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Addressing Post-Acute Sequelae of SARS-CoV-2: A Multidisciplinary Model

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Search strategy and selection criteria

Databases: Pubmed, Embase

Dates: May 1, 2020 thru Aug 1, 2021

Languages: English

Search Terms: Post-acute COVID-19 syndrome; Post-intensive care syndrome; Long COVID; Long haul COVID; Post-acute sequelae of SARS-CoV-2 infection; Chronic COVID syndrome; Post-COVID Condition

Pre-prints were included in the search.

Key Messages:

- The burden of Post-Acute Sequelae of SARS-CoV-2 infection is significant in terms of clinical complexity and the scale of patients affected worldwide
- Rigorous data characterizing symptomology is limited, but key domains include physical, psychological, cognitive, and respiratory.
- ICU Survivor Clinics offer a model for addressing PASC survivorship, both for acute and non-hospitalized patients
- Ensuring equitable provision of care to under-served populations may be challenging, but is integral to international pandemic management
- PASC clinics present research opportunities that should be harnessed to continually inform knowledge of survivorship trajectory following SARS-CoV-2 infection, and improve service innovation and delivery

Abstract

The SARS-CoV-2 coronavirus has infected more than 156 million people worldwide with over 140 million survivors. Persistent symptoms have been reported in patients with both severe and mild initial COVID-19 illness. Early reports on the Post-Acute Sequelae of SARS-CoV-2 (PASC) suggest the most common symptoms include impairments in physical, cognitive and mental health. Such impairments are complex and multifactorial, requiring a coordinated multidisciplinary approach to management. Decades of research on Post-Intensive Care Syndrome (PICS) provide a framework for establishing multidisciplinary clinics to address the immediate needs of both hospitalized and non-hospitalized COVID-19 survivors while providing a platform for rigorous research into the natural history of PASC and therapeutic interventions.

Introduction

The burden of COVID-19 survivorship is enormous with more than 65 million COVID-19 survivors by the end of the first week in March 2021.(1) Even when previously young, healthy people with COVID-19 require only out-patient care, nearly 20% do not return to their usual state of health within three weeks of infection.(2) In a study from China, approximately 75% of hospitalized COVID-19 survivors had at least one persistent symptom six months after acute illness.(3) The most commonly reported symptoms include fatigue, dyspnea, cough, headache, loss of taste/smell, and cognitive and mental health impairments (e.g. anxiety/depression).(4-6) Moreover, patients with vs without COVID-19 have a higher risk of death and healthcare utilization beyond the first 30 days of illness.(7) In response to the rapidly growing population of COVID-19 survivors who experience a wide array of complex, multifactorial symptoms, the World Health Organization advocates for a multidisciplinary approach to addressing Post-Acute Sequelae of SARS-CoV-2 infection (PASC).(8) Hence, the overall goal of this paper is to inform the development of multidisciplinary pathways of care, adapted from the post-intensive care syndrome (PICS) framework, to meet the long-term needs of patients with PASC. The target audience includes patients, clinicians, educators and researchers.

Post-Intensive Care Syndrome (PICS) and Post-Acute Sequelae of SARS-CoV-2 Infection (PASC)

Decades of research conducted prior to 2020 described the physical, cognitive, and mental health impairments experienced by survivors of critical illness (collectively termed Post-Intensive Care Syndrome (PICS)).(9) Knowledge gained about PICS can be leveraged to understand, describe, diagnose, and treat PASC. Specifically, survivors of acute respiratory failure experience exercise intolerance (e.g. perform below predicted on a six minute walk test), and half will not have returned to work at a year after discharge from the intensive care unit (ICU).(10) Anxiety, depression and posttraumatic stress disorder (PTSD) symptoms are common and persistent months to years after critical illness.(11-13) Among critical illness survivors of all ages, median cognition scores are consistent with mild cognitive impairment; more than a third will have cognitive testing comparable to moderate traumatic brain injury a year later(14)

There are few rigorous prospective reports on the natural history of PASC, including prevalence and duration, with most studies following patients fewer than seven months.(4, 15-24) (Tables 1 and 2) Existing studies, however, indicate that the burden of impairments is quite high. An analysis of the US Department of Veterans Affairs electronic health database used a high dimensional approach to evaluate 6-month outcomes for patients surviving the initial 30 days after acute COVID-19 infection. Beyond the initial 30 days, results demonstrated a higher risk of death for non-hospitalized patients with vs without COVID-19 (hazard ratio (HR) 1.59 (1.46, 1.73)) as well as for patients hospitalized with COVID-19 vs seasonal influenza (1.51 (1.30, 1.76)).(7)

