COVID CORNER
Ongoing COVID-19 updates brought to you by The Office of CME&P and The Physician Learning Program

MODERATORS

Kelly Burak MD FRCPC MSc (Epid)
Any direct financial payments, gifts, in-kind compensation or honoraria
• Employee, University of Calgary

Selena Au MD FRCPC MSc
• Nothing to disclose
Territorial Acknowledgement

Housekeeping

• Multiple speakers will address various aspects of the topic
• There will be a Q&A after all the presentations
• Use the Q&A box to enter questions by text. No spoken questions.
• Refer to this How-to page for info on Questions, Chat etc.
  • https://olab.ca/using-zoom-for-large-groups/
• We get lots of Questions: scan the list and give a thumbs up if you are interested in a question already posed.
• Formal notices, copyright, declarations and disclaimers will be offered throughout the presentation and within the chatbox
Disclosure of Financial Support

- The program was developed and planned to achieve scientific integrity, objectivity and balance
- This program has received an educational grant from the College of Physicians and Surgeons of Alberta

Help us provide ongoing COVID-19 education, training and resources for healthcare professionals by donating here [http://c-fund.us/rkg](http://c-fund.us/rkg)
Presenter Disclosure

**Lynora Saxinger MD, FRCPC, CTropMed**
Associate Professor, Division of Infectious Diseases
Departments of Medicine and Medical Microbiology and Immunology,
University of Alberta

**Disclosure**
None to Disclose

**In the Corner with...**

Dr. Lynora Saxinger
Co-Chair
Scientific Advisory Group
Alberta Health Services

Risk of COVID-19 amongst HCWs

This material is for individual use only and not to be used for further dissemination.
Scientific Advisory Group COVID-19 Recommendations

novel coronavirus (COVID-19)

AHS’ Scientific Advisory Group is connecting with clinicians, operational leaders, researchers and other experts to review emerging evidence and guidance of national and international bodies to provide information for focused areas of healthcare in relation to COVID-19. These resources are created to provide research informed advice to AHS physicians, staff, patients and families. Reports are updated frequently based on emerging evidence or concerns.

COVID-19 Resources for AHS Staff & Health Professionals


Key Research Questions: 1) Among countries who are past their initial peak of COVID-19 cases, what proportion of total cases were in healthcare workers (HCW), and what is the estimated proportion of the total number of HCWs who developed COVID-19 from presumed occupational exposure?
2) Is there any evidence that household members of HCWs are at elevated risk of COVID-19 disease, and if so, are there guidelines for mitigating that risk?

May 4, 2020

www.albertahealthservices.ca

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86% of physicians felt they had a greater than 50% chance of acquiring COVID19 during the coming months*

* Informal social media poll

<table>
<thead>
<tr>
<th>Country/Region</th>
<th>Total HCW Cases</th>
<th>Total HCWs</th>
<th>General Population Cases</th>
<th>2018 General Population</th>
<th>HCW risk %</th>
<th>General population risk %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Italy</td>
<td>15,314</td>
<td>587,211</td>
<td>124,063</td>
<td>59,644,069</td>
<td>2.61%</td>
<td>0.21%</td>
</tr>
<tr>
<td>China (Hubei)</td>
<td>1,809</td>
<td>75,075</td>
<td>65,993</td>
<td>7,480,925</td>
<td>2.41%</td>
<td>0.88%</td>
</tr>
<tr>
<td>Spain</td>
<td>15,433</td>
<td>448,841</td>
<td>94,805</td>
<td>46,275,109</td>
<td>3.44%</td>
<td>0.21%</td>
</tr>
<tr>
<td>Overall high-risk</td>
<td>25,600</td>
<td>1,110,927</td>
<td>284,861</td>
<td>113,600,103</td>
<td>2.93%</td>
<td>0.25%</td>
</tr>
<tr>
<td>China (non-Hubei)</td>
<td>246</td>
<td>6,389,978</td>
<td>14,463</td>
<td>1,378,784,022</td>
<td>0.004%</td>
<td>0.001%</td>
</tr>
<tr>
<td>Philippines</td>
<td>501</td>
<td>590,318</td>
<td>2,517</td>
<td>106,061,602</td>
<td>0.085%</td>
<td>0.003%</td>
</tr>
<tr>
<td>Indonesia</td>
<td>23</td>
<td>760,699</td>
<td>1,983</td>
<td>266,902,731</td>
<td>0.003%</td>
<td>0.0007%</td>
</tr>
<tr>
<td>Overall low-risk</td>
<td>770</td>
<td>7,740,996</td>
<td>18,943</td>
<td>1,751,748,354</td>
<td>0.010%</td>
<td>0.001%</td>
</tr>
<tr>
<td>Alberta</td>
<td>137</td>
<td>103,467</td>
<td>4,307</td>
<td>4,287,068</td>
<td>0.13%</td>
<td>0.10%</td>
</tr>
</tbody>
</table>

Source of infection (work, household, community) not reported
Difficult to determine HCW denominators – hard to determine risk for specific HCW types
May 4, 2020

** 2 cases under investigation. 20 cases linked to single community outbreak

### Key Messages from the Evidence Summary

- Alberta WHS dashboard indicates a current absolute occupational risk of COVID-19 in HCW to be 0.01%, with an overall HCW risk of 0.14% (vs 0.1% risk in the community)
  - May be explained in part by higher rates of testing in the HCW population (15% HCW tested versus 2.9% of the general population tested), and differences in travel patterns amongst HCWs prior to travel restrictions

- There are still no available data on the transmission of COVID-19 from infected HCWs to household members outside case reports
  - Recent publication suggested a household attack rate of 4.7%, supporting prompt household self isolation with any symptoms to further reduce risk (Cheng et al., 2020)
For more information visit

COVID CORNER Webinar:
The Critically Ill COVID-19 ICU Patient

Presenters:
Sean Bagshaw MD MSc
Chris Grant MD FRCPC
Daniel Niven BSc MD MSc, PhD FRCPC
Ken Parhar MD FRCPC
Wendy Sligl BSc MD MSc FRCPC
Sean Spence MD FRCPC

Panellists:
Amanda Roze des Ordons MD FRCPC
Brian Yipp MD FRCPC

Epidemiology & Clinical Features of the Critically Ill Patient with COVID-19

Daniel Niven BSc MD MSc, PhD FRCPC
Assistant Professor, Department of Critical Care Medicine, University of Calgary;
Community Health Sciences O’Brien Institute for Public Health, University of Calgary

Disclosure

- Grants of Clinical Trials: MSI foundation, CIHR, Alberta Innovates, Choosing Wisely Alberta. In addition, I am a local PI for the following clinical trials: STARRT-AKI, PROSPECT, REVISE
No ICUs in 1918...

