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President's Column



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"Ask not what your country can do..."

So concludes a justifiably famous oration entreating citizens to contribute to the greater good. Fortunately, that's one thing that doesn't need to be said at SOCCA. In the 6 months that I have been President, the one thing I hear over and over again is "How can I contribute?" or "What does SOCCA need?". It is both gratifying and exciting to feel the energy behind our growing and energetic group of critical care anesthesiologists. I am reminded time and time again of what an honor it is to serve this society.

But it IS reasonable to ask what SOCCA can do for you! After all, tribal loyalties aside, that \$160 membership could instead be a reasonable weekend dinner for two.

I've touched on some of the reasons in the Fall issue of the Interchange. SOCCA is the only society focused on the critical care anesthesiologist, and offers a chance to interact with clinicians and researchers who share the common language of the anesthesiologist. The diversity of our practice environments is unmatched, and within SOCCA's ranks you will find Trauma, SICU, Burn, Neuro, and Cardiothoracic expertise at the highest level. Have a question about a difficult management dilemma? It's likely that another SOCCA member somewhere has come up against that same problem.

But in this column I'd like to highlight some of the other, more tangible things that SOCCA might do for you. Interested in writing for our (quarterly) Interchange Newsletter? Our Interchange Editor in Chief Dr. Jordan Brand

has created an email address where you can propose ideas for articles (soccnewsletter@iars.org) and if the article fits the issue theme we are committed to helping you get it published. To those who ask: "But what's the point?", I'd note that many publications in my section of Anesthesia & Analgesia originated as ideas from SOCCA members floated in similar contexts...see PMID 28098587 and 27870745 for examples. Who knows? Your next publication could start as a piece for the Interchange!

I'd also like to highlight our new SOCCA jobs website. In working with our fellowship program directors, our Fellowship committee Chair Dr. Miko Enomoto noted that our graduating fellows often relied on word of mouth to generate job leads, and that no efficient market for such jobs existed. To address that challenge, we've put together a site that you can access if you are looking for a job, or if you want to post a job opening. Please visit, take a look (<https://go.gl/URjzMU>), and let Dr. Enomoto or me know your thoughts! We've also created a unique email address for match-related questions (SOCCAFellowshipMatch@iars.org) so if you have questions about Match rules you now have a way to ask them.

Many have inquired about SOCCA-sponsored speaking opportunities. While we can't accommodate all of the interest in speaking at the one-day SOCCA meeting itself (Dr. Adam Evans is meeting Chair), I'd note that SOCCA also has considerable input into the ASA Critical Care track (Dr. Dan Brown is Chair), and the SCA SOCCA panel (Dr. Shahzad Shaeefi is Chair). Speaking at any one of these venues is a good way to define an area of expertise, gain CME experience, and gain experience producing and delivering educational content. If you have an idea about content related to any of the above meetings, let me or any of the above Chairs know!

I'd also like to highlight some other ideas we are working on to make SOCCA more valuable to the practicing Anesthesiologist/Intensivist. Dr. Michael Fierro has been experimenting with

a Twitter page (@SOCCA_CritCare) to give us more of an on-line identity. Do take a look! So far the site has mostly functioned as a journal club paper review forum, but it could easily be more. We are also working on updating our resident teaching manual to include clinical protocols gathered from SOCCA members (Dr. Linda Liu leads that process) and launching a project to describe the scope and breadth of SOCCA's clinical practice. And, to allow SOCCA members to tap each other's expertise, we are working on allowing members to declare their subspecialty expertise as part of the membership directory, and making that information available to all members so if you have a clinical question you can tap into our collective wisdom. Stay tuned!

If you find any of the above projects interesting, or have other ideas for how SOCCA can provide value to our membership, please feel free to contact me (atung@dacc.uchicago.edu) and I can put you in touch with the relevant parties. As our website states, "SOCCA fosters the knowledge and practice of critical care medicine by anesthesiologists through education, research, advocacy, and community." Now is a good time to start!

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Call for Articles for the Spring Issue of *Interchange*!

If you have an interesting case report, an idea for a pro-con discussion, a review idea, or an opinion on a recently published article, please submit your proposal/article to soccanewsletter@iars.org on or before Friday, April 28, 2017. If your article is chosen for the Spring Issue of *Interchange* 2017, we will contact you then for editing and formatting!

