Spring 2021

Understanding Current Occupational Therapy Practice Behaviors and Knowledge relating to Post-Intensive Care Syndrome: An exploratory, cross-sectional survey

Wendy Header

Understanding Current Occupational Therapy Practice Behaviors and Knowledge relating to Post-Intensive Care Syndrome: An exploratory, cross-sectional survey.

Wendy Header

Elizabethtown College

Honors in Discipline

Debbie Waltermire, DrPH, OTR/L

05/03/2021

Understanding Current Occupational Therapy Practice Behaviors and Knowledge relating to Post-Intensive Care Syndrome: An exploratory, cross-sectional survey.

Throughout the twentieth century, healthcare in the United States and around the globe has been rapidly evolving. Remarkable advancements have been seen in patient care, technology, and the treatment of disease. As a result of these advancements, individuals are more likely to survive critical illness (Colbenson, Johnson, & Wilson, 2019). Often times, there is a tendency to assume that once a patient is discharged from an intensive care unit (ICU) they have overcome the most critical portion of their illness. However, according to the literature, a patient discharged from this setting is likely to suffer years of ongoing impairments resulting from their time spent within the ICU (Colbenson et al., 2019; Harvey & Davidson, 2016). This phenomenon is known as Post-Intensive Care Syndrome (PICS).

Post-Intensive Care Syndrome (PICS)

Post-Intensive Care Syndrome was officially recognized in 2010 by the Society of Critical Care Medicine (Laxton, 2017). PICS has been defined as the “new or worsening impairment in physical, cognitive, or mental health status arising and persisting after hospitalization for critical illness” (Harvey & Davidson, 2016, p. 381). This syndrome must be analyzed concerning its domains (physical, cognitive, and mental health), as each is associated with independent risk factors, prevalence, and participation restrictions. The purpose of this paper is to review current literature concerning Post-Intensive Care Syndrome, including subsequent risk factors, participation restrictions, interventions, and the role of Occupational Therapy.

Physical

PICS is associated with declines in physical capabilities and restrictions in activities of daily living, often resulting in the loss of independence with functional tasks (Lee, Kang, & Jeong, 2019). ICU-acquired neuromuscular weakness, or ICUaW, is an example of a specific physical disorder under the umbrella term PICS. ICUaW is recognized as the leading form of physical impairment in ICU survivors, affecting an estimated 25% of individuals within this population (Rawal, Yadav, & Kumar, 2017, p. 91). A 2015 multi-site prospective study reported that ICUaW affects more than 1/3 of critical illness survivors (Fan, Dowdy, Colantuoni, Mendez-Tellez, Sevransky, & Shanholtz, et. a., 2014, pp. 5-6). Weakness associated with this condition is often generalized throughout the proximal aspect of limbs or respiratory muscles and typically occurs bilaterally (Vanhorebeek, Latronico, & Berghe, 2020). The reduction of muscle tone typical of ICUaW is recognized as the primary contributor to subsequent functional impairments (Vanhorebeek et al., 2020). In addition, deep tendon reflexes may be reduced; however, this is not consistent for all individuals with this diagnosis (Vanhorebeek et al., 2020).

ICUaW can be categorized into two main types based on the location of the original disturbance, which resulted in the observed weakness. The term *critical illness polyneuropathy* (CIP) describes weakness that originates from a neurogenic disorder. In contrast, the term *critical illness myopathy* (CIM) refers to deficiency resulting from a myogenic disturbance (Vanhorebeek et al., 2020, p. 637). Clinically, this disorder may present as generalized weakness, fatigue, decreased mobility, and sexual dysfunction (Rawal et al., 2017). Generalized weakness refers to declines in muscle strength that are widespread throughout one’s body, resulting in increased difficulty in daily activities/participation. This is closely related to fatigue and decreased mobility, otherwise described as an individual’s inability to ambulate/move about their environment (Vanhorebeek et al., 2020).

In a 2019 prospective cohort study, Sidiras et al. (2019) reported significantly low Quality of Life (QoL) and functional abilities among ICU survivors with ICUaW at both three- and six-months post-discharge (Sidiras et al., 2019). This was reported based on the results of two separate assessments. The first assessment found that at the time of hospital discharge, the QoL of patients with ICUaW was significantly low in all seven domains than population norms, except sleep (Sidiras et al., 2019). When this tool was administered at 3-months post-discharge, reduced QoL was noted in the following domains: physical abilities and energy and emotional reactions (Sidiras et al., 2019). At the 6-month follow-up, patients with ICUaW presented with decreased QoL in all associated domains: physical, mobility, pain, sleep, energy, emotional reactions, and social isolation (Sidiras et al., 2019). As evident by the results of this assessment, QoL declined over time following ICU discharge.

When assessed regarding eight domains identified in an alternative assessment, QoL was still significantly lower for individuals with ICUaW when compared to those without this diagnosis at the time of hospital discharge (Sidiras et al., 2019). At 3- and 6-months post-discharge, significant reductions were seen in general health, physical function, and role limitations resulting from emotional and physical problems (Sidiras et al., 2019). A similar association between muscle weakness and substantial impairments in physical function and Health-Related Quality of Life (HRQoL) was also reported by Fan et al. (2014).

Sidaris et al. (2019) reported that participants' muscle strength and functional capacity improved substantially between the 3- and 6-month follow-up. These results are supported by findings reported by Fan et al. (2014). In this study, muscle weakness improved substantially within 12-months post-discharge. However, despite such improvements, both studies noted that slight impairments in physical functioning persisted throughout the study period and remained below population norms (Fan et al., 2014 & Sidiras et al., 2019). This information presents necessary evidence when considering an individual's occupational performance after a diagnosis of ICUaW. As a result of muscle weakness and declines in physical functioning, an individual will likely experience performance deficits related to mobility, independence in ADL/IADL tasks, social and leisure participation, and work or school performance (Lee et al., 2019).

Limitations in occupational performance and participation may also become apparent when one considers the tremendous socioeconomic burden of the ICU. ICUaW, specifically, contributes to this by influencing discharge planning and placement. For example, Sidiras et al. (2019) reported that 30% of individuals with ICUaW are transferred to rehabilitation facilities (Sidiras et al., 2019, p. 227). Studies show that individuals receiving treatment within one of these facilities are more likely to experience higher medical costs (Sidiras et al., 2019). Families responsible for covering unnecessary healthcare costs may then experience declines in mental health due to increased stress. These families may also struggle to afford to participate in typical leisure activities, pay for housing/other necessities, etc. Alternatively, of those who do not develop this condition, only 7% will be discharged to a similar rehabilitation facility (Sidiras et al., 2019, p. 227). Instead, these individuals are being discharged home, decreasing healthcare costs and subsequent financial burden/stress (Sidiras et al., 2019).

Several authors have identified independent risk factors for ICUaW; however, the results are varied. A 2018 systematic review of 14 studies reported that the following independent risk factors are significantly associated with this syndrome: “female sex, *Acute Physiology and Chronic Health Evaluation* (APACHE) *II* score, multiple organ failure (MOF), systematic inflammatory response syndrome (SIRS), sepsis, use of neuromuscular blocking agents, aminoglycosides, norepinephrine, duration of mechanical ventilation, parental nutrition, hyperglycemia, electrolyte disturbances, hyperosmolality, and lactate level" (Yang, Jiang, Wang, & Xi, 2018, pp. 109-110). Yang et al. (2018) also proposed that early risk factors can serve as a mechanism for early detection and treatment of ICUaW. Early risk factors include female sex and APACHE II scores greater than 12, *sequential organ failure assessment* (SOFA) scores greater than 7, higher lactate level, hyperglycemia, electrolyte disturbance, SIRs, sepsis, and MOF (Yang et al., 2018). These risk factors may manifest in ICU patients as early as 24-48 hours after admission (Yang et al., 2018).

Similarly, Sidiras et al. (2019) reported female sex as a risk factor for the development of ICUaW. It was hypothesized that this might result from lower muscle mass at baseline within the female population (Sidiras et al., 2019 & Yang et al., 2018) Sidiras et al. (2019) also reported duration of bed rest and sepsis as risk factors for the development of ICUaW. Unlike these results, Fan et al. (2014) said that the only risk factor significantly related to ICUaW was the duration of bed rest. This study concluded that an individual is at risk for losing up to 11% of their muscle strength each day of bed rest. (Fan et al., 2014, p. 6). Fan et al. (2014) did not find significant associations between age, levels of arousal, corticosteroids, and hyper/hypoglycemia, and the development of ICUaW. Current literature on the risk factors for ICUaW is not conclusive. This may be due to variations in the study setting, population, and other design features across studies.

Cognitive

Cognitive components most commonly affected in individuals with PICS include executive and global functions (Lee et al., 2019 & Pandharipande et al., 2013). Essential executive functions include skills such as working memory, inhibition, and self-regulation. As found in current literature, the prevalence of new or worse cognitive impairments among survivors of the ICU is not conclusive. Several authors have reported developing such impairments anywhere from 25-75% of survivors (Pandharipande et al., 2013, p. 5 & Rawal et al., 2017, p. 91). Despite differences in results, new or worse cognitive impairments can be identified as significant sequelae to critical illness and ICU admission.

In 2013, the Bringing to Light the Risk Factors and Incidence of Neuropsychological Dysfunction in ICU Survivors (BRAIN-ICU) study set out to investigate a battery of risk factors and impairments individuals experience after admission to an ICU. To do this, adults admitted to medical or surgical ICUs suffering from respiratory failure or shock were evaluated for global cognition, executive functioning, and in-hospital delirium at 3- and 12-months post-discharge (Pandharipande et al., 2013). During the first follow-up, 3-months post-discharge, 40% of participants presented with global cognition abilities worse than population norms for moderate traumatic brain injury survivors (Pandharipande et al., 2013, p. 5). Another 26% of participants presented with global cognition abilities expected of individuals with mild Alzheimer’s disease (Pandharipande et al., 2013, p. 5). Similar global cognition abilities were also reported at 12-months post-ICU discharge (Pandharipande et al., 2013). Additionally, no improvements regarding executive functioning were noted throughout the study (Pandharipande et al., 2013).

Based on these findings, it appears as though the gravity of cognitive declines resulting from PICS is substantial compared to knowing injuries/illnesses well and long-standing.

The BRAIN-ICU study also investigated the impact of delirium and sedative/analgesic medication on long-term cognition among survivors of critical illness. Duration of delirium was identified as an independent risk factor for poor global and executive functioning. Significant associations were found between the duration of delirium and assessment scores at both 3- and 12- months following the discharge (Pandharipande et al., 2013). This study, however, found that benzodiazepines did not hinder long-term cognitive functioning but may contribute to slight executing functioning deficits at 3-months post-discharge (Pandharipande et al., 2013). Benzodiazepines were the only medication found to have this mild association, while other sedatives and analgesic drugs had no uniform relationship (Pandharipande et al., 2013).

Per findings from the BRAIN-ICU study, several other authors have identified delirium and the duration of delirium as the number one risk factor for the development of global and executive function deficits (Pandharipande et al., 2013; Rawal et al., 2017; & Sakusic et al., 2018). Additional risk factors include education level, acute brain dysfunction, hypoxia, hypotension, glucose dysregulation, respiratory failure requiring prolonged mechanical ventilation, severe sepsis, renal replacement therapy, acute respiratory distress syndrome (ARDS), and prior cognitive impairment (Rawal et al., 2017 & Sakusic et al., 2018). Severe sepsis has been identified to increase the risk of moderate to severe cognitive impairment following ICU discharge by roughly 10% (Iwashyna et al., 2012, p. 5).

Functionally, cognitive impairments have been reported to produce adverse effects on an individual's ability to independently perform various IADL tasks. Occupational performance of

IADL tasks, including shopping, food preparation, use of public transportation, and management of medications and finances, are most commonly affected by post-ICU cognitive impairments (Hopkins, Suchyta, Kamdar, Darowski, & Jackson et al., 2017). As reported by Jackson et al. (2007), there is a clear relationship between cognitive impairments and IADL dependency. This study indicated that 22.4% of ICU survivors were dependent on IADL performance (Jackson et al., 2007, p. 84).