Similar to PICS, “brain fog”, fatigue, muscle weakness and shortness of breath are among commonly reported symptoms following COVID-19.(3, 7, 25-30) Using the six minute walk test as a measure of physical function, nearly a quarter of COVID-19 survivors perform below the lower limit of normal functioning six months after acute illness.(3) In a large international survey of COVID-19 survivors, 85% of respondents self-reported cognitive impairment;(26) both older and younger respondents reported such impairment impacted their daily lives and ability to return to work.(26) Nearly one in four patients hospitalized with COVID-19 reports substantial depression and/or anxiety symptoms lasting at least six months after acute illness.(3) An observational study from Wuhan, China demonstrated patients also commonly self-reported symptoms of PTSD.(31) Among hospitalized patients, the most common pulmonary impairment at six months following acute COVID-19 illness is a decreased diffusing capacity (about 33% of patients), followed by reduced total lung capacity (approximately 17%).(3) Persistent pulmonary impairments likely differ by initial disease severity. Patients with more severe initial COVID-19 pneumonia have significantly lower percent-predicted diffusing capacity (DLCO) at four-month follow-up (mean [SD] 73 [18] vs 95 [20], $p=0.003$). (32)

Dyspnea and fatigue are common among COVID-19 survivors.(16, 29, 30, 32-35) Importantly, there is no consistent association between dyspnea and abnormalities on chest imaging, pulmonary function test, or initial disease severity.(32-35) Dyspnea, like fatigue, is a complex, multifactorial symptom.(33) Notably, fatigue is common in acute respiratory failure survivors (approximately 70%) at 1-year follow-up.(36) Fatigue following acute respiratory failure is not consistently associated with severity of illness or ICU length of stay, but frequently co-occurs with impairments in cognition, mental health and physical function.(36) Addressing complex symptoms like dyspnea and fatigue, in both

hospitalized and non-hospitalized COVID-19 survivors, requires multidisciplinary interventions, informed by an understanding of risk factors and co-occurring impairments.(34)

Infection prevention and control measures during the COVID-19 pandemic have the potential to further impact recovery (Figure 1). For example, visitor restrictions for hospitalized patients may increase the risk of delirium and PTSD,(37) and social isolation in the outpatient setting can contribute to mental health disturbances among non-hospitalized patients as well. Essential rehabilitation and non-infection-related medical services may be limited or eliminated for COVID-19 patients both during and after hospitalization.(37, 38)

While cohort studies of people who become critically ill with COVID-19 will be important to identifying any unique long-term sequelae of infection, outcomes are expected to mirror what we already know about ICU survivorship. Namely, survivors' experiences vary greatly, with many experiencing new and persistent impairments, including complex, multifactorial symptoms, for months to years. It remains unknown whether the experiences of COVID-19 patients requiring ICU care overlap substantially with those of non-ICU, hospitalized and non-hospitalized patients, or whether these populations experience distinct, multi-disciplinary needs.

ICU Survivor Clinics: Existing Care Framework and COVID-19 Context Extension

There are ICU survivor clinics in Europe, the Americas, and the Asia-Pacific that aim to address the multifaceted needs of ICU survivors. These clinics offer key insights into barriers and facilitators to establishing PASC programs that 1) meet COVID-19 survivors' immediate clinical needs, 2) create a platform for research on the natural history of PASC, and 3) expedite the rigorous evaluation of therapeutic options.(39) Challenges to creating ICU survivor/ PASC programs fall into two broad domains: patient engagement and organisation.

Most patients will not have access to a post ICU clinic, with fewer than half of eligible survivors cared for by an ICU survivor clinic in their region.(40, 41) This may be because: 1) the clinic is unable to contact the survivor; 2) the survivor lacks transportation to the clinic; 3) the survivor lacks insurance or the means to access services; or 4) the survivor is unaware of the potential benefit of attending follow-up services.(42) The COVID-19 pandemic is disproportionately affecting poorer Black and Minority Ethnic (BAME) communities, and it is important that disparate provision of rehabilitation services does not exacerbate these inequalities further.(43, 44) To overcome these

challenges, clinicians should be flexible in their approach. While telemedicine, which was rapidly adopted during the pandemic, can overcome transportation barriers, digital poverty and illiteracy can hinder access to telemedicine appointments.(45) Hence, when possible, a hybrid model that incorporates both virtual and in-person clinic options is optimal.

Acute care teams need to pro-actively communicate with patients and their primary care providers, ideally before discharge from hospital, to counsel about the recovery trajectory, convey the potential benefit of post-acute clinic attendance, ensure access, and foster patient engagement. This communication can be achieved via direct patient education at the bedside by acute care physicians, advanced practice providers and nurses as well as members of essential therapy services. The electronic medical record can also be used to share discharge summaries and follow-up recommendations with primary care teams as well as to facilitate referrals to multidisciplinary clinics.