SOCCA Information

Email

Meetings: SOCCAm meetings@iars.org
 Membership information: SOCCA@iars.org
 Visit the SOCCA website at: www.SOCCA.org

Membership

Membership in SOCCA is open to all anesthesiologists who have an interest in critical care medicine; non-anesthesiologist-physicians and scientists who are active in teaching or research relating to critical care medicine; residents and fellows in approved anesthesiology programs; and full-time medical students in an accredited school of medicine.

Membership Benefits

Discounted pricing for the SOCCA Annual Meeting, a forum for the specialist with broad-based interests, including respiratory therapy, postoperative cardiac surgical, neurological and transplant management, and trauma care

Discounted membership in the IARS, which includes access to two peer-reviewed journals – *Anesthesia & Analgesia* and *A&A Case Reports*, free journal CME, and eligibility to apply for IARS research grants

Free ICU Residents' Guide

Free quarterly newsletter *Interchange*, which covers ethically controversial issues, survey of practice patterns, and historical aspects of anesthesiology

Renew or join today at www.SOCCA.org/membership.php

Editorial Notes

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Fellowship Program Reviews

If you would like to contribute a review for a Fellowship Program at your institution in a future issue of the *SOCCA Interchange*, please contact: jbrandmd@gmail.com.

Editorial Policy

The opinions presented are those of the authors only, not of SOCCA. Drug dosages, accuracy and completeness of content are not guaranteed by SOCCA.

“A Brief Conversation with ... Jacob Gutsche”



Dr. Jacob Gutsche, MD, is an Assistant Professor of Anesthesiology and Critical Care at the Hospital of the University of Pennsylvania and is the System Director for Cardiovascular Critical Care and Postoperative Care for the University of Pennsylvania Health System. In addition, he is the co-medical director of the Penn Lung Rescue Program. His research interests and clinical expertise center around the implementation and management of ECMO in severe respiratory failure.

1. Can you briefly describe your recent research article for our readers?

In this article, we describe the results from our retrospective study of 17 patients with severe respiratory failure and hemodynamic instability who required vasopressor infusion. These patients, despite mild to moderate right or left ventricular dysfunction, received only veno-venous extracorporeal life support (VV ECLS) as systemic rescue mechanical support. After VV ECLS cannulation, we demonstrated a rapid and significant decrease in vasopressor requirements, as well as, an improvement in the acid-base balance (resolution of acidosis). In fact, we found that even though all of these patients had severe hemodynamic instability secondary to their respiratory failure, none of these patients ultimately required conversion to veno-arterial ECLS (VA ECLS) for circulatory support after VV ECLS was initiated.

2. That is really incredible ... so what were your article's most important conclusions?

Based on the results of our analysis, we believe that a multidisciplinary ECLS program for severe respiratory failure that targets VV ECLS cannulation prior to transport is safe and effective. The use of peripheral bi-caval VV ECLS in this setting can rapidly reverse the systemic effects of respiratory failure, including secondary

hemodynamic instability that may require vasopressor infusion to support blood pressure and cardiac output. Bi-Caval VV ECLS is able to significantly improve acidosis and vasopressor requirements within 6 hours of cannulation.

3. I'll admit that I'm struck by the elegant simplicity of your basic hypothesis (although I know it's really not simple to initiate VV ECLS). What drove you to look at this topic?

In January 2015, we set up a mobile ECLS program that would triage patients with severe respiratory failure from outside hospitals and coordinate the care necessary for ECLS cannulation and transport. Using this system, if the patient met appropriate inclusion and exclusion criteria, our mobile ECLS team would go to the patient at the referring hospital, initiate VV ECLS through bi-caval cannulation, continue stabilizing maneuvers with vasopressor and ventilator management, and then transport back to our hospital. This mobile team included an Anesthesiology Critical Care team leader, a perfusionist, and a RN with OR experience. We believed this team was able to provide excellent care to patients but we wondered in the simplest, most practical terms, should we be doing this...and could we do better? So, we looked at our own institutional data and were pleased to see that our outcomes were even better than we had hoped they were.

4. In many ways, you may have just described a very important new way to provide safe and effective stabilization for some of our most complex and unstable patients. How could members of SOCCA apply your methods to their practice?

