The COVID-19 Pandemic's Impact on Critical Care Resources and Providers: A Global Survey

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The COVID-19 Pandemic's Impact on Critical Care Resources and Providers: A Global Survey

Running head: A Global Survey of Critical Care Providers on COVID-19

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ABBREVIATIONS LIST

Advanced practice providers (APPs)

Cardiopulmonary resuscitation (CPR)

East Asia/Pacific (EA/P)

Europe/Central Asia (E/CA)

Global Sepsis Alliance (GSA)

Healthcare providers (HCPs)

Intensive care unit (ICU)

Latin America/Caribbean (LA/C)

Mechanical ventilation (MV)

Middle East/North Africa (ME/NA)

North America (NA)

Prevention and Early Treatment of Acute Lung Injury (PETAL)

Respiratory therapists (RTs)

South Asia (SA)

Sub-Saharan Africa (SSA)

ABSTRACT

Background: The COVID-19 pandemic has severely impacted Intensive Care Units (ICUs) and Critical Care Healthcare Providers (HCPs) worldwide.

Research Question: How do regional differences and perceived lack of ICU resources affect critical care resource utilization and the well-being of HCPs?

Study Design and Methods: Between April 23rd-May 7th 2020, we electronically administered a 41-question survey to interdisciplinary HCPs caring for critically ill COVID-19 patients. The survey was distributed via critical care societies, research networks, personal contacts, and social media portals. Responses were tabulated by World Bank region. We performed multivariate log-binomial regression to assess factors associated with three main outcomes: 1) Limiting mechanical ventilation (MV), 2) changes in cardiopulmonary resuscitation (CPR) practices, and 3) emotional distress or burnout.

Results: We included 2700 respondents from 77 countries, including physicians (41%), nurses (40%), respiratory therapists (10%) and advanced practice providers (8%). The reported lack of ICU nurses was higher than that of intensivists (32% vs 15%). Limiting MV for COVID-19 patients was reported by 16% of respondents, was lowest in North America (10%), and was associated with reduced ventilator availability (aRR:2.10, 95% CI:1.61-2.74). Overall, 66% of respondents reported changes in CPR practices. Emotional distress or burnout was high across regions (52%, highest in North America), and associated with female gender (aRR:1.16, 95% CI:1.01-1.33), being a nurse (aRR:1.31, 95% CI:1.13-1.53), reporting a shortage of ICU nurses (aRR:1.18, 95% CI:1.05-1.33) and powered air-purifying respirators (PAPRs) (aRR:1.30 95% CI:1.09-1.55), as well as experiencing poor communication from supervisors (aRR:1.30, 95% CI:1.16-1.46).

Interpretation: Our findings demonstrate variability in ICU resource availability and utilization worldwide. The high prevalence of provider burnout, and its association with reported insufficient resources and poor communication from supervisors suggest a need for targeted interventions to support HCPs on the front lines.

INTRODUCTION

As of August 27th 2020, the COVID-19 pandemic has resulted in 204,290,582 confirmed cases worldwide and taken 828,070 lives in 188 countries[1,2]. With 5-38% of hospitalized COVID-19 patients requiring admission to an intensive care unit (ICU)[3–5], and 75-88% of critically ill COVID-19 patients requiring mechanical ventilation[5–8], ICUs around the world have been facing major challenges, including determining the appropriate allocation of resources and balancing the care of COVID-19 and other critically ill patients, while having to restructure workflows and ensure the safety of patients, their families, and healthcare providers (HCPs).

A better characterization of the pandemics' effects on ICU resources ("3S: staff, space, stuff"[9]) and on HCPs worldwide is important to identify strategies to support healthcare systems across the world in surmounting this crisis, as well as potential future disasters when rationing of resources may be necessary. With this international survey, we aimed to rapidly assess key concerns of interprofessional HCPs on the front lines caring for critically ill COVID-19 patients.

METHODS

Survey Design

An interprofessional healthcare team, including physicians, nurses, respiratory therapists (RTs), and advanced practice providers (APPs: defined as Advanced Registered Nurse Practitioners, Physician Assistants, and Certified Registered Nurse Anesthetists), developed a 41-question structured questionnaire in English (Supplementary Appendix) to elicit perceptions of international HCPs in the context of available staffing, critical care resources, and space. We followed the STROBE guidelines for the reporting of cross-sectional studies[10]. Data were collected using REDCap electronic data capture tools hosted at the Institute of Translational Health Sciences.[11] Certain questions were displayed contingent upon preceding responses. Prior to distribution, the survey was pilot tested by 30 HCPs from five countries, who were not included in the final analysis.