Iwashyna, Ely, Smith also studied IADL and ADL dependency succeeding ICU stay, and Langa (2010) in a prospective cohort study. This study, in particular, examined the relationship between sepsis and cognitive impairments, as well as the relationship of the variables above and functional capabilities (Iwashyna et al., 2010). Not only was severe sepsis found to be an independent risk factor for the development of cognitive impairments, but it was also identified as a risk factor for IADL and ADL limitations. This relationship was found in 59.3% of patients within the study that was hospitalized for severe sepsis and were generalized throughout all ADL and IADL skills (Iwashyna et al., 2010, p. 6).

Several limitations exist when assessing cognitive impairments among survivors of the ICU. First and foremost, most studies conducted on cognitive impairments collect data from different subgroups of ICU patients. In other words, diagnoses such as ARDS, sepsis, or prior cognitive impairments may exacerbate long-term impairments, and therefore results may not be generalizable to the group as a whole. Additionally, confounding variables such as baseline functioning, age, culture, volition, etc., must be considered when generalizing results to this specific population (Iwashyna et al., 2010; Pandharipande et al., 2013; & Sakusic et al., 2018).

These variables must also be measured, recognized, and taken into consideration by clinicians responsible for the care of these individuals.

Mental Health

The third domain related to PICS is mental health. Within this domain, three conditions are commonly identified, including anxiety, depression, and post-traumatic stress disorder ([PTSD] [Lee, Kang, & Jeong, 2019]). Each condition has been explored independently from the others, and therefore each has an identified prevalence and set of risk factors. A 2017 systemic review and meta-analysis identified that anxiety in ICU survivors ranged from 5-73% (Nikayin et al., 2016, p. 4). Among the 22 studies that measured anxiety with the *Hospital Anxiety and Depression Scale* (HADS-A) assessment tool, the prevalence of anxiety symptoms was relatively consistent across 14-months following ICU discharge. In the first 2-3 months following discharge, the pooled prevalence of anxiety was 32% (Nikayin et al., 2016, p. 4). By six months post-discharge, there was a relative increase in anxiety prevalence to 40%. This then tapered back down at the 14-month post-discharge mark to a pooled prevalence of 34% (Nikayin et al. 2016, pp. 4-5). This was reported when the cut-off assessment score was greater than or equal to eight. When the cut-off score was greater than or equal to 11 for this assessment, the pooled prevalence of anxiety decreased between 15-20% at each point in follow-up (Nikayin et al., 2016, p 5).

The results, as mentioned earlier, were similar to those reported by Huang et al. (2016) in a one-year, national multi-center study. This study reported that within one year following discharge from an ICU, 42% of patients experienced significant anxiety symptoms, with little to no improvement noted throughout the study (Huang et al., 2016, p. 6). In correspondence with this, a 5-year multi-center study reported the long-term prevalence of anxiety symptomology following ICU care at 38% (Bienvenu et al., 2018, p. 5). These findings were contradicted by a 2016 secondary analysis that found participant anxiety to be greatest at 2-weeks following ICU discharge while subsequently decreasing throughout the study (Choi, Tate, Rogers, Donahoe, & Hoffman, 2016). Choi et al. (2016) reported several limitations that may have elicited contradictory results, including sample size, attrition rates, and assessment limitations (Choi et al., 2016).

Depressive symptomology was explored by researchers of the BRAIN-ICU study at both 3- and 12-months post-ICU discharge. At 3-months post-ICU discharge, 37% of study participants reported depressive symptoms while 33% reported similar symptoms at 12-months post-discharge (Jackson et al., 2014, p. 7). Severe manifestations of depressive symptomology were rare within the study group. Alternatively, most participants who experienced depression following ICU discharge scored within the range for mild to moderate symptom severity (Jackson et al., 2014). Depressive symptomology was seen to persist throughout the study, with only mild declines in severity of symptoms. This was consistent despite the age of the respondent (Jackson et al., 2014).

The findings of this study are mimicked by three others also reporting on the prevalence of depressive symptomology. Two of these studies said that 30-36% of study participants experienced significant depressive symptoms at 12-months post-ICU discharge. The third study reported that 32% of participants experienced the long-term persistence of these symptoms over five years (Bienvenu et al., 2018, p. 5; Huang et al., 2016, p. 6; & Rabiee et al., 2016, p. 6). Specifically, Choi et al. (2016) reported that increased severity of depression was associated with patients that reported moderate to high levels of caregiving support throughout a 4-month follow-up period. Likewise, severity was higher among patients who were not discharged home at any point during the follow-up period (Choi et al., 2016).

Regarding the findings of the BRAIN-ICU study, participant scores were analyzed in terms of somatic versus cognitive depression criteria as outlined by the *Beck Depression Inventory* (BDI-II). More than half of those with some level of depression at the 3-month follow-up would have qualified for this clinical diagnosis based on their performance of the BDI-II's somatic subscale (Jackson et al., 2014). Concerning the cognitive-affective subscale, only 8% of these respondents would have met the criterion for depression based on their performance at 3-months post-discharge (Jackson et al., 2014, p. 7). Results were similar at the 12-month follow-up. Of the study participants with clinically significant depressive symptomology, nearly three-quarters qualified for this diagnosis based on the somatic subscale (Jackson et al., 2014, p. 7). However, only 4% of these individuals qualified for the same diagnosis when scores were interpreted regarding the cognitive-affective subscale (Jackson et al., 2014, p. 7). These results suggest that the depressive symptoms suffered by survivors of critical illness primarily take physical disabilities instead of manifesting in merely cognitive form.

This information provides valuable insight for clinicians as it may indicate both ADL/IADL disability within this population. Frequently, symptoms of mental illness (e.g., fatigue, feelings of worthlessness) interfere with an individual's expected participation in daily routines, roles, and habits. For example, 27% of individuals who were independent in ADL tasks at baseline presented with some degree of dysfunction in this domain of occupation at 3-months post-discharge (Jackson et al., 2014, p. 8). At 12-months post-discharge, 22% continued to have deficits related to ADL performance (Jackson et al., 2014, p. 8). The rate of novel IADL disability was similar, as 23% and 20% of patients reported such difficulties at 3- and 12-months post-discharge, respectively (Jackson et al., 2014, p. 8).

BRAIN-ICU researchers also reported the prevalence of PTSD among ICU survivors (Jackson et al., 2015). The majority of PTSD reported among participants in this study was 7%, and these findings were consistent at both 3- and 12-months post ICU discharge (Jackson et al., 2014, p. 7). These scores are significantly lower than other reports for this population. For example, within one year following ICU discharge, Huang et al. (2016) reported that 24% of participants developed significant PTSD-related symptoms (Huang et al., 2016, p. 6). Further validation for the findings reported by Huang et al. (2016) was demonstrated by the results of a 5-year multi-center cohort study.

Regarding the discrepancy noted for the prevalence of PTSD, it is first necessary to acknowledge that PTSD within the general population is 3% (Jackson et al., 2014, p. 10). Therefore, although the numbers reported by Jackson et al. (2014) are much lower than similar studies, they are still two times greater than what is to be expected within the general population (Jackson et al., 2014). Reasons for this discrepancy noted within the original study include the sample size and inclusion of general ICU patients (Jackson et al., 2014). Overall, it can be concluded that PTSD is a typical impairment among survivors of critical illness. Therefore, it must be regarded as an essential component of PICS during screenings and throughout the process of intervention planning.

As previously mentioned, mental health impairments may exist independently from one another in a patient suffering from PICS; however, causal relationships can be identified between developing more than one of these mental health conditions. For example, severe depression may be a risk factor for the development of PTSD at three and 12-months post-discharge. This relationship was reported by Jackson et al. (2014), as 25% and 42% of those with severe depression also had PTSD symptoms at three and 12-months, respectively (Jackson et al., 2014, pp. 7-8). For those without depression, less than 1% developed PTSD symptoms at both 3- and 12-months post-discharge (Jackson et al., 2014, pp. 7-8).

Huang et al. (2016) also reported on the co-occurrence of mental health conditions following ICU discharge. In this study, 63% of patients with a mental health impairment within 12-months post-discharge had symptoms relative to at least two of the three conditions in discussion (Huang et al., 2016, p. 6). Most commonly, patients experienced depression, anxiety, and PTSD concurrently. This was seen in 33% of those exhibiting mental health impairments (Huang et al., 2016, p. 6). Other common pairings included depression and anxiety as seen in 18% of patients, anxiety, and PTSD as seen in 7% of patients, and depression and PTSD as seen in only 3% of patients (Huang et al., 2016, p. 6).

Similarly, Maley et al. (2016) reported that it was most likely for individuals to have impairments in all three areas of mental health associated with PICS, as reported by 44% of the study population. It was much less likely for impairments to only occur in one of these areas, as reported by 24% of the study population (Maley et al., 2016, p. 1354). Regarding simultaneous impairments in two of the three areas of mental health, the reported prevalence was 32% (Maley et al., 2016, p. 1354). This information is supported by six other studies as identified by two independent systematic reviews. All six articles reporting comorbidities for mental health conditions found positive correlations between depression, anxiety, and PTSD (Nikayin et al., 2016 & Rabiee et al., 2016).

Risk factors for the development of PICS-related mental health impairments have been discussed in great detail throughout the literature. Many of these factors overlap regarding their influence on the development of anxiety, depression, and PTSD. For example, risk factors commonly associated with all three domains include pre-existing psychiatric diagnosis, younger age, female, and drug/alcohol abuse (Choi et al., 2016; Davydow, Hough, Zatzick, & Katon, 2014; & Huang et al., 2016). Some discrepancy has been identified regarding the influence of female sex and younger age as risk factors for depression and anxiety specifically; however, this lack of association was relatively uncommon (Nikayin et al., 2016 & Rabiee et al., 2016)

Risk factors associated with depression and anxiety include delirium and other psychiatric symptoms that can occur when an individual is admitted to the ICU (Nikayin et al., 2016 & Rabiee et al., 2016). Factors commonly found to have no significant association with the development of anxiety and depression include ICU length of stay and illness severity (Nikayin et al., 2016 & Rabiee et al., 2016). Additionally, discharge destination and the degree to which someone requires care following ICU stay may increase the risk of developing depressive symptomology (Choi et al., 2016). It is evident that mental health-related impairments embody a large portion of the PICS phenomenon, subsequently affecting an individual's overall health and well-being. Therefore, this domain of health must be prioritized by evaluation and treatment of the critically ill.

Co-Occurrences

Co-occurrences of impairments within the three significant PICS domains, including physical, mental, and cognitive, have also been identified within the literature. Marra et al. (2018, p. 1395) reported that at 3-months, 39% of ICU survivors had impairments in only one domain, with cognitive abilities being the most commonly affected. At this 3-month follow-up, 19% had simultaneous impairments in two domains, and 6% reported simultaneous impairments in all three domains (Marra et al., 2018, p. 1395). Participants in this study were re-evaluated at 12-months post-discharge. At this checkpoint, 35%, 16%, and 4% reported concurrent impairments in one, two, or three of the domains of PICS, respectively (Marra et al., 2018, p. 1395). A similar study reported even higher co-occurrences of PICS-related impairments. Within this study, 55.8% of participants presented with impairments in two of the three domains, and 32.6% had concurrent impairments in all three (Maley et al., 2015, p. 1354).

Marra et al. (2018) also provided data regarding which domains simultaneous impairments are most likely to occur. At both 3- and 12-months, co-occurrence of depression and cognitive impairments was the most common. For example, this comorbidity occurred in approximately 10% of the study population (Marra et al., 2018, p. 1398). This information is limited given that researchers did not include all aspects of mental health in their investigation and chose to focus solely on depression and its relationship to cognitive and physical impairments. Additional limitations are present due to the small sample size of this study. More research is necessary to fully understand the co-occurrences of PICS impairments.

Burden of PICS

As an umbrella term diagnosis, PICS creates a vast array of implications for individuals who survive critical illness and ICU hospitalization. For example, individuals may experience many challenges, including economic distress, limited access to health services, and declines in functional capabilities. For instance, roughly 2/3 of individuals with PICS either do not return to work or do not return to their previous level of employment (Colbenson et al., 2019, p. 98).

Economic distress is then further enhanced by the sheer cost of PICS and related services. 26.3% of survivors of critical illness report financial distress during and after their ICU hospitalization (Heydon, Wibrow, Jacques, Sonawane, & Antsey, 2019, p. 120). This may be the result of several factors. As discussed previously, those who present with PICS-related ICUaW are less likely to be discharged home than those who do not develop these impairments (Sidiras et al., 2019). Additionally, individuals suffering from any range of impairments associated with PICS present with the need for other health-related services following their discharge, despite destination (Heydon et al., 2019). For instance, even if an individual is discharged home following ICU admission, continued services may be warranted for impairments relating to the stay. Of those who seek services post-discharge, gaps in care have been reported as many survivors expressed their lack of access to mental health-related services (Heydon et al., 2019). This indicates a potential underestimation of the total degree of the economic burden perpetuated by PICS.