In our hospital, Anesthesiology Critical Care members play an important role in this mobile ECLS team. Not only do anesthesiology critical care members triage the initial calls from the outside hospital, but they are also responsible for coordinating the transport of the patient and

supplies and for manipulating the ventilator as well as sedative and vasopressor infusions to optimize patient stability before, during, and after cannulation. In addition, our team members are also responsible for performing the initial bedside ECHO to determine the degree of right ventricular dysfunction as a determinant of whether a trial of VV ECLS is appropriate. Finally, in many circumstances, the anesthesiology critical care team members are also responsible for the bi-caval cannulation procedure, following established clinical guidelines. While many of these roles may not be appropriate for all SOCCA members in all hospitals, many different opportunities exist to be a part of your local or regional VV ECLS teams.

5. I want to express my appreciation for taking time to speak with me about this topic. As a final thought, what advice about research would you give to junior faculty and fellows?

My best advice about research for junior faculty and fellows is to just do something ... to just start somewhere. It is easy to get stuck sitting and pondering the very best way to do the very best research to answer life's biggest questions. However, it is far better to start somewhere small and work outward from that point. Collect data at your starting point. Review that data. Make a change and then repeat over and over. It really is just a matter of practice. Whether it be practice to write better grants or IRB proposals or to develop your abstract or publication. The key is to just start somewhere and to keep practicing.

This interview was conducted by:
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Respiratory Depression: Beyond the PACU, before the ICU



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Modern-day anesthesia is safe. Therefore, intraoperative mortality is rare. Unfortunately, the same cannot be said of postoperative mortality. Among a national sampling of inpatients who undergo surgery, 2% die within a month, with 50% of deaths occurring during the initial hospitalization.¹ If the 30 days after surgery were considered a disease, it would be the third leading cause of death in the United States.² Cardiorespiratory complications are by far the most common causes of 30-day postoperative mortality.

Respiratory depression in the post-surgical period is common. The Agency for Healthcare Research and Quality (AHRQ) rated postoperative respiratory failure as the fourth most common patient safety event in its 2015 report, and the second most common if obstetric indicators were excluded. What constitutes respiratory depression? As simple as this may sound, there is no consensus on a true definition. A brief scan of the literature reveals that a combination of naloxone use, hypoventilation, hypercarbia, and hypoxemia, but utilizing varying durations and thresholds, has been used to define respiratory depression. The incidence of respiratory depression, based on these definitions, is ambiguous as well. In terms of numbers, the reported incidence varies from 0.1% to 41% depending on the defining criteria.³

Where should we look for postoperative hypoxemia? The PACU and ICU are two destinations where patients frequently find themselves immediately after surgery. Though many clinicians feel that respiratory depression needs to be addressed most aggressively while in these care areas, I want to argue otherwise. The PACU and ICU are extensively monitored areas. Every vital sign is tracked continuously and every deviation from the norm results in a physician or nursing intervention. While residual anesthetic gases, muscle relaxants, and narcotics may be common offenders in the PACU, poor respiratory mechanics, baseline respiratory diseases, poor respiratory physiology, and secondary insults with ventilatory manifestations are big players for respiratory depression in the ICU. The bottom line is that we understand the reasons for respiratory impairment in these areas. Additionally, we know when it happens in real time. We can intervene, we can tackle specific causes, we can escalate care. It would stand to reason that patients rarely die of respiratory depression as an immediate and direct cause in the PACU and ICU.

The road out of the PACU leads to the regular nursing floor. Generally, this is a place of comfort for clinically stable patients. Recently, our work with the VISION trial helped us to quantify hypoxemia on the surgical wards using blinded continuous saturation monitoring. We monitored continuous postoperative oxygen saturation in non-cardiac surgical patients for up to 48 hours after surgery. This monitoring started once the patient left the PACU or the ICU and reached the regular nursing floor. Importantly, bedside care providers were blinded to this oximetry. The nurses continued their routine checks on vital signs every four hours per protocol. The results told a story in themselves. Postoperative hypoxemia was common, serious, and prolonged. For example, 20% of patients demonstrated an average of 10 minutes of saturation <90% per hour *over*

their entire hospitalization. And soberingly and rather shockingly, 90% of serious hypoxemic episodes (saturation <90% for ≥1 full hour) were completely missed by nurses conducting routine vital sign monitoring at four-hour intervals.⁴