17M– 50M deaths worldwide

Between 1 and 10% of COVID-19 Cases Admitted to ICUs Worldwide
Potential **350,000** patients with COVID-19 admitted to ICUs worldwide since December 2019!

https://coronavirus.jhu.edu/map.html

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COVID-19 Patients in a Wuhan ICU

Physical Distancing Has Insulated Alberta ICUs from Predicted COVID-19 Surge...

May 3, 2020
231 Total Hospital Admissions (4%)
51 Total ICU Admissions (0.9%)

Progression from Mild to Severe/Critical COVID-19

- **Severe**- Dyspnea, RR >=30, PaO2/FiO2 < 300 mmHg, increase in lung infiltrates > 50% within 24-48h
- **Critical**- Respiratory failure (ARDS), shock, multiple organ dysfunction syndrome

Symptom onset
Day 0
Pneumonia
Day 5-7
Severe/Critical
Day 7-12

Office of Continuing Medical Education
and Professional Development. COVID
Corner: The Critically Ill COVID19 ICU
Patient

ICNARC report on COVID-19 in critical care
01 May 2020

- One of (if not the...) **best source of data on critically ill COVID-19 patients** to date

- **7,542 patients with COVID-19 from 254 adult ICUs** in England, Wales, and Northern Ireland

- **5,139 patients with outcome data** reported

https://www.icnarc.org/Our-Audit/Audits/Cmp/Reports

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**COVID-19 Compared to Non-COVID Viral Pneumonia**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Patients with COVID-19</th>
<th>Non-COVID Viral PNA 2017-19</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median Age (IQR)</td>
<td>60 (52 – 68) years</td>
<td>61 (48 – 71) years</td>
</tr>
<tr>
<td>Male Sex</td>
<td>72%</td>
<td>54%</td>
</tr>
<tr>
<td>Non-caucasian ethnicity</td>
<td>41%</td>
<td>14%</td>
</tr>
<tr>
<td>Very severe comorbidity</td>
<td>8%</td>
<td>24%</td>
</tr>
<tr>
<td>PaO2/FiO2 ratio &lt; 200 mmHg</td>
<td>88%</td>
<td>77%</td>
</tr>
<tr>
<td>Median APACHE II (IQR)</td>
<td>14 (11 – 18)</td>
<td>17 (13 – 21)</td>
</tr>
<tr>
<td>Mechanical ventilation in 1st 24h</td>
<td>66%</td>
<td>43%</td>
</tr>
<tr>
<td>Death in ICU</td>
<td>49%</td>
<td>22%</td>
</tr>
<tr>
<td>Median ICU LOS in Survivors (IQR)</td>
<td>6 (3 – 13) days</td>
<td>6 (3 – 12) days</td>
</tr>
<tr>
<td>Median duration advanced resp support</td>
<td>9 (5 – 15) days</td>
<td>9 (4 – 17) days</td>
</tr>
</tbody>
</table>

https://www.icnarc.org/Our-Audit/Audits/Cmp/Reports
Survival Dependent on Degree of Organ Support Required

![Graph showing survival rates for patients with COVID-19 depending on the degree of organ support required.](https://www.icnarc.org/Our-Audit/Audits/Cmp/Reports)

Other Factors Associated with Death: COVID-19 Compared to Non-COVID Viral Pneumonia

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Patients with COVID-19 Who Died in Critical Care</th>
<th>Non-COVID Viral PNA 2017-19 Who Died in Critical Care</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age &gt;= 70 years</td>
<td>67%</td>
<td>32%</td>
</tr>
<tr>
<td>Male sex</td>
<td>51%</td>
<td>24%</td>
</tr>
<tr>
<td>Any very severe comorbidities</td>
<td>57%</td>
<td>34%</td>
</tr>
<tr>
<td>Advanced resp support only</td>
<td>47%</td>
<td>19%</td>
</tr>
<tr>
<td>Advanced resp and cardiovascular support</td>
<td>71%</td>
<td>41%</td>
</tr>
<tr>
<td>Advanced resp, cardiovascular and renal support</td>
<td>83%</td>
<td>58%</td>
</tr>
</tbody>
</table>

https://www.icnarc.org/Our-Audit/Audits/Cmp/Reports
COVID-19 Thrombotic Phenotype – Link To MODS?

**Correspondence**

**COVID-19 Cases**
Coagulopathy and Antiphospholipid Antibodies in Patients with Covid-19

**Correspondence**
ST-Segment Elevation in Patients with Covid-19 — A Case Series

Photo by Brad Barket/Invision/AP, File

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**Original**

High risk of thrombosis in patients with severe SARS-CoV-2 infection: a multicenter prospective cohort study

- **Propensity-matched cohort study from 4 ICUs** in France

- Compared to 145 non-COVID ARDS pt, 77 COVID ARDS pt:
  - **Increased pulmonary emboli: 11.7% vs 2.1% (p = 0.01)**
  - Increased extracorporeal circuit clotting (CRRT Filters)

- **Mechanism increased thrombogenicity not clear**

Helms et al. Intensive Care Medicine 2020
Key Messages from the Evidence Summary

- Several guidelines provide consensus based indications for intubation
  - No empirically-derived evidence to guide best practice in COVID-19 patients

- Published mortality rates for intubated patients is 40-70%
  - Older patients and those with co-morbidity have higher mortality risk, particularly after intubation
    - CV disease, chronic respiratory disease, hypertension, diabetes
  - Recommend clinicians consider early goals of care discussions

Diagnosis and Therapy

Wendy Sligl BSc MD MSc FRCPC
Professor, Critical Care Medicine and Infectious Diseases, Adjunct appointment, School of Public Health, University of Alberta