Individuals with PICS are also at an increased risk for limitations in functional capabilities. This may manifest as limitations or dependency in the scope of activities, including both ADLs and IADLs. For example, one systematic review reported that the prevalence of novel IADL impairments for survivors of critical illness was 69% (Hopkins et al., 2017, p. 1337). Specifically, depression and ICUaW are associated with declines in muscle strength and independence in these areas of occupation (Jackson et al., 2014 & Lee et al., 2019). Limitations in ADL and IADL independence may reflect limitations in other areas such as social, leisure, and work/school. Restrictions in these occupations are not widely discussed within the literature and maybe an area of need regarding future studies.

Post-Intensive Care Syndrome – Family (PICS-F)

Survivors of critical illness are not the only population at risk for developing new or worsening impairments due to ICU hospitalization. Among those at risk for developing such impairments include family members and caregivers of the critically ill. The repercussions of critical illness on these individuals have been identified as a sub-category for PICS, Post-Intensive Care Syndrome - Family (PICS-F). PICS-F is the "psychological distress experienced by ICU family members during the post-ICU period, including symptoms of anxiety, depression, and post-traumatic stress disorder (PTSD)" (Petrinec & Martin, 2017, p. 719). One author expanded on this definition to include complicated grief (Harvey & Davidson, 2016). Complicated grief is defined as "a chronic impairing form of grief brought about by interference with the healing process" (Shear, 2012, p. 122).

PICS-F typically appears in the form of psychiatric impairments, including new or worsening symptoms of anxiety, depression, complicated grief, and PTSD (Harvey & Davidson, 2016). According to Petrinec and Martin (2017), anxiety is the most common psychiatric impairment seen in family members of critically ill persons. However, a similar study reported that of 34% of family members experiencing PICS-F related psychiatric impairments, 27% were identified to have a major depressive disorder (Siegel, Hayes, Vanderwerker, Loseth, & Prigerson, 2008, p.1725, Table 3). Findings reported within this study include a 10% prevalence of generalized anxiety disorder and a 5% prevalence of complicated grief among family members as measured at 3-12 months post-discharge (Siegel et al., 2008, p.1725, Table 3).

Regarding the prevalence of PTSD, there is a relative amount of variance between the results reported throughout the literature. As analyzed in one methodological review, six eligible studies found that within six months of ICU discharge, PTSD symptoms may be present anywhere from 33-69% of family members and decrease over time (Petrinec & Daly, 2016, p. 71). For example, one study reported that between 6 months and four years post-ICU death, PTSD was only seen in 14% of family members (Petrinec & Daly, 2016, p. 71). Similarly, at 2-years post-ICU discharge, moderate PTSD symptoms were reported in 12-14% of family members and severe symptoms in 4-5% of family members (Petrinec & Daly, 2016, p. 71). Only one study reported high percentages of PTSD in family members over time. In this study, 68-80% of family members reported PTSD 12-months after their loved ones' discharge from the ICU (Petrinec & Daly, 2016, p. 71).

As evident, there is little consistency regarding the prevalence of PTSD among family members. This may be due to several factors, including the decision-making role of the family members, history of psychiatric illness, and loved one's ICU LOS (Petrinec & Daly, 2016). Additionally, study limitations across those included in the methodological review include general variations such as the type of ICU, patient diagnoses, cultural factors, timing of measurement, etc. (Petrinec & Daly, 2016). Despite the variation in results, it can be concluded that PTSD is a significant component of PICS-F and, therefore, must be acknowledged by clinicians responsible for providing care to this population.

Several risk factors for PICS-F have been identified throughout the literature. Risk factors consistent across several studies include a history of psychiatric illness, avoidant coping strategy, family member relationship, female sex of family member, and lower education level (Petrinec & Daly, 2014; Petrinec & Martin, 2017). Additionally, several studies have concluded that the degree to which a family member is responsible for making decisions for their incapacitated loved one affects the likelihood of developing PICS-F (Petrinec & Daly, 2014; Petrinec & Martin, 2017; & Zanten, Vink, Dongelmas, Dettling-Ihnenfeldt, & Shaaf, 2016).

Regarding decision-making implications, a 2017 single-center, prospective longitudinal study identified the prevalence of mental health impairments among family decision-makers (FDMs) of critically ill patients. Among study participants, at 60 days following ICU admission, 30.6% experienced anxiety, 25% experienced depression, and 11.1% presented with symptoms of PTSD (Petrinec & Martin, 2017, p. 721). Anxiety symptoms described by the participants in this study did lessen over time, while depression and PTSD symptoms were seen to increase (Petrinec & Martin, 2017). Following these findings, Azoulay et al., as reported by Zanten and colleagues (2016), as well as Petrinec and Daly (2014), said that FDMs responsible for end-of-life decisions experienced the most significant prevalence of PICS-F related symptoms (Zanten et al., 2016; Petrinec & Daly, 2014).

Petrinec and Martin (2017) also identified the relationship between symptom severity and HRQoL (Petrinec & Martin, 2017). HRQoL, as indicated by mental components, decreased over time and was more substantial to declines in HRQoL related to physical features. FDMs with a history of psychiatric illness scored significantly lower than those with no such account in both physical and mental components of the assessment (Petrinec & Martin, 2017). These findings are supported by a separate study that identified declines in HRQoL in family members of the critically ill up to 6-months following the patients' discharge from the ICU (Wintermann et al., 2016).

PICS-F may also be related to work and socioeconomic challenges among family members of the critically ill. As outlined by Zanten et al. (2016), studies have reported that nearly 14% of family caregivers terminate their employment to fulfill this role (Zanten et al., 2016, p. 176). Another 50% make substantial changes to their work schedule to accommodate caregiving time (Zanten et al., 2016, p. 176). Various studies reporting higher percentages of work absenteeism were also summarized by Zanten et al. (2016), indicating the substantial economic burden of a loved one surviving critical illness (Zanten et al., 2016). This fits with the evidence above regarding the presentation of PICS. Survivors of critical illness are at substantial risk for developing physical, mental, and cognitive impairments, resulting in the need for family caregivers.

Implications of the COVID-19 Pandemic

It is essential to understand the relationship between the COVID-19 pandemic and the phenomenon of PICS regarding the present circumstances. Researchers hypothesize that the number of PICS cases will hit peak levels (Biehl & Sese, 2020; Stam, Stucki, & Bickenbach, 2020). The Institute of Health Metrics and Evaluation estimated that by mid-summer, COVID-19 would account for the use of an additional 12,000 ICU beds and 20,000 ventilators in the United

States alone (Stam et al., 2020, p. 1). These estimates are derived from current knowledge of COVID-19 as a respiratory disease.

In severe cases, COVID-19 may cause acute respiratory distress syndrome (Biehl & Sese, 2020). As a result of this syndrome, individuals face prolonged mechanical ventilation within the ICU (Biehl & Sese, 2020; Stam et al., 2020). Mechanical ventilation is a known risk factor for developing physical, mental, and cognitive impairments associated with PICS (Biehl & Sese, 2020; Rawal et al., 2017; Sakusic et al., 2018; Stam et al., 2020; & Yang et al. 2018). Additionally, due to the nature of this disease and the risk of transmission, interventions such as early mobility and family-involved care, which will be discussed in further detail, are restricted. As a result of this restriction, individuals are at an even greater likelihood of developing PICS.

Interventions

General intervention considerations must continue to be considered and applied in conjunction with specific PICS intervention programs. First and foremost, there needs to be a focus on providing patient-centered care (Cabrini et al., 2016). Patient-centered care within the ICU should involve effective communication, the promotion of health literacy, and environmental supports regarding the needs of patients and potential visiting family members (Cabrini et al., 2016). This may include being more aware of family values concerning end-of-life decisions and the potential for cultural traditions surrounding this time (Cabrini et al., 2016). Additionally, there is a need for standardization in intervention protocol between ICUs and discharge destinations. This will allow for better compliance to intervention programs, subsequently increasing patient outcomes and care (Cabrini et al., 2016). The neuro-occupation framework has been identified as a basis for general care and treatment within the ICU to facilitate interventions.

Neuro-Occupation Framework and Intervention Strategies

Intervention planning and implementation may be preceded by a clinician's understanding of the constructs associated with the neuro-occupation framework. Neuro-occupation is a framework that can inform assessments, evaluations, and intervention or treatment planning within the ICU environment. According to Howell (1999), neuro-occupation is the "idea that neural processes are inter-dependent with the performance of occupation" (p. 76). Regarding neural processing, Howell draws attention to the reticular activation system (RAS). The RAS is a network within the central nervous system whose primary function is to regulate brain activity and promote cognition such as attention and arousal. (Howell, 1999). Additionally, the RAS helps to interpret sensory information so that individuals may respond to or productively interact with their environment. The integration of sensory input and the aforementioned cognitive skills promote occupational performance (Howell, 1999).

Sensory overload and sensory deprivation are common sequelae of confinement within the unique environment of the ICU, which prevents the RAS from maintaining proper functioning (Howell, 1999). As a result, an individual may experience negative changes in behavior and cognitive functioning. Sensory-related behavioral changes have been noted to occur as early as 3-5 days after initial admission into the ICU and include agitation, hallucinations, and confusion (Howell, 1999). Regarding cognitive functioning, patients experiencing sensory deprivation or overload may present with deficits in attention, arousal, abstract reasoning, emotional regulation, and perceived lack of motivation. Sensory deprivation, specifically, may also result in the loss of motor coordination, typically within 2-weeks following initial ICU admission (Howell, 1999).

As described by Howell (1999), patients in the ICU are exposed to bright lights and loud noises for nearly twenty-four hours a day. One study estimated that the noise located at the head of a patient's bed is comparable to a radio at maximum volume (Howell, 1999). Critically ill patients may also be deprived of loving human touch and other typical tactile input. For example, patients are often restrained to their beds, connected to numerous tubes, and touched only for the sake of medical care by individuals dressed in personal protective equipment (Howell, 1999). Some patients also experience a loss of their ability to communicate due to mechanical ventilation. This results in social isolation and contributes to declines in self-efficacy and continued sensory deprivation (Howell, 1999).

Another form of isolation that is common within the ICU is cultural isolation. Cultural isolation occurs when an individual is prevented from engaging in their routine and is immersed into an environment that is drastically different from their natural context (Howell, 1999). For example, ICU rooms are often overflowing with machines and other medical supplies that are not commonly found in an individual's typical physical environment. Additionally, rooms typically lack clocks, family photos, and windows (Howell, 1999). As mentioned earlier, ICU rooms are usually lit at all times, and doctors/nurses check in on patients regularly. This disruption inhibits an individual from maintaining day and night routines and may also result in sleep deprivation (Howell, 1999).

As stated previously, the function and dysfunction of the central nervous system are directly related to an individual's occupational performance. To provide further explanation, Howell (1999) evaluated deficits in occupational performance within the domain of self-care. Quoting Orem’s delineation, daily living tasks are an “essential human regulatory function”; therefore, the loss of one’s ability to perform self-care tasks often results in increased pathology (Howell, 1999, p. 80). Relating this to ICU-acquired sensory deprivation/overload, it is clear that this phenomenon results in behavioral and cognitive declines. The accompanying lack of participation in self-care, as commonly seen within the ICU, serves to increase sensory deprivation and therefore promote pathology such as PICS (Howell, 1999).

The framework of neuro-occupation serves to inform intervention planning as well as assessments and evaluations within this setting. By decreasing sensory deprivation and overload, one can enhance a person's occupational performance and reduce the risk for cognitive and behavioral deficits (Howell, 1999). This can be done in a variety of ways. For example, one may begin by restoring a sense of routine and meaningful human interaction within the ICU environment. Additionally, it may be helpful to modify the environment and introduce important items to the patient (Howell, 1999). By focusing on the relationship between occupational performance and neural processes, one can enhance a patient's ability to engage in various interventions and treatments, which will be discussed within this review. Increasing participation and success in treatment will further decrease the effects of PICS, therefore successfully enhancing outcomes. Regarding specific interventions, evidence exists to support both the reliability and feasibility of such programs. Evidence-based interventions include ICU diaries, the ABCDE bundle, early mobility, and sensation awareness-focused training.