Patients continue to decompensate on the regular nursing floor, resulting in emergency medical team activation and transfer to higher levels of care. If repeated hypoxemic insults occur during these unmonitored periods, are we misplacing the emphasis in the respiratory depression story? Knowing how common the problem is, the next obvious question is whether we can better predict it. The answer unfortunately is no, at least not yet. While post-operative hypoxemia is common, it remains difficult to anticipate. We looked at a highly vulnerable population, that with obstructive sleep apnea. Surprisingly, STOP-BANG scores (a validated measure of obstructive sleep apnea risk) were not associated with the amount of postoperative oxygen desaturation.⁵ Narcotics, which are often regarded as a common villain, take the blame for a lot of emergent floor to ICU transfers in the wee hours of the night. We examined the association of the type of narcotic (long- vs. short-acting) in patient controlled analgesia (PCA) systems and saw that the risk of hypoxemia was not reduced by using short-acting opioids.⁶ Using commonly available information, it is not possible to reliably predict which postoperative inpatients will desaturate, or the severity of their hypoxemia.

A recent closed claims analysis examined postoperative opioid induced respiratory depression.⁷ Sadly, at least 77% of patients who had respiratory events suffered death or severe brain damage. As we suggested previously, only 9% had abnormal STOP-BANG scores. Importantly, 97% of these events were deemed preventable with *better monitoring and response.* Last but certainly not least, 42% of these episodes occurred within 2 hours of the last nursing check.⁷ So if postoperative

Respiratory Depression: Beyond the PACU, before the ICU

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respiratory depression is alarmingly common and we cannot predict it, can we do a better job of monitoring it? The question is a combination of how, what and who to monitor. Manually recorded oxygen saturation data were, on average, 6.5% higher than those recorded via automated systems in a large tertiary care medical center patient cohort.⁸ While continuous pulse oximetry on the regular ward prevents ICU transfers and decreases rescue events, it is certainly not the be all and end all of respiratory monitoring.⁹ The ASA recommends continuous monitoring of patients with neuraxial blocks and extended monitoring of those with obstructive sleep apnea. In addition, the guidelines from the ASA stress monitoring a combination of oxygenation and ventilation.

The other important part to this puzzle is the heart, as respiratory events do not occur in isolation. Either tachycardia or hypoxemia may occur early on in a struggling patient, or the two may co-exist, and they often progress to hypotension, which is strongly associated with myocardial injury and death.^{10,11} As a corollary, it is well established that vital signs deteriorate 6–12 hours before cardiac and respiratory arrests occur¹²⁻¹⁴ — which is the basis for having hospital rapid-response teams which undoubtedly save lives.¹⁵

What is the solution to postoperative respiratory depression? A problem that causes a large number of surgical patients to be transferred from the floor to the ICU—sometimes once, sometimes repeatedly. A problem that for now lies somewhere in the corridor between the PACU and the ICU and knows no solution. The PRediction of Opioid-induced Respiratory Depression In Patients Monitored by capnoGraphY (PRODIGY) trial [ClinicalTrials.gov](https://clinicaltrials.gov/ct2/show/study/NCT02811302) Identifier: NCT02811302 may help answer some of those questions. For now, though, continuous automated cardiorespiratory monitoring appears to be the only real answer. A combination of oxygenation, ventilation and some minimum hemodynamic parameters

should be monitored on everyone across the board. There are many more dimensions here to be explored. For instance, optimal handling of monitors and prevention of alarm fatigue are certainly important educational pieces for our colleagues on the regular nursing floors. As anesthesiologists and intensivists, we know respiratory depression too well. We also know that we cannot park everyone in the PACU or transfer everyone to the ICU. Beyond the confines of the PACU and before the doors of the ICU is the ‘grey area’ — an area that deserves better monitoring to prevent post-operative respiratory depression.

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SOCCA Has Created A New Jobs Bank!

We recognize that one of our members’ concerns is identifying job opportunities for critical care anesthesiologists.

You can visit our new site here: <https://goo.gl/1KS9mV>. If you would like to post a job on this site, please email a description and /or flyer to SOCCA President Avery Tung at atung@dacc.uchicago.edu.