In some healthcare systems, billing infrastructure, including inconsistent insurance reimbursement and billing codes, presents a significant barrier to the creation of follow-up services.(42) Addressing this barrier requires changes in policy to reflect extension of support for acute COVID-19 care to PASC as well. A recent US Congressional Hearing included advocacy for billing codes to capture PASC, allowing tracking of needs and services rendered, and incentivizing provision of services for this population.(46) In the meantime, existing billing structures can capture the type of care provided. For example, transitional care codes are designed specifically to capture the complexity and high need of the post hospital period. The value of survivorship clinics to both patients and institutions must be demonstrated to ensure consistent staffing and support. Given the increased risk of healthcare utilization among COVID-19 survivors,(7) programs should prospectively evaluate the effect of multidisciplinary interventions on outcomes including readmissions and healthcare resource.(39) Moreover, working in survivorship clinics may improve staff well-being and reduce burn-out, by allowing staff to reconnect with patients and families they cared for in the inpatient setting.(47) Importantly, the surge in COVID-19 survivors provides an opportunity to address gaps in knowledge regarding management of frequently experienced symptoms following acute illness. This includes identifying unmet needs, especially during transitions of care, and targeting interventions to meet such needs.(48)

The PASC Clinic Model

PASC has not yet been fully defined. Hence, developing a clear case definition is the focus of ongoing research. In the meantime, existing clinics must base criteria on capacity and availability of local resources. Primary care practitioners can provide initial screening to identify patients with ongoing symptoms beyond the initial acute illness, and a number of post-acute COVID services utilize a “screen and refer” model to identify which specialists are most urgently needed for each individual patient’s problems. Current guidelines advocate for PASC patients to be referred to multidisciplinary programs with expertise in evaluating and managing commonly reported symptoms after COVID-19 including fatigue, dyspnea, mental health disturbances, and cognitive impairments.(49) Given overlapping symptoms and a need for multi-disciplinary care, ICU recovery clinics and the PICS framework provide a foundation for both ICU and non-ICU populations for management of PASC. It is not essential that ICU practitioners lead such clinics. Successful existing clinics include both primary and cooperative leadership by internal medicine, pulmonology, physiatry, endocrinology, and infectious disease. More importantly, a multidisciplinary approach with “integrated referral pathways”(49) between PASC clinics, primary care practitioners, and core sub-specialists is essential to success. Given the wide array of potential COVID-19 sequelae described over the weeks and months following acute infection,(4-7) a detailed history and physical is essential to identifying complications, evaluating contributing factors, and guiding referrals. Current guidelines recommend follow-up begin 4-8 weeks after discharge, or from acute illness for those who were not hospitalized, and continue at 3-month intervals as needed.(50, 51) Such guidelines may require adaptation at both the institution/site level based on available resources and to meet individual patient needs. Here, we describe the roles of specialists central to both ICU recovery services and comprehensive PASC programs for all levels of acute illness (Figure 2).(8)

Physical Medicine and Rehabilitation

Physiatrists, rehabilitation psychologists, physical therapists (PTs), occupational therapists (OTs) and speech-language pathologists (SLPs) play a fundamental role in evaluating functional, cognitive, and mental health needs and provide essential rehabilitation services in the post-acute setting. Rehabilitation in the post-acute phase falls under five general categories: 1) acute or subacute inpatient rehabilitation; 2) skilled nursing facilities; 3) home with home therapy services; 4) home with outpatient therapy services; and 5) home without any services. Patients might engage with one

or all three therapy pathways during their recovery, and the provision of such services hinges on evaluations by key members of the rehabilitation team.

Physiatry: Physiatrists are integral members of the multidisciplinary team and coordinate rehabilitation care in acute and all five post-acute phases, focusing on bio-psycho-social functioning and return-to-life based on a new functional baseline.(52, 53) This involves not only cardiopulmonary rehabilitation after ARDS but also a comprehensive rehabilitation plan addressing physical, cognitive, psychosocial, and vocational needs given the complex and long-lasting nature of PASC. Physiatrists diagnose neurologic and musculoskeletal complications, including brachial plexopathy, critical illness neuropathy and myopathy, stroke, or limb ischemia due to thrombotic events. Autonomic dysfunction occurs in PASC patients; hence, timely autonomic function tests (e.g. tilt table test), when indicated based on initial screening, for proper diagnosis followed by appropriate medical and rehabilitation treatments are important to prevent further physical, mental, and cognitive impairments.(54) Standardized, routine evaluations determine the need for essential rehabilitation services, including PT, OT, SLP, and rehabilitation psychology.