ICU Diaries

One intervention strategy identified within the literature to treat PICS and PICS-F is the use of ICU Diaries. ICU diaries were first implemented in Scandinavian countries beginning roughly around the year 1980 and have made their way to the United States by the year 2000 (Laxton, 2017 & Wang et al., 2020). This intervention involves a standard notebook or folder of papers that are to be filled out throughout an individual's ICU admission. Several authors identify that the diary should be filled out by nurses, practitioners, and family members of the critically ill patient. The diary is typically a timeline of procedures, therapy sessions, day-to-day notes concerning patient response, mood, and experience (Laxton, 2017; McIlroy, King, Garrouste-Orgeas, Tabah, & Ramanan, 2019; & Wang et al., 2020). Some authors also identify the importance of adding photos to the diary (McIlroy et al., 2019 & Wang et al., 2020).

After an individual is discharged from the ICU, they are presented with the completed diary. The purpose of this is to provide the patient with factual knowledge to orient them to the reality of their ICU experience and, in turn, reduce new or worsening psychiatric impairments (Laxton, 2017; McIlroy et al., 2019; & Wang et al., 2020). This is relevant due to the prevalence of delirium among ICU patients (McIlroy et al., 2019). Delirium is often marked by delusions and hallucinations, which interfere with a patient's memory of factual events. It is also a known risk factor for the development of PICS related psychiatric impairments (Laxton, 2017; McIlroy et al., 2019; Nikayin et al., 2016; Pandharipande et al., 2013; Rabiee et al., 2016; Rawal et al., 2017; Sakusic et al., 2018). Secondary purposes were also identified and state that ICU diaries help to "validate emotions related to memories of medical events, and promote [patient] participation in their medical plan of care" (Laxton, 2017, p. 1).

Evidence within the literature is diverse as some researchers have concluded positive outcomes associated with ICU diaries among critically ill patients, while others have failed to identify this relationship. Regarding depression and anxiety, ICU diaries were found to reduce the prevalence by approximately 25% and 20%, respectively (McIlroy et al., 2019, pp. 276-277, Figure 3). Additional sources identified similar reductions in anxiety and depressive symptom severity and prevalence after implementing ICU diaries (Laxton, 2017). Only one study failed to report a significant relationship between anxiety and ICU diaries (Wang et al., 2020).

Regarding PTSD, two studies reported no significant improvements in prevalence among ICU survivors, while only one reported corresponding reductions (Laxton, 2017; McIlroy et al., 2019; & Wang et al., 2020). However, even in studies where no improvements were seen in the symptomology of PTSD, improvements were seen in terms of hyperarousal (Wang et al., 2020). Additionally, within the first several months following discharge, the implementation of ICU diaries improved patient life satisfaction by 11.46% (McIlroy et al., 2019, p. 277).

Potential outcomes of ICU diary interventions among the critically ill family members, specifically those suffering from PICS-F, were also reported within the literature. Several studies included in this review reported reductions in the prevalence of PTSD symptoms and symptom severity due to ICU diaries (McIlroy et al., 2019). Only one study in this report investigated the relationship between dairy programs and symptoms of anxiety and depression among family members. The findings of this study were not significant, indicating no reduction in anxiety and depression among these individuals (McIlroy et al., 2019). HRQoL was not measured in any of the reported studies (McIlroy et al., 2019).

Benefits of ICU diaries are also apparent based on verbal accounts given by both ICU patients and family members who were involved in ICU diary programs. For example, one woman stated that reading her ICU diary during and after discharge helped her make sense of what happened during her hospitalization and factualize her memories (Locke et al., 2016). Similarly, the patient's mother stated that the diary also contributed to her understanding of her daughter's care and that it will be a valuable tool for the duration of her daughter's recovery (Locke et al., 2016).

ABCDE Bundle

The ABCDE bundle is an example of an evidence-based intervention that was designed for use within the ICU. The ABCDE bundle includes the following components: awakening and breathing, coordination of care, delirium monitoring and management, and early mobilization (Hsieh et al., 2019). The ABCDE bundle is understood to prevent/treat ICUaW, in-hospital delirium, and other impairments and risk factors associated with PICS (Hsieh et al., 2019).

Hsieh et al. (2019) proposed heightened benefits of the ABCDE bundle when administered in phases. Additionally, this study intended to measure the benefits of full bundle implementation compared to only partial implementation (Hsieh et al., 2019). In order to test this hypothesis, a prospective cohort study was conducted. This study consisted of two ICUs. The first ICU implemented only the partial bundle consisting of the following components: B-AD. According to the subsequent phases, the second ICU implemented the complete bundle: B-AD-EC (Hsieh et al., 2019).

This study showed significant improvements in patient mobility, quality of care, and various other clinical outcomes. Within the ICU that implemented the full bundle, significant reductions were seen in pressure ulcers and the use of restraints (Hsieh et al., 2019). Conversely, the ICU that only implemented the partial bundle reported increased rates of pressure ulcers and the days' patients spent in restraints (Hsieh et al., 2019). Clinical outcomes were measured in terms of LOS, mechanical ventilation, cost, and mortality. Significant reductions were seen within the ICU implementing the full bundle in mechanical ventilation and ICU LOS (Hsieh et al., 2019). Alternatively, no significant differences were noted between the two ICUs in mortality (Hsieh et al., 2019). Cost reductions were seen only in the ICU implementing the full bundle after integrating EC components and not before (Hsieh et al., 2019).

Early Mobility.

One of the significant components of the ABCDE bundle is early mobility to prevent PICS-related impairments, including ICUaW. This form of rehabilitation also increases independence and participation in daily tasks (Hopkins et al., 2016). This is accomplished by reducing several known risk factors related to PICS, including delirium, LOS, and immobility, while also rehabilitating muscle strength (Hopkins, Suchtya, Farrer, & Needham, 2012 & Hopkins et al., 2016).

Mobility can be addressed concerning four significant milestones, each of which consists of mobility levels. In total, there are 16 mobility levels ranging from "bed rest without passive ROM" (Level 1) to having a patient "walk independently" (Level 16; Klein, Mulkey, Bena, & Albert, 2014, p. 867). Early mobility rehabilitation ideally begins on the first day of admission to successfully achieve the four significant milestones (Klein et al., 2014).

As identified by Hopkins et al. (2016), the implementation of early mobility rehabilitation programs involves various clinicians such as nursing staff, occupational therapists, physical therapists, respiratory therapists, and physicians (Hopkins et al., 2016). To facilitate success within early mobility, factors such as sedation, sleep, and delirium must be addressed (Hopkins et al., 2016). Additionally, it is essential to note that not all patients are medically able to participate in daily ambulation. For these individuals, in-bed exercises such as passive and active range of motion must be prioritized (Hopkins et al., 2016).

Hopkins et al. (2012) hypothesized that early physical rehabilitation and mobility would improve neuropsychiatric outcomes within this population. For example, current evidence concludes that exercise is associated with increased blood flow and neurogenesis, and larger brain volumes among humans throughout the lifespan (Hopkins et al., 2012). As a result, exercise has been found to improve cognitive abilities among various populations (Hopkins et al., 2012). By improving cognitive functioning, subsequent improvements are seen in QoL, the ability to perform daily tasks, and participate in valued occupations such as work (Hopkins et al., 2012). To apply this knowledge to survivors of the ICU, one study used the presence of delirium to measure the degree to which early mobility prevented cognitive impairments. This study found a 50% reduction in the presence of delirium, and therefore cognitive impairments, among survivors who received early mobility services throughout their ICU admission (Hopkins et al., 2012, p. 5).

Early mobility can also be accredited with several other improvements in the long-term outcomes of survivors of the ICU. For example, advances in physical functioning were identified by three studies reviewed in one particular journal publication. Within these studies, participants receiving early mobility rehabilitation scored higher on the *Short Form 36 Health Survey* (SF-36) *Physical Functioning Scale* (Hopkins et al., 2016). This can be related to higher levels of independence in individuals who received these services. Specifically, it was found that those who received early mobility rehabilitation presented with increased independence in functional mobility, bathing, dressing, personal hygiene/grooming, and feeding/eating (Hopkins et al., 2012 & Hopkins et al., 2016). Similarly, another study reported that patients receiving early mobility rehabilitation were twice as likely to achieve higher levels of weight-bearing status, pivoting, and both aided/unaided ambulation (Klein et al., 2014).

Early mobility rehabilitation also resulted in a dramatic decrease in the number of days spent within the ICU. The average ICU LOS declined by 45% (Klein et al., 2014, p. 868). Relating to this, those who received early mobility services were 11.3% more likely to be sent home than another medical facility upon their discharge from the ICU (Klein et al., 2014, p. 868). Additionally, within one year following discharge from the ICU, patients who received early mobility rehabilitation were less likely to be readmitted to the hospital and succumb to illness-related complications (Hopkins et al., 2016).

Sensation Awareness Focused Training (SAF-T)

Sensation awareness-focused training (SAF-T) is an intervention strategy that is beginning to be implemented within family members of critically ill patients suffering from PICS-F. The purpose of SAF-T is to "decrease sympathetic response by exercising dual taxation of working memory, increased interhemispheric interaction, smooth pursuit eye movements, and slow deep breathing, which results in a calming response and interruption of negative thoughts, feelings, and behaviors" (Cairns et al., 2019, p. 472). SAF-T includes a scripted guide to enhance an individual's perception of any ICU experiences that resulted in negative thoughts and sensations. Throughout this exchange, an individual is engaged in lateral eye movements, which has been identified as an effective calming mechanism (Cairns et al., 2019).

This intervention strategy is relatively new to the practice, and therefore little data is available on its effectiveness. However, a randomized control trial including two groups composed of patient spouses was conducted. The intervention group underwent a 3-day SAF-T treatment amid their loved ones' ICU admission (Cairns et al., 2019). Statistically significant scores were reported by this study, suggesting that SAF-T is a reasonable and effective intervention to reduce PICS-F symptomology in spouses of the critically ill (Cairns et al., 2019). However, several limitations did exist within this study, including sample size and a lack of congruence between the intervention and control groups at baseline (Cairns et al., 2019). SAF-T is a promising intervention strategy; however, future research is necessary to understand its actual capacity for treating and preventing PICS-F complications (Cairns et al., 2019).

Longitudinal Care Model

As Cabrini et al. (2016) identified and evident throughout this review, PICS is associated with a variety of long-term impairments within several domains of functioning, including physical, cognitive, and psychological (Cabrini et al., 2016). To provide the best care to individuals suffering from this syndrome as they transition from the ICU to home or medical settings, a longitudinal care model may be implemented. This model is composed of four distinct elements (Cabrini et al., 2016).

The first element of a longitudinal care model includes beginning implementing other well-established interventions as soon as possible. Such interventions include those discussed above, such as the ABCDE bundle, early mobility, ICU diaries, and SAF-T (Cabrini et al., 2016).

The second element of this model focuses on involving ICU survivors in post-discharge rehabilitation. This rehabilitation may take place within various settings and should be individualized to the specific needs (Cabrini et al., 2016). The third element is concerned with the rehabilitation team involved in the continuum of care. Survivors of critical illness should have clinicians from various disciplines (Cabrini et al., 2016). Lastly, the fourth element calls for public health infrastructure and physician-led policy-making (Cabrini et al., 2016). This will promote patient outcomes by supporting informed policy concerning the continuum of care and patient trajectory (Cabrini et al., 2016).

The Role of Occupational Therapy

The role of Occupational Therapy within the ICU is not well understood across professions, which has resulted in the underutilization of services (Costigan, Duffett, Harris, Baptiste, & Kho, 2019). To better understand this current role, Costigan et al. conducted a scoping review of several hundred documents. Guiding their study was a question of the current position of Occupational Therapists with adult patients in the ICU (Costigan et al., 2019, p. 1015).

As identified within this review, rehabilitation goals often include rehabilitating performance skills and participation in daily life activities and meaningful roles. Goals such as these are achieved by focusing on the characteristics of one's injury or illness and subsequent repercussions, including those related to activity limitations and participation restrictions (Costigan et al., 2019). Goals should be set regarding managing PICS risk factors while a patient is admitted to an ICU. Furthermore, after an individual is discharged, continued therapy must be administered to target the prevailing impairments associated with PICS (Costigan et al., 2019).