Disclosure
None to Disclose

SARS-CoV2

Nature Reviews Microbiology  ISSN 1740-1534 (online)
Detection of SARS-CoV-2 in Different Types of Clinical Specimens

Table. Detection Results of Clinical Specimens by Real-Time Reverse Transcriptase-Polymerase Chain Reaction

<table>
<thead>
<tr>
<th>Specimens and values</th>
<th>Bronchoalveolar lavage fluid (n = 15)</th>
<th>Fibrobronchoscope brush biopsy (n = 13)</th>
<th>Sputum (n = 104)</th>
<th>Nasal swabs (n = 8)</th>
<th>Pharyngeal swabs (n = 398)</th>
<th>Feces (n = 153)</th>
<th>Blood (n = 307)</th>
<th>Urine (n = 72)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive test result, No. (%)</td>
<td>14 (93)</td>
<td>6 (46)</td>
<td>75 (72)</td>
<td>5 (63)</td>
<td>126 (32)</td>
<td>44 (29)</td>
<td>3 (1)</td>
<td>0</td>
</tr>
<tr>
<td>Cycle threshold, mean (SD)</td>
<td>31.1 (3.0)</td>
<td>33.8 (3.9)</td>
<td>31.1 (5.2)</td>
<td>24.3 (8.6)</td>
<td>32.1 (4.2)</td>
<td>31.4 (5.1)</td>
<td>34.6 (0.7)</td>
<td>ND</td>
</tr>
<tr>
<td>Range</td>
<td>26.4-36.2</td>
<td>26.9-36.8</td>
<td>18.4-38.8</td>
<td>16.9-38.4</td>
<td>20.8-38.6</td>
<td>22.3-38.4</td>
<td>34.1-35.4</td>
<td></td>
</tr>
<tr>
<td>95% CI</td>
<td>28.9-33.2</td>
<td>29.8-37.9</td>
<td>29.3-33.0</td>
<td>13.7-35.0</td>
<td>31.2-33.1</td>
<td>29.4-33.5</td>
<td>0.0-36.4</td>
<td></td>
</tr>
</tbody>
</table>

Abbreviation: ND, no data.

Virological assessment of hospitalized patients with COVID-2019

Received: 1 March 2020
Accepted: 24 March 2020
Accelerated Article Preview
Published online 1 April 2020

To view graph please go to:
https://www.nature.com/articles/s41586-020-2196-x
They will be available when published
**Diagnostics Take-Home Points**

- PCR diagnostic test of choice for active infection
- Sensitivity varies by site and quality of sample collection
  - False negatives can occur – most often due to poor sample acquisition, early or late in disease, in those with pneumonia
- PCR positivity does not necessarily correlate with viable/infectious virus and persists well beyond symptoms and antibody response
  - Infection control implications
- Serologic testing in development

**Therapeutics**

- Number of drugs with in vitro antiviral activity against SARS-CoV2
- Antivirals
  - Lopinavir/ritonavir, hydroxychloroquine, remdesivir
- Immune modulators
  - IL-6 inhibitors, IL-1 inhibitors, steroids, interferons
Hydroxychloroquine in patients with COVID-19: an open-label, randomized, controlled trial

Wei Tang, Zhujun Cao, Mingfeng Han, Zhengyan Wang, Junwen Chen, Wenjin Sun, Yaojie Wu, Wei Xiao, Shengyong Liu, Erzhen Chen, Wei Chen, Xiongbiao Wang, Juyong Yang, Jun Lin, Qingxia Zhao, Youqin Yan, Zhibin Xie, Dan Li, Youfeng Yang, Leshan Liu, Jieming Qu, Guang Ning, Guochao Shi, Qing Xie

doi: https://doi.org/10.1101/2020.04.10.20060558

This article is a preprint and has not been peer-reviewed

https://www.medrxiv.org/content/10.1101/2020.04.10.20060558v1.full.pdf+html

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The critically ill COVID19 ICU Patient

**Table:**

<table>
<thead>
<tr>
<th>Subgroup analysis</th>
<th>SOC+HCQ</th>
<th>SOC</th>
<th>Hazard Ratio (95%CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age ≥ 65 years</td>
<td>26/40</td>
<td>25/52</td>
<td>0.799 (0.480, 1.329)</td>
</tr>
<tr>
<td>Age &lt;65 years</td>
<td>27/35</td>
<td>31/43</td>
<td>0.869 (0.538, 1.390)</td>
</tr>
<tr>
<td>BMI ≥ 24 kg/m²</td>
<td>24/32</td>
<td>25/31</td>
<td>0.791 (0.431, 1.447)</td>
</tr>
<tr>
<td>BMI &lt;24 kg/m²</td>
<td>29/42</td>
<td>29/40</td>
<td>0.791 (0.470, 1.334)</td>
</tr>
<tr>
<td>With existing conditions</td>
<td>18/28</td>
<td>13/17</td>
<td>0.727 (0.354, 1.493)</td>
</tr>
<tr>
<td>Without existing conditions</td>
<td>35/47</td>
<td>43/58</td>
<td>0.917 (0.594, 1.439)</td>
</tr>
<tr>
<td>Days between disease onset and randomization ≤ 7</td>
<td>10/14</td>
<td>14/19</td>
<td>0.656 (0.282, 1.530)</td>
</tr>
<tr>
<td>Days between disease onset and randomization &gt;7</td>
<td>42/59</td>
<td>41/55</td>
<td>0.923 (0.598, 1.422)</td>
</tr>
<tr>
<td>Baseline CRP higher than upper limit of normal</td>
<td>19/28</td>
<td>15/20</td>
<td>0.931 (0.471, 1.840)</td>
</tr>
<tr>
<td>Baseline CRP lower than upper limit of normal</td>
<td>28/38</td>
<td>37/49</td>
<td>0.832 (0.550, 1.291)</td>
</tr>
<tr>
<td>Baseline lymphocyte count lower than lower limit of normal</td>
<td>17/22</td>
<td>14/16</td>
<td>0.875 (0.431, 1.779)</td>
</tr>
<tr>
<td>Baseline lymphocyte count higher than lower limit of normal</td>
<td>35/53</td>
<td>42/59</td>
<td>0.813 (0.518, 1.276)</td>
</tr>
<tr>
<td>Using potential anti-SARS-CoV2 drugs after randomization</td>
<td>40/58</td>
<td>40/56</td>
<td>0.775 (0.499, 1.205)</td>
</tr>
<tr>
<td>Without using potential anti-SARS-CoV2 drugs after randomization</td>
<td>13/17</td>
<td>16/19</td>
<td>1.281 (0.613, 2.680)</td>
</tr>
</tbody>
</table>