**Register
Onsite
Beginning
May 4!**

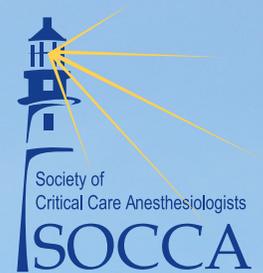
SOCCA 30th Annual Meeting and Critical Care Update

**Grand Hyatt Washington
Friday, May 5, 2017**

Explore current practices and discuss cutting edge topics in research and education with the leading educators and researchers in critical care anesthesia.

Stay an extra day and take advantage of the IARS Aligned Meeting and SOCCA Focus on Critical Care Day on Saturday, May 6, available complimentary to all SOCCA registrants.

Visit www.socca.org for Program Details and to register today!



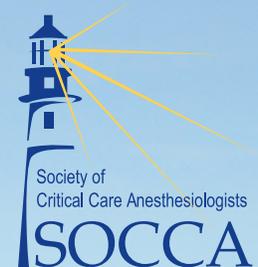
Program Schedule*

Friday, May 5, 2017

Session Highlights include:

- **Education Session 1: *Sepsis 3 - Love It or Hate It, What Changes?***
Moderator: Dr. Mark Nunnally
Presenters: Drs. Vidula Vachharajani, Shatish Bhagwanjee, Ramanan Laxminarayan and David Shimabukuro
- **SOCCA Lifetime Achievement Award Presentation:**
Critical Care 2017: 30 Years in 30 Minutes
Presenter: Dr. Todd Dorman
- **Education Session 2: *Acute Lung Injury - Scientific Advances and the Road to Recovery***
Moderator: Dr. Andrew C. Steel
Presenters: Drs. Aleksandra Leligdowicz, Jacob Gutsche and Margaret Herridge
- **Address from the American Society of Anesthesiologists**
Presenter: Dr. Jeffrey Plagenhoef
- **Education Session 3: *Training the Next Generation - An Update for Critical Care Education***
Moderator: Dr. Sheela Pai Cole
Presenters: Drs. Andrew C. Steel, Ashish Khanna and Erin Hennessey
- **SOCCA Young Investigator Award Presentation**
Moderator: Dr. Daryl J. Kor
Presenters: Drs. Abdullah Rasheed, Kelly K. Everhart, and William M. White
- **Moderated Poster Discussion Session**
- **Education Session 4: *Trauma and Mass Casualty - The Intensive Care Response***
Moderator: Dr. Maureen McCunn
Presenters: Drs. Samuel M. Galvagno, Jr., Sasha Grek and Kevin B. Gerold

* Preliminary schedule is as of press time and subject to change.



Survival is Just the Beginning: The Post-intensive Care Syndrome



Marilyn Michelow, MD and Kevin Thornton, MD
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A considerable body of evidence published over the past decade has deepened our understanding of the immense challenges faced by survivors of critical illness as they leave the hospital and begin the recovery process. It is essential to our mission as intensivists to understand the long-term physical, cognitive, and emotional sequelae of critical illness, as well as to incorporate into our practice evidence-based interventions that can not only reduce mortality, but also improve quality of life for our surviving patients and their families.

Taken together, the evidence suggests that at least half of patients who survive critical illness and leave the ICU will experience new, long lasting (6 months to a year or greater) health related quality of life impairments in multiple domains including physical function, cognitive ability, and emotional wellness.^{1,2} A framework to capture these multidimensional morbidities, developed at a stakeholder conference of the Society of Critical Care Medicine in 2010, was termed the “post-intensive care syndrome”, or PICS.³

This article is intended to briefly summarize the evidence surrounding PICS and highlight possible interventions to reduce morbidity in some domains. For the interested clinician, several reviews of the post-intensive care syndrome have recently been published, including an excellent article by Herridge *et al.*

in Intensive Care Medicine in 2016,¹ which can serve as a more detailed resource.