Occupational therapists have a role with patients and family members within the ICU setting and follow one's discharge from this environment.

Occupational Therapy interventions can be divided into six categories: physical, social/emotional, environmental, sensory, cognitive, and communication (Costigan et al., 2019). Across all six categories, 21 specific interventions were pinpointed, with the most commonly implemented interventions being mobility, physical rehabilitation, and ADLs (Costigan et al., 2019, p. 1016). Mobility and physical rehabilitation, as mentioned here, may refer to specific interventions such as the implementation of the ABCDE bundle and the component of early mobility. Expected clinical outcomes and goals across all studies included health and functional status, LOS, mortality rates, discharge destination, safety, and mechanical ventilation status (Costigan et al., 2019, pp. 1016-1017).

Occupational Therapists also have a clear role in the implementation of ICU diaries. From a functional standpoint, ICU diaries promote the opportunity to improve skills related to cognition, sensory integration, motor coordination, and neuromuscular re-education (Laxton, 2017). During an occupational therapy session, either during or after a patient's ICU stay, one may be presented with diary entries and photos. This would provide sensory stimuli in both visual and auditory contexts while simultaneously building cognitive skills related to orientation, attention, and memory recall (Laxton, 2017). Motor coordination, visual-motor integration, and neuromuscular re-education may also be addressed if/when a patient can fill out portions of their diary. This would include considerations such as seating, posture, handwriting, manipulating pages/materials, etc. (Laxton, 2017).

When understanding the role of Occupational Therapy with ICU patients, it is vital to recognize the timeline of interventions. For instance, Occupational Therapy is practical and valuable when an individual is admitted to the ICU and in the time following their discharge. This may include the utilization of Post-ICU clinics. Post-ICU clinic services target various aspects of PICS and typically involve therapeutic interventions delivered by a wide variety of practitioners (Held & Moss, 2019). Post-ICU clinics are considered outpatient clinics and do not have one standard or model for service implementation (Held & Moss, 2019). Specific Occupational Therapy interventions administered to those suffering the repercussions of critical illness and ICU stay may be largely dependent on the individual manifestation of PICS.

Occupational Therapy may also effectively reduce PICS-F-related impairments in family members and caregivers of the critically ill. For instance, Occupational Therapists may be involved in the implementation of SAF-T programs. This role is less clear as literature is absent regarding this intervention approach. However, the literature supports that SAF-T can be implemented by any clinician, which could include Occupational Therapists (Cairns et al., 2019). Occupational Therapists may be well suited to provide this intervention for a variety of reasons. First and foremost, as mentioned, Occupational Therapists have expertise in all domains of health and functioning, including physical, cognitive, emotional, psychological, behavioral, and sensory processing (Costigan et al., 2019). Additionally, Occupational Therapists are adept at developing therapeutic relationships and understanding/modifying the environment and contexts in which an individual resides to promote success further.

Potential Role of OT Moving Forward

Despite the prominent role of Occupational Therapists in mobility and physical rehabilitation, there is evidence to support this professions' position in improving cognitive and psychological impairments related to the ICU (Costigan et al., 2019). This is supported by Occupational Therapists' expertise and clinical training in assistive technology and the importance of cognition in daily functioning (Costigan et al., 2019). Moving forward, Occupational Therapy services may be integrated with more significant volumes and include activities such as participation in self-care, leisure, and social activities (Costigan et al., 2019). Additionally, interventions may consist of tasks aimed at orienting an individual to reality and facilitating executive functioning. These strategies may reduce anxiety, depression, cognitive impairments and manage risk factors such as delirium (Costigan et al., 2019).

Additionally, it may be beneficial for Occupational Therapists to continue to research, advocate, and develop programs and models of care that can be implemented and generalized across Post-ICU clinics. According to Held and Moss (2019), there is a scarcity of such clinics and subsequent utilization throughout the United States. The development of a model of care and original evidence to support the necessity of post-ICU service utilization may serve to advocate for these clinics.

In the future, Occupational Therapy may also expand regarding interventions administered with family members/caregivers of the critically ill. This may serve to reduce the psychological impairments associated with PICS-F, as commonly seen within this population. To increase occupational therapy service delivery among this population, standardized assessments and evaluations must be developed. Furthermore, there must be a greater awareness of PICS-F to promote more regular screenings among these individuals.

Problem Statement

Throughout the literature, there is clear evidence concerning the underutilization of Occupational Therapy services for the cognitive and psychological components of PICS (Costigan et al., 2019). Additionally, there is little consistency regarding the types of assessments/evaluations used with this population and the timelines in which these tools are being administered. As a result, it does not appear as though there is a single standard or model of care to guide the Occupational Therapy process with individuals at risk for and suffering from PICS.

Due to these inconsistencies, it would be beneficial to understand current knowledge and subsequent gaps in knowledge. Thus, this study sought to answer the following questions, including: "What do Occupational Therapists currently know about PICS," "What do current practice behaviors reflect in terms of this understanding?", "What do Occupational Therapists feel is missing in terms of their knowledge of PICS?" and “How are Occupational Therapists currently involved in treating the cognitive and psychological impairments related to PICS?”

Methodology

The research study was submitted to the Elizabethtown College IRB for exempt review and was approved on 1/07/2021. An addendum was added and approved by the IRB on 2/23/2021. The purpose of this addendum was to allow for additional forms of participant recruitment.

Design

An exploratory, cross-sectional survey design was implemented to evaluate occupational therapists' current knowledge and practice behaviors regarding Post-Intensive Care Syndrome. The purpose of exploratory research is to "formulate problems, clarify concepts, and form hypotheses" (Sue & Ritter, 2011, p. 2). A cross-sectional survey allows participant selection to occur based solely on inclusion and exclusion criteria. In this way, cross-sectional studies are helpful for population-based surveys (Setia, 2016). This design was appropriate for the intended research because it allowed the researcher to obtain information from occupational therapy practitioners who can be considered knowledgeable about practice behaviors.

Participants

Participants included in this study were required to be licensed Occupational Therapy Practitioners currently employed in one or more of the following settings: Intensive-Care Unit (ICU), Step-Down Unit, Inpatient Rehabilitation, Acute Care, Medical Unit, and Surgical Unit, and able to read/write English.

Instruments/Materials

An anonymous survey was composed of 21 multiple choice and open-ended questions using Microsoft Forms®. The survey was divided into the following six sections: demographics, general information, knowledge of physical impairments, knowledge of psychiatric impairments, knowledge of cognitive impairments, and future education. Questions and multiple-choice answers were developed based on information within the literature review. Before the study was submitted for IRB approval, the survey was reviewed by two occupational therapy faculty members who had relevant clinical experience. The purpose of this review was to ensure content validity of the questions included in the survey. A copy of this instrument is located in Appendix A.

Procedures

After IRB approval, information about the study and a link to the survey was posted on the Pennsylvania Occupational Therapy Association (POTA) student research website page. This is a free service for POTA members. However, after two weeks of few responses from this website, participant recruitment expanded to include Elizabethtown College Occupational Therapy alumni. To reach this population, a list of alumni was obtained and sorted by year of graduation. This list included all alumni who completed their entry-level OT degree by 2020 for 1322 alumni. After removing current or adjunct faculty (10 names) and 471 names of alumni who had no email addresses, the final possible list contained 842 alumni. A random sample of 200 alumni was selected from the alumni list; this number represented 15% of the entire OT alumni population or 24% of the available alumni population with email addresses. Those selected alumni received an email from the study's primary investigator with a link to the survey. A copy of this email can be found in Appendix B.

The survey link included on the POTA website and within recruitment emails directed participants to an online anonymous informed consent page. On this page, participants were given additional information concerning the current study and survey tool. Participants were informed that their responses were completely anonymous and that they could choose to exit the survey at any time. Participants were asked to "Agree" or "Disagree" with a set of inclusion criteria. Selecting "Agree" routed the participants to the survey, while selected "Disagree" routed individuals to a "Thank You" screen.

The use of random sampling increases the credibility of the study. Random sampling is one of several forms of probability sampling that has been proven to enhance both the reliability and the validity of a study (Suresh, Thomas, & Suresh, 2011). This recruitment strategy was intended to attract a broad cross-section of therapists from both sampling pools, including members of the POTA and Elizabethtown College alumni. Credibility was also enhanced through anonymity. The anonymity of survey responses allowed participants to share openly and honestly concerning their knowledge and current practice behaviors. This also served to minimize ethical concerns, as it protected the identity of respondents.

Data Analysis

Descriptive statistics provided insight regarding patterns or trends in knowledge and current practice. Regarding open-ended questions, data analysis was completed via qualitative review. Participant statements were analyzed by both the primary investigator and faculty mentor to determine common themes among responses. The primary investigator and faculty mentor reviews were first completed individually. A second collaborative review followed this preliminary review. During the joint review, initial themes were discussed until the reviewers reached a consensus of themes. The purpose of this review was to ensure the credibility and trustworthiness of the data.

Results

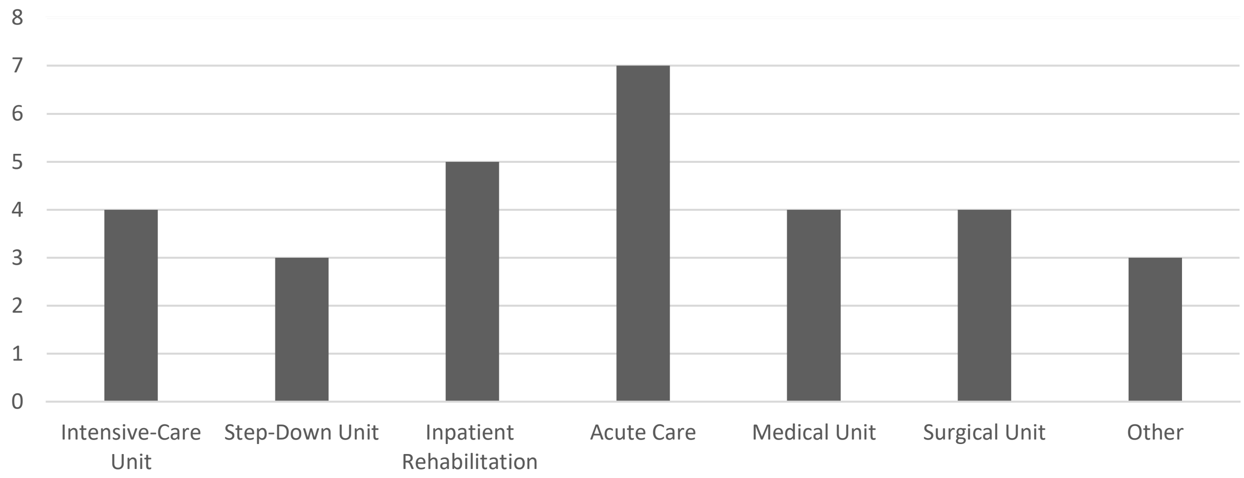
The results below are presented with respect to each of the six categories on the survey instrument.

Demographics

A total of 13 respondents entered the survey; however, only 11 of these individuals completed the form. All of the individuals who responded to the survey were licensed/registered

Occupational Therapists. None of the respondents were Occupational Therapy Assistants. Seven participants reported between 1 and 10 years of experience, while only four participants reported having greater than 11 years of experience in their current practice environment. State of practice varied among participants, including Pennsylvania, Maryland, Connecticut, New Jersey, Virginia, and North Carolina. The current practice settings of the participants are displayed in Figure 1. It must be noted that some of the survey respondents work in more than one setting. This is reflected in the number of responses displayed.

Figure 1: Current Practice Settings of Participants.



General Information

Familiarity of several topics closely related to PICS was assessed by participant rating on a 5-point ordinal scale from unfamiliar to expert knowledge. None of the participants rated themselves as experts in the following areas: PICS diagnosis, sensory overload/deprivation in the ICU, and the Neuro-Occupation framework. Participant ratings are displayed below in Figure 2. Participant familiarity with several evidence-based interventions found within the literature is also shown below (Figure 3). As exhibited, participants were most familiar with Early Mobility interventions. For example, 36.5% of respondents rated themselves as experts in this intervention. Participants were less familiar with the ABCDE Bundle, ICU diaries, and Sensation Awareness Focused Training (SAF-T). A total of 81.1% of respondents rated themselves as unfamiliar with both the ABCDE bundle and SAF-T, while 72.7% rated themselves as unfamiliar with ICU diaries.

Figure 2. Participant familiarity with topics relating to PICS.