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**Figure 1:** Cumulative improvement rate (%)

- **SOC plus HCQ:** 64 patients, 56 events (50.0%)
- **SOC:** 55 patients, 44 events (43.6%)
- Median improvement days (95%CI): 19.0 (14.0, 22.0) vs. 21.0 (14.0, NE)
- P value by log-rank: 0.0650
- Hazard Ratio (95%CI): 1.012 (0.587, 1.744)

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https://www.medrxiv.org/content/10.1101/2020.04.10.20060558v1.full.pdf+html

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https://www.medrxiv.org/content/10.1101/2020.04.10.20060558v1.full.pdf+html

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Office of Continuing Medical Education and Professional Development. COVID Corner: The Critically Ill COVID19 ICU Patient

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Remdesivir in adults with severe COVID-19: a randomised, double-blind, placebo-controlled, multicentre trial

Figure 2: Time to clinical improvement in the intention-to-treat population

Figure 3: Viral load by quantitative PCR on the upper respiratory tract specimens (A) and lower respiratory tract specimens (B)

The Lancet, April 29, 2020

NIH clinical trial shows Remdesivir accelerates recovery from advanced COVID-19

Preliminary results indicate that patients who received remdesivir had a 31% faster time to recovery than those who received placebo (p<0.001).

Specifically, the median time to recovery was 11 days for patients treated with remdesivir compared with 15 days for those who received placebo. Results also suggested a survival benefit, with a mortality rate of 8.0% for the group receiving remdesivir versus 11.6% for the placebo group (p=0.059).

NIH clinical trial shows Remdesivir accelerates recovery from advanced COVID-19
Office of Continuing Medical Education and Professional Development. COVID Corner: The Critically Ill COVID19 ICU Patient

May 01, 2020

Gilead’s Investigational Antiviral Remdesivir Receives U.S. Food and Drug Administration Emergency Use Authorization for the Treatment of COVID-19

— Authorization Enables Broader Use of Remdesivir to Treat Hospitalized Patients with Severe COVID-19 Disease in the United States —

JAMA | Preliminary Communication

Treatment of 5 Critically Ill Patients With COVID-19 With Convalescent Plasma

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Effective treatment of severe COVID-19 patients with tocilizumab

Xiaoling Xu,1,2, Mingfeng Han1, Tiantian Li,2, Wei Sun2, Dongsheng Wang1, Bingting Fu1, Yonggang Zhou2, Xiaohui Zhang3, Aijun Pan4, and Haoming Wei1,2

Drugs & Diseases > Infectious Diseases > Coronavirus Disease 2019 (COVID-19) Q&A

What is the role of the IL-6 inhibitor sarilumab (Kevzara) in the treatment of coronavirus disease 2019 (COVID-19)?

Updated: May 02, 2020 | Author: David J Cunninmo, MD, FAAP, FACP, AAHKS; Chief Editor: Michael Stuart Bronze, MD more...

Interferon: Potential COVID-19 Treatment

Doctors Try Steroids to Treat Coronavirus Patients, Against WHO Counsel

Treatment gets results for serious cases in China and Japan, but use of the drugs is discouraged
Therapeutics Take-Home Points

- No known effective COVID therapies at this time
- Therapeutic studies to date have been limited by:
  - Small patient populations
  - Lack of comparison group in some studies
  - Limited outcome and safety data
  - Lack of correlation between reduction in viral load and clinical outcomes
- Clinical trials ongoing

Nonpharmacological Management

Ken Parhar MD FRCPC
Intensivist; Clinical Assistant Professor, Department of Critical Care Medicine, University of Calgary

Disclosure
Membership on advisory boards or speakers’ bureau: Elsius Biomedical
Grants or clinical trials: PI/CoPI on TheraPPP Trial, SMART-BP Trial, COVI-PRONE trial, CORONA trial, SubI on CATCO

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Learning Objectives

• To review ARDS
• To review non-pharmacological management strategies for COVID19 ARDS including:
  • Lung protective ventilation
  • Prone Positioning
  • Extracorporeal Life Support
  • (Neuromuscular Blockade)

What is ARDS?

What is ARDS?

- ARDS is a Syndrome (not an etiology)

- Characterized by
  - hypoxemic respiratory failure
  - reduced lung compliance
  - bilateral pulmonary infiltrates

Risk Factors for ARDS

<table>
<thead>
<tr>
<th>Table 2. Risk Factors for ARDS.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct lung-injury risk factors</td>
</tr>
<tr>
<td>Pneumonia (bacterial, viral, fungal, or opportunistic)²</td>
</tr>
<tr>
<td>Aspiration of gastric contents²</td>
</tr>
<tr>
<td>Pulmonary contusion</td>
</tr>
<tr>
<td>Inhalation injury</td>
</tr>
<tr>
<td>Near drowning</td>
</tr>
<tr>
<td>Indirect lung-injury risk factors</td>
</tr>
<tr>
<td>Sepsis (nonpulmonary source)²</td>
</tr>
<tr>
<td>Nonthoracic trauma or hemorrhagic shock</td>
</tr>
<tr>
<td>Pancreatitis</td>
</tr>
<tr>
<td>Major burn injury</td>
</tr>
<tr>
<td>Drug overdose</td>
</tr>
<tr>
<td>Transfusion of blood products</td>
</tr>
<tr>
<td>Cardiopulmonary bypass</td>
</tr>
<tr>
<td>Reperfusion edema after lung transplantation or embolectomy</td>
</tr>
</tbody>
</table>