The post-intensive care syndrome can be divided into physical challenges, pain, cognitive impairments, and psychological challenges. These cumulatively impact health related quality of life in dimensions such as the ability to complete activities of daily living, ongoing needs for caregiver assistance, and the ability to return to employment following a life-threatening illness. For an overview, one recent meta-analysis by Yende *et al.* of nearly 2000 patients who lived independently prior to an episode of sepsis found that at six months, approximately of the cohort had died, and of the survivors had not yet returned to independent living. Of survivors at six months, nearly 40% had problems with completing usual daily activities, and in these survivors, half had died or had persistent difficulties with mobility at one year.²

Physical challenges faced by those who survive critical illness include persistent weakness and pulmonary deconditioning. Muscle mass decreases by approximately 2% per day with acute disease in the ICU.⁴ ICU-acquired weakness, encompassing critical illness myopathy and polyneuropathy, is a bilateral and symmetric weakness following critical illness, not related to another specific etiology.⁵ The estimated incidence from one review of ICU-acquired weakness was 25-30% in medical ICUs and 55-75% in surgical ICUs.⁵ Persistent weakness even at 5 years after hospitalization has been described.⁶ A recent quantitative study of weakness in 56 survivors of critical illness by Solverson *et al.* found that at 6 months, over 50% of their cohort did not achieve 80% of their age- and gender-expected muscle strength, as measured by hand-held dynamometry.⁷ Another recent study measuring exercise capacity, muscle strength, and self-reported physical functioning in 193 survivors of acute respiratory distress syndrome found physical

declines in 86% of their cohort at six months.⁸

Chronic pain is closely related to ongoing muscle weakness and difficulty with physical mobility. A recent review of chronic pain after critical illness suggested that there is a 12-44% prevalence of ongoing pain 6 months after hospital discharge.⁹ Much of this pain was of moderate to severe intensity. It is unclear at this time how much of this pain is related to chronic injury, and what role opiate use, withdrawal, and sensitization may be playing.

Cognitive function is significantly impacted by critical illness. Research has demonstrated that survivors of intensive care may suffer from memory impairment, difficulty concentrating, decreased attention, and impaired language function.^{1,6} For example, one prospective cohort study of 821 survivors of critical illness found that 40% of the cohort had global cognition scores 1.5 standard deviations below the population mean at six months. The study authors describe this degree of cognitive impairment as analogous to sustaining a moderate traumatic brain injury.¹⁰ These deficits largely persisted at 12 months after hospital discharge.

The post-intensive care syndrome also encompasses the significant anxiety, depression, post-traumatic stress disorder, and sleep disturbances that can shadow survival of a critical illness. Estimates of the prevalence of these psychological challenges vary. One recent review of the post-intensive care syndrome suggested a prevalence of 19-33% for post-traumatic stress disorder, 23-48% for anxiety symptoms, and 17-43% for depression following an intensive care stay.¹¹ By contrast, the relative prevalences of depression and post-traumatic stress disorder in the general population are <10% and <5%, respectively.⁶ It is increasingly recognized that the psychological effects of critical illness extend beyond the patient to affect family members as well. In one study of critically ill patients

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and their family members, both patients and their relatives demonstrated similar rates of post-traumatic stress disorder, and had poorer health related quality of life than a normative sample population.¹² Another recent study reported a nearly 70% rate of depression in caregivers of critically ill patients, with the rate of depression remaining 43% at one year.¹³

The summative consequences of the post-intensive care syndrome include an ongoing need for caregiver support for a prolonged period after hospitalization with an inability to compete basic activities of daily living, a decreased likelihood to return to work if previously employed, and an overall decrease in quality of life compared with the general population. Financial impacts of ongoing needs following critical care can be substantial for both patients and their families. A 2013 study of 293 patients who spent greater than 48 hours in an ICU found that 22% of the cohort was in need of assistance for basic care at one year.¹⁴ In the study there was also a 50% decrease in the number of patients who reported employment to be their principle source of income at one year.¹⁴ Others have noted that while mortality after one year may normalize with the general population, 6 patients who survive critical illness in general have a lower overall quality of life than age or gender matched controls at one year after ICU discharge.¹⁵

It should be noted that very little research has been devoted to the subset of ICU survivors who can be described as chronically critically ill, requiring prolonged mechanical ventilation and care in a long term facility. One small study of this population, by Lamas et al., found, unsurprisingly, even lower overall quality of life compared with the general population of ICU survivors. In their study of 50 chronically critically ill patients and their surrogates, nearly 70% of the group described the patient's current quality of life as poor, with persistent problems with hunger, thirst, difficulty communicating, boredom, and impaired mobility.¹⁶