Physical Therapy: ICU-Acquired weakness (ICUAW), including critical illness polyneuropathy or myopathy, is associated with decreased strength and physical function that can persist for years after acute illness.(55-57) While the long-term effects are equivocal, beginning early rehabilitation within 48 hours of ICU admission, is associated with improvement in strength and independent walking in the hospital.(58, 59) Physical therapy services in the post-acute phase can be provided in the home as well as in the outpatient setting.(60) Some standardized assessments of muscle strength and activity limitations (exercise capacity, gait speed, etc) in the post-acute setting can be performed both via telemedicine and in-person (e.g. Activity Measure for Post-Acute Care, sit to stand) while others require in-person visits (e.g. 6-minute walk test, manual muscle testing score for strength).(61) Early in the post-acute period, restorative interventions are of limited efficacy for patients recovering from critical illness. Therefore, physical therapy interventions in the post-acute setting initially focus on teaching both patients and caregivers compensatory strategies for adapting and improving

functioning.(61) Once functioning has been optimized, restorative exercises (e.g. aerobic strength and endurance training) titrated to overload are implemented while assessing cardiorespiratory demand.(61)

Occupational Therapy: In the post-acute phase, practice guidelines specific to occupational therapy for COVID-19 survivors include: considering the effects of oxygen weaning on activities of daily living (ADLs); providing energy conservation and work simplification strategies; addressing the impact of cognitive impairments on occupational performance; addressing mental health, stress, and coping related PTSD or anxiety disorders; and continuing the plan set in the early phases of the disease to return to participation in meaningful activities.(62) OTs assist survivors with returning to work by facilitating graded return, part time vs. full time, working from home, adjusted work tasks and responsibilities, and by providing assistive technology, and vocational rehabilitation.(63) OTs also monitor for residual impairments in range of motion, sensation, fine motor coordination, or pain related to positioning such as prolonged proning. OT interventions include remediation, such as strengthening or fine motor training, and compensation, such as writing aids or assistive technology.

OTs play an important role in the evaluation and management of cognitive impairment, including encouraging active engagement in meaningful activities, resumption of a productive life and a return to social participation and human connection.(64) OTs help patients focus on engagement in meaningful occupations including activities they need to, want to, and are expected to do.(65) Cognitive rehabilitation includes retraining orientation, memory, attention, and executive functioning skills that are required to successfully complete tasks such as financial management and multitasking for return to work. In addition to retraining internal cognitive skills, OTs also educate patients on the use of external strategies such as memory aids and assistive technology.(66)

Speech-Language Pathology: Speech-language pathologists (SLPs) are vital members of the multi-disciplinary survivorship team.(9, 67, 68) SLPs evaluate and treat speech/language/cognition, voice/airway, and swallowing disorders. In the ICU, SLPs focus on delirium prevention, communication options for mechanically ventilated patients, and swallowing assessments. As patients transition to the wards, rehabilitation facilities, outpatient clinics, and home care, focus shifts to a more traditional rehabilitative approach.(69) Patients who experienced delirium while critically ill

appear particularly prone to cognitive-linguistic changes including deficits with attention, memory, and other executive functions (e.g., planning, organization, self-monitoring).(14, 70, 71) Because behavioral treatments by SLPs also occur after ICU discharge, they are essential members of outpatient survivorship clinics.

Patients who were intubated are at high risk for voice and airway disorders after extubation.(72-75) SLPs are often the first clinicians to identify the etiology of voice and airway disorders while evaluating laryngeal and upper airway anatomy.(76) Voice and/or breathing changes may include changes in vocal fold mobility and obstructions (e.g., inflammation, tissue changes).(72, 73)

Intubation injuries extend from voice and airway to dysphagia.(73, 77, 78) SLPs evaluate patients for dysphagia, either after a failed swallow screening or as a result of clinical referral.(79) A videofluoroscopic swallow study or flexible endoscopic evaluation of swallowing (FEES) is used to characterize disordered swallowing physiology and plan treatment.(80, 81) While dysphagia may extend many months beyond hospital discharge, most survivors will recover with proper care.(82)

Rehabilitation Psychology and Neuropsychology: Rehabilitation psychologists provide comprehensive evaluation, targeted psychotherapy and health and behavior interventions. Evaluations of current functioning follow a biopsychosocial model, which includes physical, emotional, cognitive, and social aspects of an individual's status in the context of medical and psychosocial history and current circumstances. A thorough assessment helps identify barriers to optimal function as well as areas of strengths and resiliency. The following **Patient-Reported Outcomes Measurement Information System (PROMIS)**(83) measures have been used to evaluate symptoms and gauge treatment progress: PROMIS Pain Interference, Ability to Participate in Social Roles and Activities, Anxiety, Depression, Fatigue, and Self-Efficacy for Managing Symptoms. Since the start of the COVID-19 pandemic, most evaluations have been conducted using telehealth.