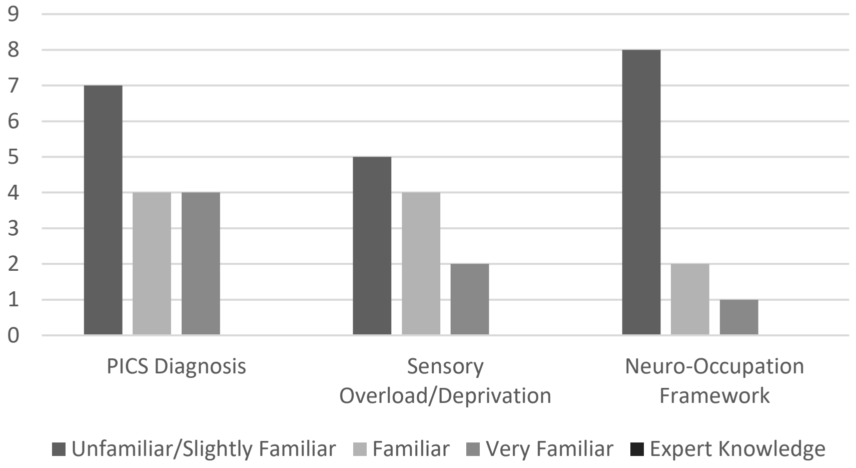
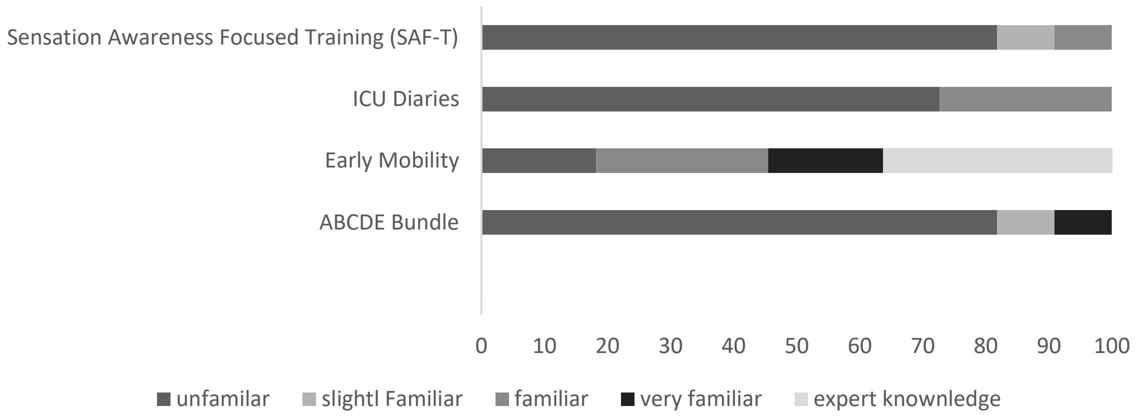


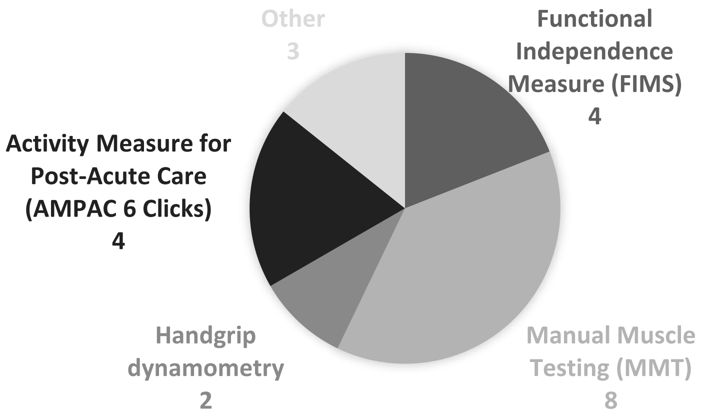
Figure 3. Participant familiarity with evidence-based interventions for treating individuals with PICS.



Physical Impairments

PICS is known to affect three areas of functioning, one of which is the physical domain. In fact, according to survey responses, physical impairments are the most common reason for an individual to be referred to occupational therapy services during/following an ICU stay. Manual Muscle Testing (MMT) was often used by participants when assessing physical functioning, as seen in Figure 4. Participants were also asked to describe common interventions implemented with patients suffering from physical impairments. The majority of interventions reported by participants were functional tasks, e.g., ADLs and functional standing/balance activities. Many participants also reported using interventions aimed at the upper extremity, e.g., ROM, strengthening, and endurance. Participant verbatim responses are listed in Appendix C. Level of familiarity of ICU-acquired weakness (ICUaW) was also assessed. Five of the eleven respondents rated themselves as unfamiliar/slightly familiar, while six participants rated themselves as familiar/very familiar. None of the participants rated themselves as experts in ICUaW.

Figure 4: Assessments used to evaluate physical impairments during/following a patient's ICU stay.



Psychiatric Impairments

Another common area of functioning impaired in individuals with PICS is psychiatric functioning. According to survey responses, psychiatric concerns are least likely to be included on an occupational therapy referral. Regarding these impairments, only three of eleven participants reported using standardized assessments such as the Beck Depression Inventory-II (BDI-II) and the Post-Traumatic Stress Checklist – Specific Version (PCL-S); these assessments were identified in the literature. Participants also described common interventions implemented for patients suffering from psychiatric impairments. The four most common responses were empathetic discussion, coping skills training, engagement in meaningful activities, or no intervention. Participant verbatim responses are included in Appendix C.

Cognitive Impairments

The third and final area of functioning affected by PICS is cognitive functioning. According to survey responses, occupational therapy practitioners are least likely to write goals reflective of this domain of health/occupation when working with patients during or following ICU stay. The Mini-Mental State Exam (MMSE) was often used by participants, with 6 out of 11 reporting using this when assessing cognitive functioning. Seven participants also responded with "other," indicating the use of alternative assessments than those included in the survey. Several common interventions were also apparent based on participant statements within the survey. For example, interventions used to address cognition included functional tasks, e.g., ADL/IADL, orientation training, compensatory strategies, and no intervention. Complete participant responses are included verbatim in Appendix C.

Future Education

Participants were asked to rate their agreement with the following statement, "I think I would benefit from more education regarding Post-Intensive Care Syndrome." Seven of the eleven participants agreed or strongly agreed to this statement. Only one individual disagreed, and the remaining participants remained neutral on the matter (*Figure 5*). Seven participants also gave recommendations for additional support. Of these responses, there was a consensus for the need for general information regarding the treatment of individuals at risk for/suffering from PICS. Further recommendations also included the need for specific details concerning interventions and assessments that can be used when addressing the cognitive domain of functioning. Complete participant statements are included verbatim in Appendix C.

Figure 5. Participants' Interests in Additional Education

Discussion

This study addressed the use of evidence-based practice by occupational therapists in the ICU and related settings. This study produced preliminary evidence regarding therapists' knowledge and evidence-based practice behaviors when working with patients at risk for or suffering from PICS. Study results support further education and learning regarding this diagnosis and relative aspects of the occupational therapy process. It is possible that the novelty of this diagnosis, as it was first recognized in 2010, contributes to the lack of overall knowledge.

According to survey responses, there is a lack of utilization of the specific assessments that are identified throughout the literature. This disparity is most noticeable in the domains of cognitive and psychiatric functioning. This begs the question as to why therapists are not using the recommended assessments. Several reasons may exist to answer this question. For example, there may be a lack of awareness of specific assessments best suited for this population. Additionally, policies and procedures may hinder occupational therapists from utilizing assessments outside of those deemed for use by their facility. The survey did not ask participants to elaborate on this, so the underlying reason remains uncertain.

Throughout the literature, evidence exists to support the use of four specific interventions when addressing performance deficits in patients at risk for or suffering from PICS. These intervention approaches include the ABCDE Bundle, ICU Diaries, Early Mobility, and Sensation Awareness Focused Training (Cairns et al., 2019; Hsieh et al., 2019; Hopkins et al., 2016; & Laxton, 2017). Despite the available evidence, most participants in this study reported unfamiliarity with all but one of these approaches, Early Mobility. Further research is necessary to understand the gap between evidence-based intervention approaches and those utilized in practice. One possible explanation may be the emphasis placed on physical health and rehabilitation within the ICU. For example, the ICU employs the medical model to achieve general health and survival of patients. This claim is further supported by survey responses that indicate the majority of occupational therapy referrals are for physical impairments. Of the interventions found throughout the literature, Early Mobility best aligns with this viewpoint. Additionally, more evidence and literature are available for the effectiveness of early mobility interventions than its counterparts.

Based on sampling methods, it is assumed that most of the participants included in this study were Elizabethtown College alumni. However, given the broad range of years of experience and state of practice, it is likely that these results may be generalized to other OT practitioners. Furthermore, study limitations included a small sample size and survey design. The minimal sample size may not represent the breadth of knowledge and practice of OT practitioners working with PICS patients. In addition, the survey was not designed to allow the participants to elaborate on their answers when selecting "other." This may have limited the information obtained throughout the study, especially regarding the assessments used for cognitive and psychiatric impairments related to PICS. More research is needed to clarify the discrepancy between practice and what is reported in the literature.

It must also be noted that one of the eleven respondents was a school-based occupational therapy practitioner. Although this participant was not employed in one of several practice areas known to treat patients during or following ICU stay, their responses were included in the analysis. This decision was made on the premise that knowledge of this diagnosis may be necessary for occupational therapists working with children. In other words, the literature does support the presence of PICS in children (PICS-p), and therefore it is possible that this therapist has or will treat children with this condition.

According to several studies, children suffer from an array of physical, cognitive, and psychological impairments during and after ICU admission. These declines in functional performance are very similar to those studied and reported within the adult population (Ekim, 2020; Herrup, Wieczorek, & Kudchadkar, 2017; & Watson et al., 2018). However, unlike adults, pediatric patients are undergoing stages of growth that are crucial to long-term development. Within these periods, children may be most vulnerable to illness and injury (Watson et al., 2018).

If a child does develop PICS, implications of physical, cognitive, and psychiatric impairments may include delayed achievement of developmental milestones, decreased academic abilities, difficulty attaining and maintaining peer relationships, etc. Research also suggests that therapy may have more significant results among this population due to children's general capacity for rehabilitation (Watson et al., 2018). Temporal contexts may have a vast degree of influence on symptoms and implications of PICS, suggesting the importance of OT interventions among younger populations at risk for PICS.

Conclusion

Post-Intensive Care Syndrome is an overarching diagnosis that refers to developing new or worsening impairments in several health domains, including cognitive, psychiatric, and physical. Symptoms of this disorder arise during or following admission and treatment within the ICU. This condition can be developed in children and adults. Post-Intensive Care Syndrome is a growing concern worldwide as more and more individuals are surviving critical illness. Additionally, due to the recent COVID-19 pandemic, the number of positive cases of PICS is likely to rise. This results from the increased use of mechanical ventilation, which is a known predictor for developing this condition. Moving forward, occupational therapy practitioners must be diligent about learning about PICS and evidence-based practice techniques. Continuing education courses and academic programs should address this topic because it is a relevant diagnosis across the lifespan. Additionally, further research is necessary to better understand the disparities related to occupational therapy practice with individuals at risk for/suffering from PICS.

References

American Psychiatric Association. (2013). *Diagnostic and Statistical Manual of Mental Disorders*. American Psychiatric Association, *5*, 423-450.

Biehl, M., & Sese, D. (2020). Post-intensive care syndrome and COVID-19 – Implications post pandemic. *Cleveland Clinic Journal of Medicine,* 1-3. 10.3949/ccjm.87a.ccc055.

Bienvenu, O. J., Friedman, L. A., Colantuoni, E., Dinglas, V. D., Sepulveda, K. A., Mendez-Tellez, P., Shanholz, C., Pronovost, P. J., & Needham, D. M. (2018). Psychiatric symptoms after acute respiratory distress syndrome: A 5-year longitudinal study. *Intensive Care Med, 44*(1), 38-47. 10.1007/s00134-017-5009-4.

Cabrini, L., Landoni, G., Antonelli, M., Bellomo, R., Colombo, S., Negro, A., Pelosi, P., & Zangrillo, A. (2016). Critical care in the near future: Patient-centered, beyond space and time boundaries. *Minerva Anestesiologica, 82*(5), 599-604.