*N Engl J Med 2017; 377:562-572*
**Berlin Definition - 2012**

<table>
<thead>
<tr>
<th>Timing</th>
<th>Within 1 week of a known clinical insult or new/worsening respiratory symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chest Imaging a</td>
<td>Bilateral opacities – not fully explained by effusions, lobar/lung collapse, or nodules</td>
</tr>
<tr>
<td>Origin of Edema</td>
<td>Respiratory failure not fully explained by cardiac failure or fluid overload; Need objective assessment (e.g., echocardiography) to exclude hydrostatic edema if no risk factor present</td>
</tr>
<tr>
<td>Oxygenation b</td>
<td></td>
</tr>
<tr>
<td>Mild</td>
<td>200&lt;P_{a}O_{2}/F_{I}O_{2}≤300 with PEEP or CPAP ≥5 cmH_{2}O</td>
</tr>
<tr>
<td>Moderate</td>
<td>100&lt;P_{a}O_{2}/F_{I}O_{2}≤200 with PEEP ≥5 cmH_{2}O</td>
</tr>
<tr>
<td>Severe</td>
<td>Pa_{a}O_{2}/F_{I}O_{2}&lt;100 with PEEP ≥5 cmH_{2}O</td>
</tr>
</tbody>
</table>

*JAMA. 2012;307(23):2526-2533*

---

**The Baby Lung**

Reduced compliance because ARDS lungs are small not stiff

**Ventilator Induced Lung Injury**

- **Atelectrauma**
- **Volutrauma**
- **Barotrauma**

**Biotrauma**

VILI through Biotrauma leads to multi-organ dysfunction syndrome to death.

**Other types of VILI**

- **SILI**

  - Diaphragmatic myotrauma: a mediator of prolonged ventilation and poor patient outcomes in acute respiratory failure.


- **Myotrauma**
Pathophysiology

Landmark Trials for Treatment of ARDS

- Low tidal volume ventilation (ARMA)
- PEEP (LOVS/EXPRESS/ALVEOLI)
- Neuromuscular blockade (ACCURASYS/ROSE)
- Prone Positioning (PROSEVA)
- Oscillator (OSCAR/OSCILLATE)
- Extracorporeal Life Support (CESAR/EOLIA Bayesian)
- Conservative Fluid Strategy (FACTT)
- Esophageal Balloon (EP-VENT1/EP-VENT2)
- ESICM Steroid Recommendations
- Open Lung Ventilation (ART trial)
Low Tidal Volume Ventilation – ARMA study

Patient Population: ALI or ARDS (PF < 300)

Driving Pressure

Patient Population: ALI or ARDS (PF < 300)

This material is for individual use only and not to be used for further dissemination.
Why does positioning matter?

Supine Position (Unprone)
- Dorsal - Ventral Distribution of Pleural Pressure
- Dorsal is higher due to gravity, ventral lungs, chest wall, heart, abdomen
- VQ mismatch due to poor ventilation in perfusion rich areas

Prone Position
- Improves regional atelectasis
- Reduces regional hyperinflation
- Improved VQ matching
- Right ventricular unloading

AHS – Prone Positioning Practice Guidelines

Clinics in Chest Medicine 2014, 35(4), 743-752
**PROSEVA trial**

Patient Population: Severe ARDS (PF < 150, FiO2 > 0.60 and PEEP ≥ 5 cm H20)

![PROSEVA trial graph](image)

*Figure 2. Kaplan-Meier Plot of the Probability of Survival from Randomization to Day 90.*

*Proseva trial, N Engl J Med 2013; 368:2159-2168*

---

**Veno-venous ECMO**

![Veno-venous ECMO diagram](image)

*Veno-venous ECMO, JACC 2014, 63(25), 2769-2778*
CESAR Trial

Efficacy and economic assessment of conventional ventilatory support versus extracorporeal membrane oxygenation for severe adult respiratory failure (CESAR): a multicentre randomised controlled trial

Patient Population:
severe reversible respiratory failure and a Murray score of 3 or higher, FiO2 =1 OR
hypercapnoea with a pH < 7.20 despite optimum conventional treatment

Murray Score:
PaO2/FiO2 ratio
PEEP
Lung compliance
Chest radiograph (no of quadrants involved)

The Lancet 2009, 374(9698), 1351-1363

EOLIA trial

Extracorporeal Membrane Oxygenation for Severe Acute Respiratory Distress Syndrome

AECC ARDS AND
PF <50 mm Hg for > 3 hours OR
PF <80 for > 6 hours OR
pH < 7.25 or PaCO2 ≥ 60 > 6 hours

Despite vent optimization
(RR>35, plat ≤32 cm H20, PEEP ≥ 10 cm H20, TV 6mL/kg)

EOLIA – Bayesian post hoc

JAMA | Special Communication | CARING FOR THE CRITICALLY ILL PATIENT
Extracorporeal Membrane Oxygenation for Severe Acute Respiratory Distress Syndrome and Posterior Probability of Mortality Benefit in a Post Hoc Bayesian Analysis of a Randomized Clinical Trial

Table 2. Probability of Treatment Effects Estimated by Bayesian Analysis According to Varying Prior Beliefs About Mortality Benefit From ECMO in Patients With Very Severe ARDS

Table 3. Probability That Early ECMO Reduces Mortality by a Proposed/Maximum Clinically Important Difference According to Varying Prior Beliefs About Mortality Benefit From ECMO in Patients With Very Severe ARDS

• Guidelines

• Summary of Evidence

This material is for individual use only and not to be used for further dissemination.
• Questions?

• Supplementary reading....