Ethics Approval

The study was deemed exempt by the University of Washington Institutional Review Board (IRB) since no personally-identifying data was recorded and written consent was not required. Prior to initiating the survey, respondents were informed that the survey is anonymous, that participation is voluntary, and summary results would be shared with the scientific community.

Population

Our target population included physicians, nurses, APPs, and RTs who care for COVID-19 patients hospitalized in an ICU. We asked survey respondents to self-attest to having direct involvement in the care of COVID-19 patients requiring intensive care. Respondents who

negated this question (N=426) were excluded from the analysis, along with particpants who completed only demographic information (N=37).

Survey Administration

The survey was distributed electronically between April 23rd 2020-May 7th 2020, with the intention to capture data during or close to the time of peak surges in many countries. HCPs were reached via the following strategies: (1) the World Federation of Intensive and Critical Care emailed its 85 scientific member societies and encouraged them to distribute the survey among their membership; (2) we collaborated with 15 critical care professional societies (Supplementary Appendix) who shared the link with their membership (via email or post on websites/social media); (3) the survey link was distributed to subgroups within the Global Sepsis Alliance (GSA) and the Prevention and Early Treatment of Acute Lung Injury (PETAL) network; (4) we emailed corresponding authors from clinical publications about critically ill COVID-19 patients based on a literature search of COVID-19 publications from February 1st 2020-April 22nd 2020; (5) personal contacts of the authors known to directly care for COVID-19 patients in the ICU were invited to participate and asked to distribute the survey to their colleagues; and (6) we distributed the link on social media platforms (Twitter and Facebook) and shared it within intensive/critical care forums focusing on COVID-19 that required medical credentials to approve members. Posts were sharable to facilitate widespread distribution.

We chose this convenience sampling approach to reach a large number of HCPs worldwide in a short time period, accepting that we would not be able to gauge an accurate individual response rates due to various dissemination mechanisms (e.g. critical care societies

sharing the link on various websites and social media portals), and had limited ability to confirm how many respondents saw or received the link within these forums.

Variable categorization

Countries were categorized by World Bank region: East Asia/Pacific (EA/P), Europe/Central Asia (E/CA), Latin America/Caribbean (LA/C), Middle East/North Africa (ME/NA), North America (NA), South Asia (SA), Sub-Saharan Africa (SSA). We categorized countries into pre-/peri-/post-peak of deaths per day[12,13], and calculated an indicator of how much a country was affected by COVID-19 at the time of survey administration ('severity index,' Supplementary Table 1) using the average daily death rate by population[13,14]. Mortality was chosen as a surrogate for peak and severity index instead of incidence, as mortality is less confounded by testing availability and serves as an indicator of disease burden on ICUs.

Statistical Analysis

Descriptive statistics were used to report respondent characteristics and survey outcomes. We utilized univariate binomial regression to assess associations between region, provider type and pre-specified outcomes of interest. We conducted multivariate log-binomial regression to assess predictors of three main outcomes: 1) limiting the use of mechanical ventilation (MV) for COVID-19 patients; 2) changing policies or practices of cardiopulmonary resuscitation (CPR); and 3) reporting emotional distress and burnout. These outcomes were selected as surrogates for ICU resource utilization (1 and 2) and the psychological burden of the pandemic on HCPs (3). Exposures considered included provider type, gender, perceived lack of resources (organized by

3 S: "Staff, Space, and Stuff"[9]), time from COVID-19 peak, and severity index. Exposures that were statistically significant in the univariate regression were considered for inclusion in the multivariate model. We performed a complete case analysis; respondents with missing data were removed from regressions. Analyses were conducted using R Software[15–17].

RESULTS

We identified and approached contacts in 95 countries and received 3,182 responses from 93 countries; 2,700 respondents from 77 countries were included in the analysis (81% of countries contacted, Figure 1a). HCPs within China reported being unable to access the survey link. Reasons for excluding responses are outlined in Figure S1. Detailed respondent characteristics by World Bank region are displayed in Table 1. The majority of respondents were from North America (63%) and Europe/Central Asia (24%). The top responding countries (with >50 respondents per country) were: United States, United Kingdom, Italy, Japan, Australia, and Germany. Survey respondents were: physicians (41%), nurses (40%), RTs (11%), and APPs (8%). Most participants reported working in urban, large teaching hospitals (71%), and 66% were female. Among the 798 (30%) respondents who opted to disclose their institution, 422 different institutions were reported. Most respondents listed critical care medicine as a subspecialty (85% of attending physicians, 69% of physicians in training, 93% of nurses, Table S3). Overall, 76% of respondents (N=2056) completed all survey questions.