Psychotherapy or behavioural interventions focus on helping survivors develop coping and compensatory strategies. Evidence-based therapeutic interventions for mental health difficulties include: 1) cognitive behavioral therapy (CBT) for depression, anxiety and pain; 2) cognitive processing therapy for PTSD; 3) interventions focused on improving sleep (e.g., CBT-I); 4) fatigue management; and 5) mindfulness-based interventions (MBI) focused on

improving awareness and distress tolerance. Patients with pre-existing psychiatric co-morbidities or those requiring medication management are also evaluated by psychiatrists.

In many cases, persistent fatigue, sleep disturbance, and emotional distress further aggravate cognitive difficulties. Consistent with reported patterns of cognitive difficulties in PICS,(9, 14, 84) many post-COVID patients who have moderate-to-severe disease present with generalized cognitive slowing, and deficits in executive function, including divided and sustained attention, initiation, cognitive flexibility, and executive control over memory. Neuropsychological evaluation of cognitive function in the context of estimated optimal ability helps identify current difficulties, aid in differential diagnosis, and develop treatment recommendations. A subset of survivors might benefit from referral to speech and language pathology (SLP) services for cognitive rehabilitation. As a patient's disease process often is experienced closely by their family members, screening for psychological symptoms should be extended to this group.(85)

Neuropsychiatry: Neuropsychiatrists can provide specific input when the medical, biological and psychological aspects of a patient's clinical presentation converge. Examples include when knowledge about the impact of the antidepressant properties of anti-inflammatory treatments(86) and the anti-inflammatory aspects of antidepressant treatments can work synergistically. (87) Whereas rehabilitation psychologists often deal with the problems affecting patients from a mind-based perspective with implications from the effects on the brain, neuropsychiatrists do the opposite—beginning with a brain-based perspective that has a bidirectional impact on the mind. Meeting in the middle, and providing a complementary and collaborative approach to the care of patients in need of multidisciplinary input, allows rehabilitation psychologists and neuropsychiatrists the opportunity to have the combined tools to address the myriad manifestations ICU stays and COVID-19 have on patients.

Pharmacy

A comprehensive medication review is the core service provided by a pharmacist in a PASC clinic.(88, 89) This multifaceted review encompasses medication de-prescribing, initiating or restarting drug regimens, and therapy optimization. While stress ulcer prophylaxis in the ICU is classically associated with inappropriate continuation, any

medication initiated for an inpatient indication has the potential to be inappropriately continued in the outpatient setting. Post-COVID emphasis is placed on determining the duration of antithrombotic therapy, which may have been initiated in the setting of an unconfirmed diagnosis. A full understanding of the new and dynamic impairments facing ICU survivors is needed to properly adapt and adjust drug therapy regimens. Improving physical function can affect blood pressure or glucose levels and their associated medications. Close monitoring and frequent medication dose adjustments are particularly important for survivors experiencing recovery of kidney or liver function.

A pharmacist who understands the challenges of COVID-19 survivorship can also help ensure that prescribed medications are accessible and taken at the right time. For example, new cognitive impairment may limit a survivor's understanding of newly prescribed medications and their side effects. Memory impairments can decrease medication compliance. Restrictions on in-person primary care in 2020 may have result in missed immunizations, and changes in employment status or medication insurance coverage may limit the continuation of prior drug therapy.(88, 89) A critical care clinical pharmacist is well positioned to address these challenges as part of an interdisciplinary clinic team.(90) Pharmacists work with a medication access team to ensure affordability and appropriate access to medications. They supply pillboxes or discuss strategies for medication reminders to improve medication adherence. Depending on local practice laws, pharmacists are often able to obtain a vaccination history and administer immunizations.

Social Work/Welfare Support Access

Social workers address several important aspects of recovery following COVID-19. About one third of COVID-19 patients report that persistent symptoms affect their ability to return to work up to seven months after acute illness.(26) Social workers can connect patients with job resources and provide support to address financial needs. Social workers and community health workers can intervene to improve access to care for underserved populations and enhance communication between patients, their families, and the healthcare team.(91, 92) They also conduct screening for mental health impairments among both patients and their families or caregivers, and provide psychoeducation and referrals as needed.(91) Addressing the needs of family caregivers is particularly important during large-scale disasters

like the COVID-19 pandemic because social distancing and restricted family presence in hospitals threaten family integrity and make it difficult for them to feel calm, connected, and useful.(93)

Primary Care

In the long-term, primary care practitioners will provide both aftercare and care coordination for the majority of COVID-19 survivors.(94, 95) Due to their knowledge of patients' long-term medical history and expertise in care coordination, they play a key role in the management of PASC – especially in regions where PASC clinics will not be available. However, the rapid growth of information and diversity of manifestations post-COVID is not yet consistently available in a comprehensive format, making it challenging for primary care practitioners to stay up to date. Thus, effective information transfer from both hospital and the PASC clinic is mandatory - regarding all dimensions as detailed above and including communication of concrete treatment recommendations. This process may occur via by elaborated discharge letters handed out to the patient directly with instruction to bring to follow-up primary care appointments, direct communication between hospital/PASC clinic and primary care providers, and further development of virtual services.(94)

