor requires a certain amount of training and the assessment takes approximately 10 min to complete [48]. HRQOL assessment tools, namely, SF-36 and EQ-5D, include questions on physical function and mental health [49, 50], and these items may be substituted for the limited number of positions involved in ICU follow-up clinics, which do not allow detailed physical function and mental health surveys. Therefore, in ICU follow-up clinics, the functional assessment performed varies from facility to facility due to time constraints, workforce issues, personnel costs, and other issues. It is necessary to select and implement tests that may be conducted at each facility according to the types of jobs involved in PICS outpatient services and the PICS outpatient quota. The use of information technology may effectively reduce the evaluation time.

It remains unclear whether target patients all need to be patients admitted to the ICU or limited. This is important because the number of outpatients will increase, and there is a risk of workload pressure; therefore, it may be more effective to limit target patients to those with relatively severe illnesses that are risk factors for PICS [8, 51], such as patients with sepsis, ventilated patients, those exceeding 48 h in the ICU, and patients with delirium. Although there were no details on the opening days of ICU follow-up clinics, limiting the number of target patients may be better in consideration of the workforce required [18, 24], because a few facilities are expected to provide daily ICU follow-ups.

In many studies, the date of the first outpatient visit was 1, 3, or 6 months after discharge from the hospital because muscle mass loss and muscle weakness as physical impairments and pulmonary respiratory dysfunction were already observed at the time of ICU discharge [52–54], requiring a relatively early evaluation. Cognitive dysfunction was reported to have already developed during hospitalization or at discharge and remained in many ICU survivors 1 and 2 years after ICU discharge [55]. Mental health issues, such as anxiety and depression, are observed after admission to the ICU, whereas PTSD may develop later, more than 3 months after ICU discharge; therefore, a yearly evaluation is necessary [56, 57]. The incidence of PICS was 64% 3 months after ICU discharge and remained high at 56% after 12 months, suggesting the need for long-term follow-ups [58]. In consideration of the mortality rate of critically ill patients after discharge from the hospital [59], it may be better to set the date of the first outpatient visit to 1 month after discharge because some patients will have difficulty with outpatient visits if the first visit is several months after discharge. However, setting the date to 1 month after discharge is difficult because the patient may be unable to return home if transferred to a different hospital. In this case, it is necessary to ask family members to visit the ICU follow-up clinic and ask about the patient's condition or mail a questionnaire asking the family about the patient's condition and requesting a response.

PICS may improve over time, and the rate of the self-interruption of outpatient visits may increase after 1 or 2 years. The time when the first outpatient visit was based on the date of discharge or the date of ICU discharge varied among studies; however, most used the date of discharge

as the basis because obtaining an appointment date many months after discharge is easier when the main focus is on outpatient visits. Therefore, the timing of follow-ups for PICS outpatients needs to be at least 1–3 months after discharge from the first outpatient visit, and multiple follow-ups every few months are important for physical function, cognitive function, and mental health because all of these symptoms are observed long term.

No evidence was presented regarding the cost-effectiveness of ICU follow-up clinics [42]. However, a number of limitations were noted, including failure to consider other aspects of patient illnesses, sample selection bias issues, and external validity issues; therefore, further research on cost-effectiveness is needed [27]. Lack of funding has been cited as one of the barriers to operating ICU follow-up clinics because they involve multiple professions, require time for functional assessments, and are expensive to set up as a system. In facilities in the UK, 90% did not receive funding and operated ICU follow-up clinics on their own budget, and 90% of facilities in the UK that did not operate an ICU follow-up clinic reported lack of funding as a barrier [60]. Although insufficient evidence exists regarding the effectiveness of ICU follow-up clinics [60], PICS is an important social issue that healthcare professionals need to monitor and prevent after discharge [61]. Additionally, financial support may accelerate the establishment of ICU follow-up clinics and build evidence for PICS prevention measures.

This scoping review revealed that an optimal mode of operation for ICU follow-up clinics has not yet been established; evidence suggesting the effectiveness of ICU follow-up clinic interventions for improving PICS-related outcomes is limited [25, 26]. Therefore, establishing an optimal ICU follow-up clinic operating format is a future challenge. The onset of PICS affects ICU survivors, amplifies the burden on their families, and increases the cost to the healthcare system [62, 63]. Therefore, providing support for ICU follow-up clinics is crucial because peer support group interventions and ICU follow-up clinics effectively improved the QOL of ICU survivors and reduced mortality after discharge [26, 64, 65].

The present scoping review has some limitations. Despite multiple database searches, only a few studies were included and all were conducted in developed countries. Therefore, the post-ICU follow-up models described may have different effects in other sociocultural settings (e.g., low- and middle-income countries). Additionally, the search formula used in this study may not have extracted older studies. Another limitation was the paucity of literature providing detailed information on ICU follow-up clinics. Since the authors were not asked about specific outpatient operations in this study, the survey had a limited scope. Furthermore, patients targeted for ICU follow-up clinics are diverse, and there are limitations to discussing them simultaneously. It is also impossible to estimate the actual situation based on this study alone.

In conclusion, we conducted a scoping review to clarify the optimal operating format for ICU follow-up clinics. All studies on ICU follow-up clinics were from developed countries, with varying operational modalities across countries and regions; the most commonly used ICU follow-up clinics were nurse or physician led, targeting more severely ill ICU survivors, with the initial assessment 1–3 months after discharge. The most frequently used assessment tools were the MRC score and 6MWD for physical function, MoCA for cognitive function, HADS and IES-R for mental health, and SF-36 and EQ-5D-5L for ADL and QOL. This scoping review revealed that an optimal mode of operation for ICU follow-up clinics has not yet been established; the categories of critically ill patients admitted to the ICU widely vary, and there is limited evidence to suggest the effectiveness of ICU follow-up clinic interventions at improving PICS-related outcomes. Therefore, establishing the optimal form of operation for ICU follow-up clinics is a future challenge.

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Declarations

Conflict of interest The authors declare that they have no conflict of interest.

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