Cairns, P. L., Buck, H. G., Kip, K. E., Rodriguez, C. S., Liang, Z., & Munro, C. L. (2019). Stress management intervention to prevent post-intensive care syndrome-family in patients' spouses. *American Journal of Critical Care, 28*(6), 471-476. 10.4037/ajcc2019668.

Choi, J., Tate, J. A., Rogers, M. A., Donahoe, M. P., & Hoffman, L. A. (2016). Depressive symptoms and anxiety in intensive care unit (ICU) survivors after ICU discharge. *Heart & Lung*, *45*(2016), 140-146. 10.1016/j.hrtlng.2015.12.002.

Colbenson, G. A., Johnson, A., & Wilson, M. E. (2019). Post-intensive care syndrome: Impact, prevention, and management. *Breathe, 15*(2), 98-101. 10.1183/20734735.0013-2019.

Costigan, F. A., Duffett, M., Harris, J. E., Baptiste, S., & Kho, M. E. (2019). Occupational therapy in the ICU: A scoping review of 221 documents. *Journal of Critical Care Medicine, 47*(12), 1014-1021. 10.1097/CCM.0000000000003999.

Davydow, D. S., Hough, C. L., Zatzick, D., & Katon, W. J. (2014). Psychiatric symptoms and acute care service utilization over the course of the year following medical-surgical intensive care unit admission: A longitudinal investigation. *Critical Care Medicine, 42*(12), 2473-2481. 10.1097/CCM.0000000000000527.

Ekim, A. (2020). The Post-Intensive Care Syndrome in children. *Comprehensive Child and Adolescent Nursing*, *43*(1), 15-21. DOI: 10.1080/24694193.2018.1520323.

Fan, E., Dowdy, D. W., Colantuoni, E., Mendez-Tellez, P. A., Sevransky, J. E., Shanholtz, C., Himmelfarb, C. R. D., Desai, S. V., Ceisla, N., Herridge, M. S., Pronovost, P. J., & Needham, D. M. (2014). Physical complications in acute lung injury survivors: A 2-year longitudinal prospective study. *Critical Care Medicine, 42*(4), 849-859. 10.1097/CCM.0000000000000040.

Harvey, M. A., & Davidson, J. E. (2016). Postintensive care syndrome: Right care, right now…and later. *Critical Care Medicine, 44*(2), 381-385. 10.1097/CCM.0000000000001531.

Held, N.,& Moss, M. (2019). Optimizing post-intensive care unit rehabilitation. *Turkish Thoracic Journal, 20*(2), 147-152. 10.5152/TurkThoracJ.2018.18.172.

Herrup, E. A., Wieczorek, B., & Kudchadkar, S. R. (2017). Characteristics of postintensive care syndrome in survivors of pediatric critical illness: A systematic review. *World Journal of Critical Care Medicine, 6*(2), 124-134. DOI: 10.5492/wjccm.v6.i2.124.

Heydon, E., Wibrow, B., Jacques, A., Sonawane, R., & Anstey, M. (2019). The needs of patients with post-intensive care syndrome: A prospective, observational study. *Australian Critical Care Journal, 33*(2020), 116-122. 10.1016/j.aucc.2019.04.002.

Hopkins, R. O., Mitchell, L., Thomsen, G. E., Schafer, M., Link, M., & Brown, S. M. (2016). Implementing a mobility program to minimize post-intensive care syndrome. *AACN Advanced Critical Care Journal, 27*(2), 187-203. 10.4037.aacnaac2016244.

Hopkins, R. O., Suchtya, M. R., Farrer, T. J., & Needham, D. (2012). Improving post-intensive care unit neuropsychiatric outcomes. *American Journal of Respiratory Critical Care Medicine, 186*(12), 1220-1228. 10.1164/rccm.201206-1022CP.

Hopkins, R. O., Suchyta, M. R., Kamdar, B. B., Darowski, E., Jackson, J. C., & Needham, D. M. (2017). Instrumental activities of daily living after critical illness: A systematic review. *American Thoracic Society, 14*(8), 1332-1343. 10.1513/AnnalsATS.201701-059SR.

Howell, D. (1999). Neuro-occupation: Linking sensory deprivation and self-care in the ICU patient. *Occupational Therapy in Health Care, 11*(4), 75-85. 10.1080/J003v11n04_07.

Hsieh, S. J., Otusanya, O., Gershengorn, H. B., Hope, A. A., Dayton, C., Levi, D., Garcia, M., Prince, D., Mills, M., Fein, D., Colman, S., & Gong, M. N. (2019). Staged implementation of ABCDE bundle improves patient outcomes and reduces hospital costs. *Critical Care Medicine, 47*(7), 885-893. 10.1097/CCM.0000000000003765.

Huang, M., Parker, A. M., Bienvenu, O. J., Dinglas, V. D., Colantuoni, E., Hopkins, R. O., & Needham, D. M. (2016). Psychiatric symptoms in acute respiratory distress syndrome survivors: A 1-year national multicenter study. *Critical Care Medicine, 44*(5), 954-965. 10.1097/CCM.0000000000001621.

Iwashyna, T. J., Ely, E. W., Smith, D. M., & Langa, K. M. (2010). Long-term cognitive impairment and functional disability among survivors of severe sepsis. *JAMA, 304*(16), 1787-1794. 10.1001/jama.2010.1553.

Jackson, J. C., Obremskey, W., Bauer, R., Greevy, R., Cotton, B. A., Anderson, V., Song, Y., & Ely, E. W. (2007). Long-term cognitive, emotional, and functional outcomes in trauma intensive care unit survivors without intracranial hemorrhage. *The Journal of Trauma Injury, Infection, and Critical Care, 63*(1), 80-88. 10.1097/TA.0b013e31802ce9bd.

Jackson, J. C., Pandharipande, P. P., Girard, T. D., Brummel, N. E., Thompson, J. L., Hughes, C. G., Pun, B. T., Vasilevskis, E. E., Morandi, A., Shintani, A. K., Hopkins, R. O., Bernard, G. R., Dittus, R. S., Ely, E. W., & BRAIN-ICU Investigators. (2014). Depression, posttraumatic stress disorder, and functional disability in survivors of critical illness: Results from the BRAIN ICU (Bringing to light the risk factors and incidence of neuropsychological dysfunction in ICU survivors) investigation: A longitudinal cohort study. *Lancet Respiratory Medicine, 2*(5), 369-379. 10.1016/S2213-2600(14)70051-7.

Klein, K., Mulkey, M., Bena, J. F., & Albert, N. M. (2014). Clinical and psychological effects of early mobilization in patients treated in a neurological ICU: A comparative study. *Critical Care Medicine, 43*(4), 865-873. 10.1097/CCM.0000000000000787.

Laxton, L. (2017). Implementing the ICU diary in the medical intensive care unit. *SIS Quarterly Practice Connections, 2*(2), 19-20.

Lee, M., Kang, J., & Jeong, Y. J. (2019). Risk factors for post-intensive care syndrome: A systematic review and meta-analysis. *Australian Critical Care Journal, 33*(2020), 287-294. 10.1016/j.aucc.2019.10.004.

Locke, M., Eccleston, S., Ryan, C. N., Bymes, T. J., Mount, C., & McCarthy, M. S. (2016). Developing a diary program to minimize patient and family post-intensive care syndrome. *AACN Advanced Critical Care, 27*(2), 212-220. 10.4037/aacnacc2016467.

Maley, J. H., Brewster, I., Mayoral, I., Siruckova, R., Adams, S., McGraw, K. A., Piech, A. A., Detsky, M., & Mikkelsen, M. E. (2016). Resilience in survivors of critical illness in the context of the survivors' experience and recovery. *American Thoracic Society, 13*(8), 1351-1360. 10.1513/AnnalsATS.201511-782OC.

Marra, A., Pandharipande, P. P., Girard, T. D., Patel, M. B., Hughes, C. G., Jackson, J. C., Thompson, J. L., Chandrasekhar, R., Ely, E. W., & Brummel, N. E. (2018). Co-occurrence of post-intensive care syndrome problems among 406 survivors of critical illness. *Critical Care Medicine, 46*(9), 1393-1401. 10.1097/CCM.0000000000003218.

McIlroy, P. A., King, R. S., Garrouste-Orgeas, M., Tabah, A., & Ramanan, M. (2019). The effect of ICU diaries on psychological outcomes and quality of life of survivors of critical illness and their relatives: A systematic review and meta-analysis. *Journal of Critical Care Medicine, 47*(2), 273-279. 10.1097/CCM.0000000000003547.

Nikayin, S., Rabiee, A., Hashem, M. D., Huang, M., Bienvenu, O. J., Turnbull, A. E., & Needham, D. M. (2016). Anxiety symptoms in survivors of critical illness: A systematic review and meta-analysis. *Gen Hosp Psychiatry, 43*, 23-29. 10.1016/j.genhosppsych.2016.08.005.

Pandharipande, P. P., Girard, T. D., Morandi, J. A., Thompson, J. L., Pun, B. T., Brummel, N. E., Hughes, C. G., Vasilevskis, E. E., Shintani, A. K., Moons, K. G., Geevarghese, S. K., Canonico, A., Hopkins, R. O., Bernard, G. R., Dittus, R. S., Ely, E. W., & BRAIN-ICU Investigators. (2013). Long-term cognitive impairment after critical illness. *New England Journal of Medicine, 369*(14), 1306-1316. 10.1056/NEJMoa1301372.

Petrinec, A. B., & Daly, B. J. (2016). Post-traumatic stress symptoms in post-ICU family members: Review and methodological challenges. *Western Journal of Nursing Research, 38*(1), 57-78. 10.1177/0193945914544176.

Petrinec, A. B., & Martin, B. R. (2017). Post-intensive care syndrome symptoms and health-related quality of life in family-decision-makers of critically ill patients. *Cambridge University Press*, 719-724. 10.1017/S1478951517001043.

Rabiee, A., Nikayin, S., Hashem, M. D., Huang, M., Dinglas, V. D., Bienvenu, O. J., Turnbull, A. E., & Needham, D. M. (2016). Depressive symptoms after critical illness: A systematic review and meta-analysis. *Critical Care Medicine, 44*(9), 1744-1753. 10/1097/CCM.0000000000001811.

Rawal, G., Yadav, S., & Kumar, R. (2017). Post-intensive care syndrome: An overview. *Journal of Translational Internal Medicine, 5*(2), 90-92. 10.1515/jtim-2016-0016.

Sakusic, A., O'Horo, J. C., Dziadzko, M., Vohla, D., Ali, R., Singh, T. D., Kashyap, R., Farrel, A. M., Fryer, J. D., Petersen, R., Gajic, O., & Rabinstein, A. A. (2018). Potentially modifiable risk factors for long-term cognitive impairment after critical illness: A systematic review. *Mayo Clinic Proceedings, 93*(1), 68-82. 10.1016/j.mayocp.2017.11.005.

Setia M. S. (2016). Methodology series module 3: Cross-sectional studies. *Indian Journal of Dermatology*, *61*(3), 261–264. https://doi.org/10.4103/0019-5154.182410.

Shear M. K. (2012). Grief and mourning gone awry: Pathway and course of complicated grief. *Dialogues in Clinical Neuroscience*, *14*(2), 119–128.

Sidiras, G., Patsaki, I., Karatzanos, E., Dakoutrou, M., Kouvarakos, A., Mitsiou, G., Routsi, C., Stranjalis, G., Nanas, S., & Gerovasili, V. (2019). Long term follow-up of quality of life and functional ability in patients with ICU acquired weakness – A post hoc analysis. *Journal of Critical Care, 53*(2019), 223-230. 10.1016/j.jcrc.2019.06.022.

Siegel, M. D., Hayes, E., Vanderwerker, L. C., Loseth, D. B., & Prigerson, H. G. (2008). Psychiatric illness in the next of kin of patients who die in the intensive care unit. *Critical Care Medicine, 36*(6), 1722-1728. 10.1097/CCM.0b013e318174da72.

Stam, H. J., Stucki, G., & Bickenbach, J. (2020). COVID-19 and post intensive are syndrome: A call for action. *Journal of Rehabilitation Medicine*, *52*, 1-4. 10.2340/16501977-2677.

Sue, V. M., & Ritter, L. A. (2011). Introduction. In *Conducting Online Surveys* (2nd Ed.), (pp. 1-13). SAGE Publications Inc. Retrieved from https://us.sagepub.com/sites/default/files/upm-assets/44129_book_item_44129.pdf.