Important Considerations for the Equitable Provision of Care

Under-served Populations and Implementation in Low- and Middle-Income Countries

Ensuring equity of access to post COVID healthcare services to optimise patient recovery is essential, and particular attention should be paid to under-served populations. Examples of under-served populations include Black, Asian, and Ethnic Minorities (BAME, particularly known to be a factor associated with increased infection risk, mortality, and poorer outcomes from COVID infection(96, 97)), those at educational or socioeconomic disadvantage, religious minorities, people living in remote areas, those with caregiving responsibilities or in full-time employment, and those with factors associated with health status such as cognitive impairment, learning disability, or multiple co-morbidities, amongst many others.(98, 99) Strategies to help vulnerable communities access healthcare services have been reported, most notably 1) addressing the social determinants of health, through screening and information provision, signposting

healthcare users to appropriate community services, and encouraging community stakeholders to support individualised service delivery according to the needs of patients, 2) adopting new and innovative virtual care strategies, e.g., through various forms of telehealth, 3) designing global budget payments to support hospitals located in areas delivering services to vulnerable communities, and 4) using inpatient/outpatient transformation strategy, i.e., more closely integrating hospital- and community-based services, and adapting each, to meet the needs of individual communities.(99)

Implementation of multidisciplinary PASC clinics might be challenging in low- and middle-income countries. Existing multidisciplinary models serve as a guide to addressing barriers.(100) Educational programs, targeting healthcare workers and community and public health staff, and focused on providing information on screening for commonly experienced symptoms are essential.(100) Community health workers provide education and raise awareness in local communities.(101) A hub and spoke model, where larger academic centers provide specialized care and consultation to surrounding providers/communities is effective.(101) Finally, the provision of telehealth infrastructure to facilitate self-assessment and self-management supports patients in remote communities.(101)

Language Services for Non-Native Speakers

Language support services are vital for COVID-19 survivors in immigrant communities which are experiencing disproportionately high rates of infection and severe disease (e.g.. Hispanic and Latino populations in the U.S.).(102, 103) Multi-lingual staff are highly valued within PASC clinics, particularly when responding to phone calls from non-native speaking clinic patients. Pre-translation of written informational documents is crucial to care delivery for these survivors. Interpreter services have adapted to telemedicine models allowing interpreters to be present on both phone calls and video platforms, which can also be used during in-person clinic visits. In addition to being convenient to schedule, remote interpreter services reduce the need to accommodate additional persons in the clinic space under infection control procedures.

Research Collaboration

The chief goal of PASC clinics must be to support the recovery and well-being of people who survive infection. However, clinics can help estimate the frequency of patient outcomes and identify survivor phenotypes without compromising their primary mission, by optimizing the data they record in electronic health records.(104, 105) Therefore, an international task force comprised of 93 experts including representatives of the European Respiratory Society (ERS) and American Thoracic Society (ATS) convened in 2020 suggested that follow-up assessments of hospitalized COVID-19 survivors occur 6-8 weeks after discharge and include the core outcome set for survivors of acute respiratory failure.(106, 107) The core outcome set is comprised of the EuroQoL-5D (EQ-5D), the Hospital Anxiety and Depression Scale, and the Impact of Events Scale-Revised, and can be administered entirely over the phone, making it feasible to implement in clinics using tele-health.(108) Importantly, the core outcome set represents a minimum number of assessments to facilitate research and comparisons, and most clinics will choose to incorporate additional assessments determined by resources and interest. In addition to assessment at 6-8 weeks post discharge, a coordinated approach to COVID-19 care should plan for serial assessments triggered by life events. For example, assessment pre-hospital discharge will determine the need for post-acute care services, while the end of employment-based medical disability benefits, plateaus in recovery, or significant changes in symptoms or disability should prompt reassessment.(109)

PASC clinics also provide a unique opportunity to advance the field of ICU survivorship clinics given the unprecedented surge of critical illness survivors presenting for care. A Cochrane review demonstrated there was insufficient evidence to demonstrate ICU survivorship clinics improve outcomes by addressing unmet needs for ICU survivors.(110) The review highlighted the heterogeneity in services delivered and design of studies evaluating efficacy as limitations. Prospective evaluation of the efficacy of PASC clinics, especially those including ICU survivors, and ideally with a randomized controlled design, could answer important questions regarding how such clinics might improve outcomes.