• Email: ken.parhar@ahs.ca or @kenparhar

Post ICU Care

Chris Grant MD FRCPC
Clinical Assistant Professor, Department of Critical Care Medicine, Department of Neurosciences, University of Calgary

Disclosure
None to Disclose
Office of Continuing Medical Education
and Professional Development. COVID
Corner: The Critically III COVID19 ICU
Patient

Support The Guardian

The Guardian

Coronavirus outbreak

Lingering and painful: the long and unclear road to coronavirus recovery

People tell of symptoms coming and going weeks after falling ill even in mild cases

Coronavirus–latest updates

See all our coronavirus coverage


Severe Acute Respiratory Syndrome and Coronavirus

David S.C. Hui, MD, UNSW, FRACP, FRCP, Paul K.S. Chan, MD, FRCP

"The functional disability seems out of proportion to the degree of lung function impairment"

KEYWORDS

• SARS • Clinical features • Pathogenesis • Treatment • Outcome

Severe acute respiratory syndrome (SARS) emerged unexpectedly in 2003 and posed an enormous threat to international health and economy.1-4 By the end of the epidemic in July 2003, 8098 probable cases were reported in 29 countries and regions with a mortality of 774 (9.6%).5 SARS re-emerged at small scales in late 2003 and early 2004 in South China after resumption of wild animal trading activities in markets.6,7


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One-Year Outcomes in Survivors of the Acute Respiratory Distress Syndrome

Margaret S. Herdige, M.D., M.P.H., Angela M. Cheung, M.D., Ph.D., Catherine M. Tansey, M.S.C., Andrea Master-Martin, B.Sc., Natalia Diaz-Granados, B.Sc., Fatema Al-Saidi, M.D., Andrew B. Cooper, M.D., Cameron B. Guest, M.D., C. David Master, M.D., Sangitaeta Mehta, M.D., Thomas E. Stewart, M.D., Asiai Barr, Ph.D., Deborah Cook, M.D., and Arthur S. Slutsky, M.D., for the Canadian Critical Care Trials Group

ABSTRACT

BACKGROUND
As more patients survive the acute respiratory distress syndrome, an understanding of the long-term outcomes of this condition is needed.

METHODS
We evaluated 109 survivors of the acute respiratory distress syndrome 3, 6, and 12 months after discharge from the intensive care unit. At each visit, patients were interviewed and underwent a physical examination, pulmonary-function testing, a six-minute walk test, and a quality-of-life evaluation.

RESULTS
Patients who survived the acute respiratory distress syndrome were young (median age, 45 years) and suffering from severe illness (median Acute Physiology, Age, and Chronic Health Evaluation score, 25) and had a long time in the intensive care unit (median, 25 days). Patients surviving the acute respiratory distress syndrome had major additional complications (eg, chronic respiratory failure, pulmonary hypertension, and interstitial lung disease) and had a poor quality of life.

From the Department of Medicine, University Health Network (M.J.A., A.M.C., C.M.T., A.H.M., J.A.S); the Interdepartmental Division of Critical Care Medicine (B.S.A, A.M.C., C.M.T., A.H.M., W.J.C.M., V.E.L., S.K.H.S., F.K.L.); the Department of Medicine, Sinai Health System (A.M.C., N.D.G., A.B.); the Department of Critical Care Medicine and Anesthesiology, Sunnybrook and Women's College Health Sciences Centre (A.R.C., C.E.G.); the Department of Anesthesiology and Critical Care Medicine (M.J.M.) and Medicine and Critical Care Medicine (A.S.S.), St. Michael's Hospital, the Department of Medicine (D.M., T.E.S) and Anesthesiology (A.S.S) University Health Network, Toronto, Canada.

NEJM. (2003) 348(8):683-93

### Table 1: Ability to Exercise and Return to Work and Health-Related Quality of Life among Patients with the Acute Respiratory Distress Syndrome during the First 12 Months after Discharge from the ICU.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>3 Months</th>
<th>6 Months</th>
<th>12 Months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance walked in 6 min</td>
<td>80%</td>
<td>78%</td>
<td>81%</td>
</tr>
<tr>
<td>No. evaluated</td>
<td>80%</td>
<td>78%</td>
<td>81%</td>
</tr>
<tr>
<td>Median — m</td>
<td>281</td>
<td>396</td>
<td>422</td>
</tr>
<tr>
<td>Interquartile range — m</td>
<td>33–454</td>
<td>244–500</td>
<td>277–330</td>
</tr>
<tr>
<td>Percentage of predicted value</td>
<td>49</td>
<td>64</td>
<td>66</td>
</tr>
<tr>
<td>Returned to work — no/total no. (%)</td>
<td>13/83 (16)</td>
<td>26/82 (32)</td>
<td>40/82 (49)</td>
</tr>
<tr>
<td>Returned to original work — no/total no. (%)</td>
<td>10/13 (77)</td>
<td>23/26 (88)</td>
<td>31/40 (78)</td>
</tr>
<tr>
<td>Physical functioning</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median (normal value)</td>
<td>35 (90)</td>
<td>55 (89)</td>
<td>60 (89)</td>
</tr>
<tr>
<td>Interguartile range</td>
<td>15–58</td>
<td>30–75</td>
<td>35–85</td>
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<tr>
<td>Physical role</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median (normal value)</td>
<td>0 (88)</td>
<td>0 (84)</td>
<td>25 (84)</td>
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<tr>
<td>Interguartile range</td>
<td>0–0</td>
<td>0–50</td>
<td>0–100</td>
</tr>
<tr>
<td>Pain</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Median (normal value)</td>
<td>42 (77)</td>
<td>52 (77)</td>
<td>62 (77)</td>
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<tr>
<td>Interguartile range</td>
<td>31–73</td>
<td>37–84</td>
<td>41–100</td>
</tr>
<tr>
<td>General health</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median (normal value)</td>
<td>52 (78)</td>
<td>56 (77)</td>
<td>52 (77)</td>
</tr>
<tr>
<td>Interguartile range</td>
<td>35–67</td>
<td>36–74</td>
<td>35–77</td>
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<tr>
<td>Vitality</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median (normal value)</td>
<td>45 (89)</td>
<td>55 (88)</td>
<td>55 (86)</td>
</tr>
<tr>
<td>Interguartile range</td>
<td>30–55</td>
<td>28–63</td>
<td>28–63</td>
</tr>
<tr>
<td>Social functioning</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median (normal value)</td>
<td>38 (88)</td>
<td>63 (88)</td>
<td>63 (88)</td>
</tr>
<tr>
<td>Interguartile range</td>
<td>10–100</td>
<td>96–100</td>
<td>10–100</td>
</tr>
</tbody>
</table>

NEJM. (2003) 348(8):683-93

ARDs survivors 1 year after ICU
- n = 109
- young (45 years)
- sick (APACHE II = 25)
- long ICU stays (25 days)
- long time on vent (21 days)

One year after ICU discharge ...

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One year after ICU discharge ...