Suresh, K., Thomas, S. V., & Suresh, G. (2011). Design, data analysis and sampling techniques for clinical research. *Annals of Indian Academy of Neurology*, *14*(4), 287–290. https://doi.org/10.4103/0972-2327.91951.

Vanhorebeek, I., Latronico, N., & Berghe, G. V. (2020). ICU-acquired weakness. *Intensive Care Med, 46*, 637-653. 10.1007/s00134-020-05944-4.

Wang, S., Xin, H., Lim Vico, C. C., Liao, J., Li, S., Xe, N., & Hu, R. (2020). Effect of an ICU diary on psychiatric disorders, quality of life, and sleep quality among adult cardiac surgical ICU survivors: A randomized controlled trial. *Critical Care, 24*(81), 1-10. 10.1186/s13054-020-2797-7.

Watson, R. S., Choong, K., Colville, G., Crow, S., Dervan, L. A., Hopkins, R. O., Knoester, H., Pollack, M. M., Rennick, J., & Curley, M. A. Q. (2018). Life after critical illness in children – Toward an understanding of pediatric post-intensive care syndrome. *The Journal of Pediatrics, 198,* 16-24. https://doi.org10.1016/j.jpeds.2017.12.084.

Yang, T., Li, Z., Jiang, L., Wang, Y., & Xi, X. (2018). Risk factors for intensive care unit-acquired weakness: A systematic review and meta-analysis. *Acta Neurological Scandinavica, 138,* 104-114. 10.1111/ane.12964.

Zanten, S. A., Vink, R., Dongelmans, D. A., Dettling-Ihnenfeldt, D., & Shaaf, M. (2016). Caregiver strain and posttraumatic stress symptoms of informal caregivers of intensive care unit survivors. *Rehabilitation Psychology Journal, 61*(2), 173-178. 10.1037/rep0000081.

Appendix A

Copy of the survey instrument.

Section I: Demographics

1. Which of the following settings do you currently work in? (Mark all the apply)
    a. Intensive-Care Unit (ICU)
    b. Step-Down Unit
    c. Inpatient Rehabilitation
    d. Acute Care
    e. Medical Unit
    f. Surgical Unit
    g. Other
2. Please indicate your years of experience within the setting you are currently practicing.
    a. 1-5 years
    b. 6-10 years
    c. 11-15 years
    d. 16-20 years
    e. 21 or more years
3. Are you a/an
    a. OTR/L
    b. COTA/L
4. How would you describe your role within the ICU/within Step-Down Units?
    a. Text box
5. Are you currently treating patients with COVID-19?

   a. Yes
   b. No

6. What state are you currently practicing in?
   a. Text box (or scroll through).

Section II: General Information

7. Please rate your familiarity with the phenomenon, Post-Intensive Care Syndrome (PICS)?
   a. 1 – unfamiliar, 2 – slightly familiar, 3- familiar, 4- very familiar, and possibility 5 – expert knowledge
8. How familiar are you with sensory overload and deprivation relating to the ICU environment?
   a. 1 – unfamiliar, 2 – slightly familiar, 3- familiar, 4- very familiar, and possibility 5 – expert knowledge
9. How familiar are you with the Neuro-Occupation framework?
   a. 1 – unfamiliar, 2 – slightly familiar, 3- familiar, 4- very familiar, and possibility 5 – expert knowledge
10. Which of the following areas are typically indicated on Occupational Therapy referrals? (Please mark all the apply.)
    a. Cognitive
    b. Physical
    c. Mental Health
    d. Other (text box to type)

11. How familiar are you with the following interventions?
    a. ABCDE Bundle
        i. 1 – unfamiliar, 2 – slightly familiar, 3- familiar, 4- very familiar, and possibility 5 – expert knowledge
    b. Early Mobility
        i. 1 – unfamiliar, 2 – slightly familiar, 3- familiar, 4- very familiar, and possibility 5 – expert knowledge
    c. ICU Diaries
        i. 1 – unfamiliar, 2 – slightly familiar, 3- familiar, 4- very familiar, and possibility 5 – expert knowledge
    d. Sensation Awareness Focused Training (SAF-T)
        i. 1 – unfamiliar, 2 – slightly familiar, 3- familiar, 4- very familiar, and possibility 5 – expert knowledge
12. Therapy goals are typically reflective of which of the following domains of health/occupation?
    a. Self-Care
        i. 1 – almost always, 2- frequently, 3 – sometimes, 4 – seldom, 5 - never
    b. Mobility
        i. 1 – almost always, 2- frequently, 3 – sometimes, 4 – seldom, 5 - never
    c. Cognition
        i. 1 – almost always, 2- frequently, 3 – sometimes, 4 – seldom, 5 - never
    d. ADLs
        i. 1 – almost always, 2- frequently, 3 – sometimes, 4 – seldom, 5 - never

   e. Physical Rehabilitation
      i. 1 – almost always, 2- frequently, 3 – sometimes, 4 – seldom, 5 – never

Section III: Physical Impairments

13. What assessments do you typically administer to evaluate for physical impairment during/following a patients ICU stay? (Please mark all that apply.)
    a. Functional Independence Measure (FIM)
    b. Manual Muscle Testing (MMT)
    c. Handgrip dynamometry
    d. AMPAC 6 clicks
    e. Other… (text box)
14. What interventions do you typically administer to target physical impairments?
    a. Text Box
15. How familiar are you with ICU-acquired weakness (ICUaW)?
    a. 1 – unfamiliar, 2 – slightly familiar, 3- familiar, 4- very familiar, and possibility 5 – expert knowledge

Section IV: Psychiatric Impairments

16. What assessments do you typically administer to evaluate for psychiatric impairments during/following a patients ICU stay? (Please mark all that apply.)
    a. Beck Depression Inventory-II (BDI-II)
    b. Post-Traumatic Stress Checklist – Specific Version (PCL-S)
    c. Hospital Anxiety and Depression Scale (HADS)
    d. Impact of Event Scale – Revised (IES-R)

  e. Shortened Profile of Mood States – Anxiety subscale (POMS-A)
  f. Center for Epidemiological Studies – Depression 10 items (CESD-10)
  g. Other… (text box)

17. What interventions do you typically administer to target psychiatric impairments?
    a. Text Box

Section V: Cognitive Impairments

18. What assessments do you typically administer to evaluate for cognitive impairments during/following a patients ICU stay? (Please mark all that apply.)
    a. Trail Making Test, Part B
    b. Repeatable Battery for the Assessment of Neuropsychological Status (RBANS)
    c. Modified Telephone Interview for Cognitive Status (TICS-M)
    d. Rey-Osterrieth Complex Figure Test (ROCF)
    e. Mini-Mental State Exam (MMSE)
    f. Other… (text box)
19. What interventions do you typically administer to target cognitive impairments?
    a. Text Box

Section VI: Future Education

20. Please indicate your level of agreement with the following statement: “I think I would benefit from more education regarding Post-Intensive Care Syndrome.”
    a. 1 – strongly disagree, 2 – disagree, 3- neutral, 4 – agree, 5 – strongly agree
21. If you answered agree or strongly agree to the prior question, please describe what you need or want to know more about regarding Post-Intensive Care Syndrome.

a. Text box

Please feel free to contact Wendy Header, OT student investigator, at headerw@etown.edu if you wish to engage in more conversation about this topic or receive more information concerning the current study.

Appendix B

Copy of email sent to Elizabethtown College Alumni during participant recruitment.

Hello,

My name is Wendy Header, and I am currently a senior Occupational Therapy student at Elizabethtown College. I am conducting a 21-question survey relating to Post-Intensive Care Syndrome. The survey form is anonymous and available for completion via Microsoft forms. The purpose of this study and subsequent survey is to create a better understanding of Occupational Therapist's current knowledge and practice behaviors regarding Post-Intensive Care Syndrome. As such, results may indicate whether or not further education or professional development is needed or desired by OT Practitioners.

More information, including informed consent is available within the survey link. This page will be accessed prior to the survey, as you will have to agree to the terms outlined in the consent form.

https://forms.office.com/Pages/ResponsePage.aspx?id=Ek-IHdeg8EKLFTqRyFO8tWwiTfwfiZJPsZ6xSBoPRkNUM1lJQlI4UEtYQjczWU9aNFowRFNUSklTTi4u

If you have any further questions please feel free to contact student investigator, Wendy Header, at headerw@etown.edu. You may also contact faculty advisor, Debbie Waltermire, DrPH, OTR/L at walterda@etown.edu or the Elizabethtown College Institutional Research Board at 717-361-1133.

Thank you for your participation.

Appendix C

Qualitative Data including participant responses regarding specific interventions in each of the three domains of functioning that are commonly affected by PICS (physical, psychiatric, and cognitive) and participant recommendations for further education.

Interventions typically administered to target physical impairments.

- “ADLs, increasing standing tolerance during ADLs at the sink, practicing functional (toilet) transfers, occasionally AROM exercises”
- “Depends on what the physical impairment is and the resources available”
- “Functional balance activities, neuro strengthening, NMES”
- “Functional standing, ambulation, transfers, UE exercise”
- “ADL, co-treat with PT, tilt table, therex, UE faciliatory techniques etc”
- “Early mobility as tolerated (dangling edge of bed, bedside activities to improve functional activity tolerance and endurance, strengthening with own body weight or theraband to tolerance, AROM, self care training) standing and taking side steps if patient is able”
- “Function based tasks”
- “ROM, strengthening, general movements”
- “Neuromuscular re-education, ROM, Strengthening, Balance, Transfer Training, ADL retraining”
- “It varies on the type of injury or reason for hospitalization- usually interventions targeting strengthening/endurance of upper extremity, crossing midline, etc.”

Interventions typically administered to target psychiatric impairments.

- “Meaningful participation in self care, functional mobility out of room, walk to large window with Mountain View”
- “I frequently (because of my behavioral health background) target coping skills such as deep breathing, use of simply tai chi for relaxation; but also just active reflective empathetic listening to allow the patient to feel heard and express their emotions regarding their current situation. I also encourage them to identify leisure tasks or set goals for themselves to find things they want to do that are productive and healthy to occupy their time upon d/c. Also we do provide newspapers or crossword puzzles and things they are interesting in to promote use of free time while in the hospital”
- “Empathetic discussion”
- “Typically I’m seeing patients with functional movement disorder, PTSD or anxiety. Positive reinforcement, realistic goal setting, intrinsic motivation facilitation”

- “None, should do more”
- “It’s a very client specific intervention, we are finding many patients with COVID have PTSD and benefit from stress management, meditation, yoga, diaphragmatic breathing, journaling, etc.”
- “I try to simulate a home environment by opening the blinds during the day, having them perform morning ADLs according to their own routine”
- “Not a frequent enough referral”
- “Delirium precautions, orientation strategies, finding out background of person to engage in conversations meaningful to them”
- “Referral to counseling/psychology services offered at out facility and within the community”
- “N/A”

Interventions typically administered to target cognitive impairments.

- “Simple commands, orientation training”
- “Usually I don’t get to intervene – I make a discharge rec based on the assessment results”
- “None”
- “Functional IADL tasks such as med management, Bill paying, etc”
- “Rarely any”
- “Very functional treatment as not to overlap with SLP: sequencing, problem solving with ADL/IADL, money management, awareness training”
- “Functional cognitive training during ADL tasks (facilitating task completion with forward/backward chaining)”
- “Compensatory techniques, pt/family training”
- “Orientation, finding out from family meaningful things to patient to engage with, discussing current topics, leaving lights on during day, quizzing patients”
- “Functional Cognitive Retraining through executive functioning activities with a focus on divided attention, pen/paper tasks, etc.”
- “N/A – interventions provided by school psychologist”

Recommendations for additional support/knowledge regarding Post-Intensive Care Syndrome.

- “I am always eager to learn and would love general overview in service”
- “I don’t have experience or knowledge regarding how to prevent it in the ICU and how to address sensory/cognitive impairments from an intervention standpoint – since I feel my

acute care job more so promotes evaluations/assessments to get them to the next level of care."

- "I know very little so truly anything"
- "Specific treatments and assessments for cog and psych impairment"
- "How to better identify pt, assessments to identify needs, best practice treatment interventions"
- "I've never heard of this concept and would benefit from inservice or recorded information to pass onto the department"
- "It would be helpful for anyone who works with patients who transition out of intensive care to be more knowledgeable on PICS in order to best meet their needs."