There are considerable ongoing efforts to understand the factors related to hospitalization that may cause PICS, however there is little concrete evidence at this stage to guide the design of interventions that diminish the incidence or prevalence of PICS. Duration of mechanical ventilation and duration of bed rest have both been linked to chronic ICU acquired weakness.^{1,8} However, despite considerable study there has been no clear demonstrated link between the use of neuromuscular blocking agents in the ICU and prolonged weakness. The use of high dose steroids has also not conclusively been demonstrated to cause long term weakness.⁷ Hypoxia, prolonged hypotension, hyperglycemia, and blood glucose variability have been implicated in post-ICU cognitive impairment, though data is limited.¹ There is some suggestion that a conservative fluid management strategy may be associated with long-term cognitive impairment.¹⁷ Data are conflicting but largely do not show a link yet between sedation levels in the ICU or the incidence of delirium to the risk of developing PTSD, anxiety, or depression in the months following hospital discharge.^{1,18} There is some suggestion that post-traumatic stress disorder is related to high circulating levels of norepinephrine, and there is active study of the use of beta-blockers (possibly helpful) or statins (trials did not show benefit yet) for this purpose.¹ Research is ongoing to clarify the role that nutrition and glycemic control during critical illness may play in PICS.

One major initiative designed to mitigate some of the risk factors for the development of the PICS is the Society of Critical Care Medicine's ICU Liberation Campaign ABCDEF bundle. Through its focus on reducing delirium, improving pain management, and mitigating ICU acquired weakness, it is hoped that this bundle may also impact long term survivor quality of life in multidimensional ways. 1 The ABCDEF bundle stands for A- assess, prevent and manage pain, B- both spontaneous awakening

trials and spontaneous breathing trials, C- choice of analgesia and sedation, D- delirium assessment, prevention, and management, E- early mobility and exercise, and F- family engagement and empowerment. Those seeking more information on the ABCDEF bundle are directed to <https://goo.gl/YnDqhk>.

Others have suggested that closer attention to pain control and judicious use of opiates,⁹ early treatment of sepsis, and close attention to nutrition status may impact the development of PICS.⁷ ICU diaries, kept by patients or their relatives and caregivers, have also been evaluated as a method to reduce the incidence of post-traumatic stress disorder after critical illness. Although some small studies have shown that ICU diaries have a benefit both for patients and their family members, a recent Cochrane review of the use of ICU diaries to reduce post-traumatic stress disorder did not show clear harm or benefit for this intervention.¹⁹

After the episode of intensive care, several groups have evaluated the effect of post-discharge interventions such as psychotherapy, physical therapy, and physician visits targeted to review the episode of critical illness. A systematic review of post-ICU follow up consultations completed in 2015 did not show a benefit for these clinic visits in improving quality of life, diminishing anxiety or depression, improving physical or cognitive function, or in helping patients return to work. Post-ICU consultation did lead to a modest reduction in levels of post-traumatic stress disorder.¹¹ However, active research continues on post-ICU clinics, and at the least as a tool for detecting the symptoms of PICS and referring patients for appropriate treatment, clinics or standard post-operative screening tools may show value. There are some recent documents to guide teams developing physical rehabilitation programs after ICU discharge, despite the lack of benefit shown to date from post-ICU rehabilitation programs in a Cochrane

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Survival is Just the Beginning

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review of randomized controlled trials.^{20,21}

Moving forward, the development of interventions that can mitigate PICS will be essential. One major limitation in this field is the lack of studies that consider quality of life measures as major endpoints in trials evaluating potential therapies and interventions in the critically ill. Whether an intervention shows a mortality benefit or reduces ICU length of stay may or may not have any relation to the potential impact on the long-term symptoms of post-intensive care syndrome. Incorporating quality of life measures as core outcomes of future critical care studies could have an enormous impact in the field of ICU medicine. The long-term human and financial costs of post-intensive care syndrome are too great not to make these outcomes a major focus of our future studies.

For those seeking further resources on PICS, the Society for Critical Care Medicine offers grants and opportunities for collaboration through their THRIVE program, as well as patient resources including a video explaining PICS for patients and families <https://goo.gl/52IC17>. The OACIS (Outcomes After Critical Illness and Surgery) group, centered at Johns Hopkins, also provides a rich array of resources and information related to the study of the post-intensive care syndrome <https://goo.gl/uhAzct>.

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