- **Physical:** 6-minute walk = 2/3rd of predicted
- **Return to work:** 49%
One year after ICU discharge ...

- Physical: 6-minute walk = 2/3 of predicted
- Return to work: 49%
- Quality of life: not so great

<table>
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<tr>
<th>Outcome</th>
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</tr>
<tr>
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</table>

**Table 3. Ability to Exercise and Return to Work and Health-Related Quality of Life among Patients with the Acute Respiratory Distress Syndrome during the First 12 Months after Discharge from the ICU.**

**NEJM. (2003) 348(8):683-93**

**Impact of Patient and Family Involvement in Long-Term Outcomes**

Christopher J. Grant, MD, FRCP*;b,c,e; Lauren F. Doig; Joanne Everson, MN, NP;c,f; Nadine Foster, RN;g, Christopher James Doig, MD, MSc, FRCP*;c,g

**KEYWORDS**
- Critical care
- Critical illness recovery
- Critical care outcomes
- Post-intensive care syndrome (PICS)
- Post-intensive care syndrome, family (PIICS-F)

**KEY POINTS**
- Recovery from a critical illness includes addressing physical, cognitive, emotional, and functional effects that can persist for many months following discharge from an intensive care unit (ICU).
- Attending to patient and family care needs across the spectrum of care (in the ICU on the

**Critical illness affects families ... relationships, social, financial**

"I'm so tired I can't imagine having sex. I need help getting dressed. I need help with personal care. After dialysis I want to puke. After I eat, I want to puke. Sex is the last thing on my mind. I haven’t even asked my wife. Do you think she wants to have sex with the person whose bum she has to wipe?"

– patient

**CCNC. (2020) In press.**
What to expect

• A large percentage will not express concerns
  ... but, when you scratch the surface:
  • “I’m weak.”
  • “I’m fatigued.”
  • “I can’t sleep.”
  • “I can’t think.”
  • “I don’t remember what happened.”
  • “I’m stressed.”
  • “How do I go back to work?”
  • “Will I get sick again?”

• Commonly they don’t volunteer symptoms. You have to ask.

• A small percentage will be camped out in your waiting room.
• Typically :
  • Non-cardiopulmonary medical concerns
    • Shoulder pain
    • Digit ischemia
    • Neuropathy
    • Telogen effluvium
  • Mental health
    • Stress/anxiety > mood

• These people are looking for help.

Issues following critical illness

• Medical/Surgical
  (typically fairly straightforward)

• Recovery/Rehabilitation
  (sometimes challenging)
Medical issues post-critical illness

- Key information resources:
  - ICU transfer summary
  - Hospital discharge summary

- Important touch points:
  a) New diagnoses (education)
  b) Specialist follow-ups and procedures
  c) Medication Reconciliation (e.g. stress ulcer prophylaxis, anti-psychotics)
  d) Incidental findings (e.g. hernias, pulmonary nodules, renal cysts)
  e) Addictions (alcohol, smoking, substances)
  f) Goals of care

Rehabilitation issues post-critical illness

- Start with grandmother medicine:
  - “Eat well. Sleep well. Move your body. Do joyful, meaningful things.”

- Give permission

- Focus on function
  - Likely, physical reconditioning is the lowest hanging fruit.
  - Leave room for the patient to discuss feelings. Expect stress.
  - Ask about cognitive concerns. Validate if present, but probably try to fix the pain, mood, sleep, anxiety, social, and vocational issues first.
COVID-19 in Rural Alberta

Sean Spence MD FRCPC
Intensivist & Internist, Chinook Regional Hospital

Disclosure
None to Disclose
Geographic Context

• Population of Alberta:
  • 4,371,316 (AB Gov)

• Population of Italy:
  • 60,421,760 (Worldbank)

• Surface Area:
  • Alberta 2.2x larger

http://www.comparea.org/ITA+CA_AB/

Not Just an Urban Disease

Figure 10: Cumulative COVID-19 cases in Alberta by zone and date reported to Alberta Health

https://covid19stats.alberta.ca/
Not Just an Urban Disease (cont.)

Figure 11: Rate of COVID-19 cases per 100,000 population in Alberta and by zone

https://covid19stats.alberta.ca/

RAAPID
Referral, Access, Advice, Placement, Information & Destination
North: 1-800-282-9911 • 780-735-0811
South: 1-800-661-1700 • 403-944-4486
Before calling RAAPID

- Ensure patient stability permits phone call
- Ensure patient GOC congruent with proposed escalation in care
- Have patient demographics ready
- Have an accurate patient weight to provide transport team
- Generate a “capsule summary” of patient HPI, comorbidities, test results, and current interventions
- Determine the likely level of isolation precautions required during transport
Intubating Safely

- Ensure the 1st attempt is the best attempt:
  - Most experienced operator available
  - Airway pause where time permits
  - Ensure adequate sedation (ideally paralysis)
  - Video Laryngoscopy for 1st attempt

- Use a hemodynamically stable induction strategy

- Diligent PPE (consider a buddy system)

---

Table 1: ARDS Berlin definition.

<table>
<thead>
<tr>
<th>The Berlin definition of acute respiratory distress syndrome</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Timing</strong></td>
</tr>
<tr>
<td><strong>Chest imaging</strong></td>
</tr>
<tr>
<td><strong>Origin of edema</strong></td>
</tr>
<tr>
<td><strong>Oxygenation</strong></td>
</tr>
<tr>
<td>Mild</td>
</tr>
<tr>
<td>Moderate</td>
</tr>
<tr>
<td>Severe</td>
</tr>
</tbody>
</table>

Abbreviations: CPAP, continuous positive airway pressure; $\text{FiO}_2$, fraction of inspired oxygen; $\text{PaO}_2$, partial pressure of arterial oxygen; PEEP, positive end-expiratory pressure; "Chest radiograph or computed tomography scans; "If altitude is higher than 1,000 m, the correction factor should be calculated as follows: $\left[\text{PaO}_2/\text{FiO}_2\right]_{\text{corr}} = \left[\text{barometric pressure}/760\right] \times \left[\text{PaO}_2/\text{FiO}_2\right]_{\text{atm}}$; This may be delivered noninvasively in the mild acute respiratory distress syndrome group.