Conclusion

COVID-19 represents an unprecedented public health emergency. Multidisciplinary post-acute care programs, established using a PICS framework, can deliver essential support for both hospitalized and non-hospitalized patients

during their recovery. These programs also provide an infrastructure for rigorous research, conducted alongside clinical care, to better understand the prevalence, natural history and risk factors of PASC and evaluate therapeutic interventions to improve outcomes. Given the disproportionate impact of COVID-19 on under-served populations, special attention should be given to ensuring the equitable delivery of care. The PICS/PASC model has the potential to endure beyond the COVID-19 pandemic as a means of providing essential multidisciplinary care for patients experiencing complex, multifactorial symptoms from a variety of acute and chronic illnesses.

Declaration of interests

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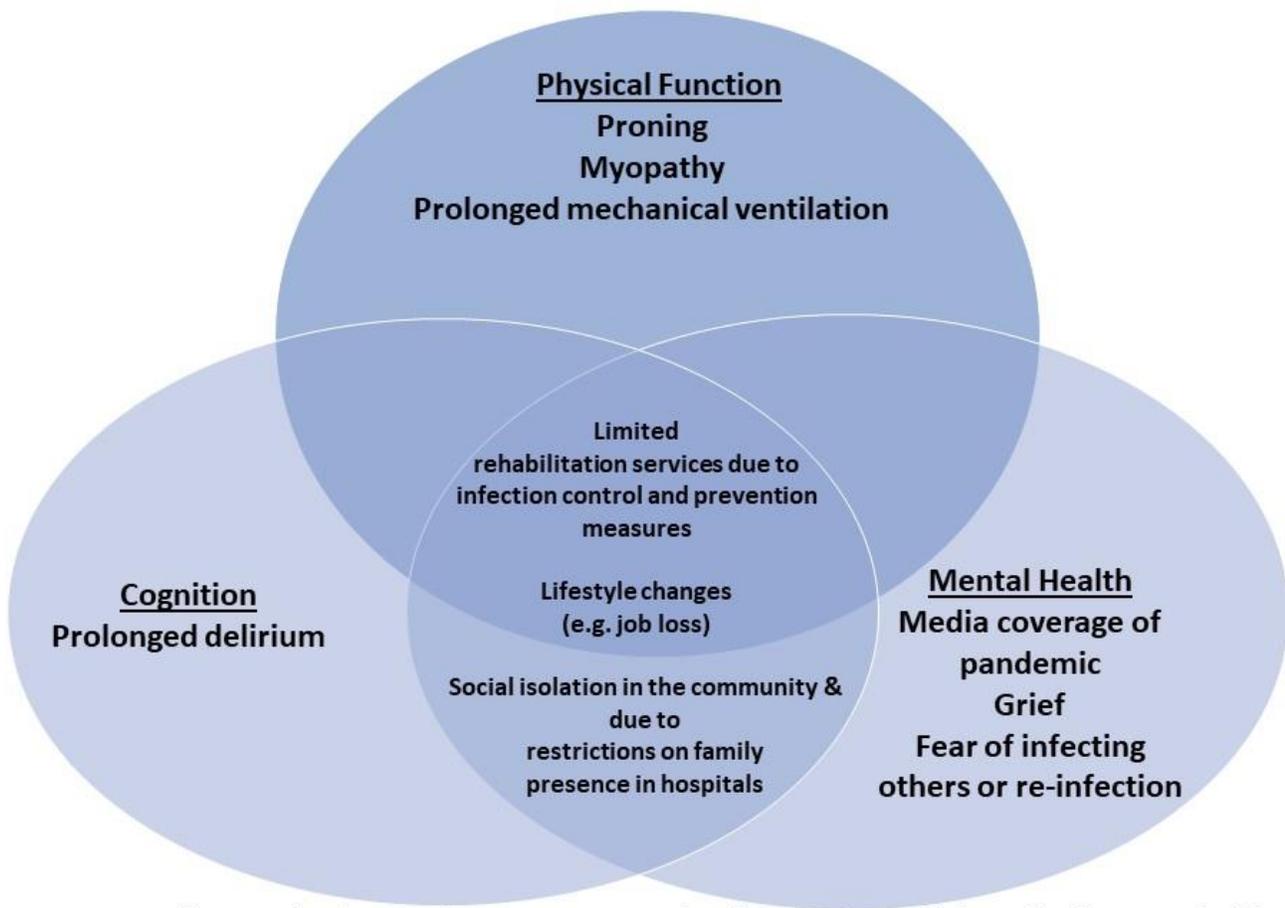
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Figure 1. COVID-19 Pandemic-Related Factors Exacerbating Physical, Cognitive, Mental Health Impairments