Ventilating Safely

- Identify patients who meet criteria for ARDS
- Measure patient height → use this to calculate ideal body weight (IBW)
- Initial ventilation with Vt @ 6cc/kg IBW (or less)
- High PEEP can help; ensure Pplat 30 cmH20 or less
- Conservative oxygen targets
- Deep sedation, paralysis

Transport Tips

- If patient intubated: ensure ETT well secured and good position confirmed on CXR
- Ensure robust vascular access (and backup) established: central lines and art lines are not a MUST
- If any suspicion of PTX ensure pleural space is decompressed or PTX has been definitively ruled out (esp. for air transport)
- Ensure patient well-sedated (if not paralyzed) to facilitate a smooth and safe transport
- Ensure family kept up to date re: patient transport and destination to avoid any confusion and minimize stress
Therapies to Defer

- Advanced ventilatory modalities (IRV, APRV)
- Prone ventilation
- Anticoagulation in the absence of a clear indication
- Antiviral therapies
- Decisions around ECLS
- Inhaled medications (NO, Epoprostenol)

Bottom Lines

- The Alberta Critical Care Network has not been overrun
- Barring any major changes, rural centers are to act as waypoints for critically ill COVID patients
- It is always OK to ask for help or to say “I’m not sure”
- Call early, call often, call RAAPID
- You are not alone! We are in this as a province-wide team!
Critical Care Strategic Clinical Network (CC SCN) - COVID-19 Response

Sean Bagshaw MD MSc
Chair and Professor, Department of Critical Care Medicine, Faculty of Medicine and Dentistry, University of Alberta

Disclosure
Any direct financial payments, gifts, in-kind compensation or honoraria: Spectral Medical
Membership on advisory boards or speakers' bureau: Baxter, CNA Diagnostics
Grants or trials: CIHR

“The Plague Travels Around the Country”
Theodor Kittelsen (1904)
Building ICU Capacity

Hospitalizations and ICU - Probable

Hospitalizations and ICU – Elevated Scenario


Elizabeth MacKay via Twitter

Sources: Sky News; Wall Street Journal; Twitter (Elizabeth McKay)

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Critical Care Strategic Clinical Network:

Information infrastructure ensures a learning health system

Samantha L. Bowker PhD, Henry T. Stelfox MD PhD, Sean M. Bagshaw MD MSc; for the Critical Care Strategic Clinical Network

- Focuses on ensuring the highest-quality evidence-based care for people with critical illness in Alberta.

- Three foundational principles: 1) patient and family-centered care; 2) evidence-informed decision-making; 3) quality improvement.

- Leverages a provincial informatics infrastructure (eCritical Alberta) to drive innovation, knowledge translation and implement evidence-informed science.

- Ensure diverse inter-professional participation in all SCN activities.
### Daily Provincial Critical Care COVID-19 Calls and Summary

<table>
<thead>
<tr>
<th>Summary</th>
<th># Currently Ventilated Patients</th>
<th># Patients on ECLS</th>
<th># Currently Suspected Cases</th>
<th># Currently Confirmed Cases</th>
<th># Currently Confirmed Cases Ventilated</th>
<th># Confirmed Cases Transferred</th>
<th># Confirmed Cases Transferred (CUMULATIVE)</th>
<th># Confirmed Deaths DAILY</th>
<th># Confirmed Deaths (CUMULATIVE Total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>North</td>
<td>5</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Edmonton</td>
<td>48</td>
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<td>7</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>8</td>
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<tr>
<td>Central</td>
<td>6</td>
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<td>1</td>
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<tr>
<td>Calgary</td>
<td>12</td>
<td>2</td>
<td>4</td>
<td>14</td>
<td>11</td>
<td>0</td>
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</tr>
<tr>
<td>TOTAL</td>
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<td>2</td>
<td>16</td>
<td>20</td>
<td>15</td>
<td>0</td>
<td>33</td>
<td>0</td>
<td>11</td>
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</tbody>
</table>

[www.criticalcareresearchscn.com](http://www.criticalcareresearchscn.com)
Office of Continuing Medical Education and Professional Development. COVID Corner: The Critically Ill COVID19 ICU Patient

Provincial Connection
- Provincial Critical Care COVID-19 Committee & Subgroups
- Repository of Resources
- Provincial Tele-support
- Webinars
- Daily Calls

Clinical Support
- Care of COVID-19 Critically Ill Patient - Adult & Pediatric
- Pandemic and Disaster Triage Guidelines - Adult and Pediatric
- ECLS Recommendations for COVID-19 and Triage

ICU Processes
- Provincial Roll Up of Surge Plans
- Team Model Resources
- Procurement of Critical Care Consumables
- Altered Documentation Standards
- Altered Care Delivery during Pandemic

Education
- Proning Preparedness
- PPE Conservation recommendations

Analytics & Research
- Tracer Dashboards
- Critical Care COVID-19 Data
- Data & Support for Sprint SARI

Family & Staff Support
- Supporting Families as Virtual Team Members
- Family Resources
- Resources for Staff to Support Families
- Psychological First Aid for Critical Care Providers

Ongoing & Future
- ICU Recovery for COVID-19 patients
- Alertor & Pump Guidance

Provide Clinical, ICU Process and Education Support

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Office of Continuing Medical Education and Professional Development. COVID Corner: The Critically Ill COVID19 ICU Patient

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Supporting Analytics and Research

https://tableau.albertahealthservices.ca/#/views/COVID-19-EarlyWarningDashboards/CapacitySurgeStageSummary?:iid=1

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Family and Healthcare Professional Support

Psychological First Aid for Critical Care

You are already skilled
Let's make us Stronger!
Thank you for your attention!

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Panellists

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Disclosure
None to Disclose

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Disclosure
None to Disclose

Q&A

Amanda Roze des Ordons
Brian Yipp
Sean Bagshaw
Sean Spence
Chris Grant
Daniel Niven
Ken Parhar
Wendy Sligl
Family in the ICU

Changes to Visitation Policy
• Family Presence Focus → Essential Visitor Policy
• Adapting Communication Practices
  • Using technology
  • Infosheets to family members and staff
  • MyHealth.Alberta.ca

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