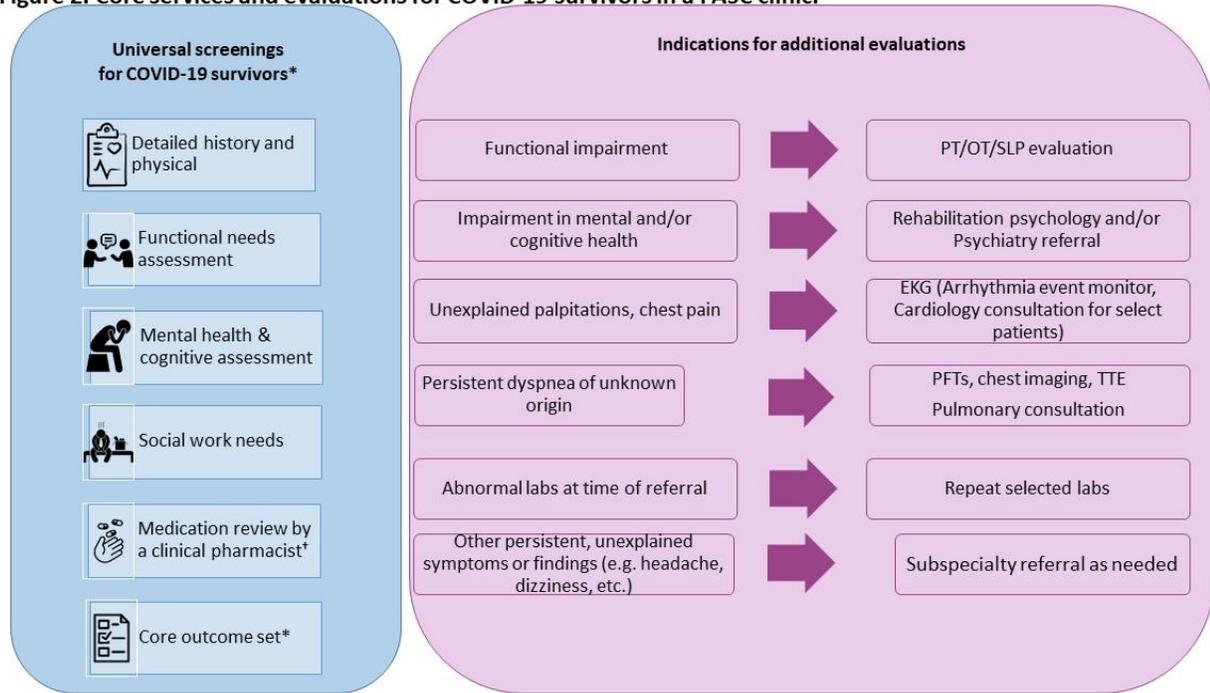


The COVID-19 pandemic can further complicate recovery across key domains of mental, physical and cognitive health, which are commonly impaired in the setting of critical illness.

Figure 1. COVID-19 Pandemic-Related Factors Exacerbating Physical, Cognitive, Mental Health Impairments

Legend: The COVID-19 pandemic can further complicate recovery across key domains of mental, physical and cognitive health, which are commonly impaired in the setting of critical illness.

Figure 2. Core services and evaluations for COVID-19 survivors in a PASC clinic.



*Core services recommended by NICE guidelines.(49)

[^]Core outcome set for acute respiratory failure(108) and COVID-19.(106, 107)

Abbreviations: PT, Physical Therapy; OT, Occupational Therapy; SLP, Speech-Language Pathology; EKG, electrocardiogram; PFTs, Pulmonary Function Tests; TTE, Transthoracic echocardiogram

Figure 2. Core services and evaluations for COVID-19 survivors in a PASC clinic.

Legend: Represents the initial screening evaluation for COVID-19 survivors based on current guidelines and general recommendations for indications for additional evaluation.

*Core services recommended by NICE guidelines.(49)

[^]Core outcome set for acute respiratory failure(108) and COVID-19.(106, 107)

Abbreviations: PT, Physical Therapy; OT, Occupational Therapy; SLP, Speech-Language Pathology; EKG, electrocardiogram; PFTs, Pulmonary Function Tests; TTE, Transthoracic echocardiogram

Panel 1: Research Considerations to Advance PASC Knowledge and Management

Research Gaps:

- prevalence of long-term symptoms, including stratification by key variables (eg demographic factors like age and ethnicity, initial COVID-19 severity of illness)
- risk factors for the development of persistent symptoms
- trajectory and changes over time
- mechanisms of persistent symptoms
- therapeutic interventions
- costs associated with persistent symptoms

Methodological Considerations:

- rigorous prospective studies that aim to reduce bias through thoughtful recruitment and retention strategies and careful consideration of control groups
- development of core outcomes measurement sets to standardize assessments
- randomized controlled trials of therapeutic interventions
- epidemiological and interventional studies conducted in low and middle income countries and areas with limited resources and including a diverse patient population in terms of age, sex, ethnicity, etc.