Staff:

Tables 2 and S4 summarize perceived lack of resources, changes in clinical practice, and HCPs concerns by region. While 15% of respondents reported insufficient numbers of

intensivists to care for critically ill COVID-19 patients, 32% reported insufficient numbers of ICU nurses. Regions with the highest report of insufficient numbers of intensivists were Sub-Saharan Africa (50%) and Latin America/Caribbean (37%), compared to North America (11%). The highest report of insufficient numbers of ICU nurses was in South Asia (57%) and Europe/Central Asia (47%), compared to North America (27%). Figure 1b and 1c display the proportion of respondents reporting shortages of intensivists and nurses by country.

Space:

Shortages of ICU beds were reported by 13% of respondents (ranging from 11% in North America to 50% in South Asia) to care for critically ill COVID-19 patients (Figure 1d), and by 17% (ranging from 13% in North America to 41% in Latin America/Caribbean) for other patients requiring ICU care. Figure S2 displays reported measures that were implemented to mitigate the impact of ICU bed shortages, including the conversion of post-OP recovery rooms (reported by 20%), and operating rooms (12%).

Stuff:

Testing: The SARS-CoV2-RT-PCR was available for all patients according to 35% of respondents, and for 'select patients based on symptoms' according to 56% (Table S4). For HCPs, the test was available for all according to 15% of respondents, and for 'select HCPs based on symptoms and area of work' according to 62%. Among the respondents that reported testing was available, 41% indicated that it required hospital approval. Few respondents reported absence of testing capabilities for patients (0.5%) or HCPs (6%).

Personal protective equipment (PPE): Surgical masks and gloves were reported to be 'always available' according to 95% and 83% of respondents respectively. Other PPE was generally restricted to select HCPs or HCPs caring for patients with certain characteristics (Figure 2a): N95 masks (35% available for all HCPs, 57% restricted); dedicated eye protection (50% and 40%); face shields (46% and 44%). The largest shortage was reported for powered air purifying respirators (PAPR, 14% available for all and 48% restricted), with 26% of respondents reporting a complete lack of PAPR in their hospital (least in North America at 12%). One in four respondents (23%) felt that their hospital's policy on PPE was not appropriate or safe (Table S4); in univariate regressions, this sentiment was significantly higher among nurses (48%), RTs (27%), APPs (19%) and physicians in training (21%), compared to attending physicians (7%), and higher in North America (27%) compared to other regions.

Ventilators and oxygenation therapies: Limited availability (i.e. only for select patients) was reported for mechanical ventilators (11%, Figure 1e), noninvasive positive pressure ventilation (NIPPV, 21%), and high flow nasal cannula (HFNC, 23%) (Figure 2b). The percentage of respondents reporting limited ventilator availability varied across regions and was lowest in North America (7%) compared to Sub-Saharan Africa (43%), Middle East/North Africa (34%), and Europe/Central Asia (17%). No respondent reported a complete lack of ventilators, and only 1% reported simultaneously using the same ventilator on multiple patients.

Diagnostics: Tests and procedures for critically ill COVID-19 patients were frequently restricted, with a substantial proportion of respondents reporting limiting the use of bronchoscopy (54%), computed tomography (60%), echocardiography (47%), magnetic resonance imaging (MRI, 44%), ultrasound (41%), lumbar puncture (40%), and paracentesis

(38%) to select patients. About a quarter of respondents reported not performing bronchoscopy (22%) or MRI (25%) despite availability to do so (Figure 2c).

Limiting the use of MV in COVID-19 patients

One in 6 (16%) respondents reported limiting the use of MV in COVID-19 patients based on clinical severity (54%), comorbidities (42%), age (29%) or health insurance or financial means (3%). In the multivariate regression, the likelihood of limiting MV was 2-3 times higher in all other world regions compared to North America (Table 3a), highest in settings where a lack of ventilators was reported (aRR:2.10, 95% CI:1.61-2.74), and marginally associated with lack of PAPRs and caring for >50 COVID-19 patients. Shortages of intensivists, nurses, and ICU beds were univariately associated with limiting MV, but these associations disappeared (aRR close to 1) after adjusting for other covariates.

Changes in CPR practices, shared decision making and palliative care

Changes in CPR practices due to COVID-19 were reported by 66% of respondents, with 38% reporting implementation of a new policy. In multivariate analyses, changes in CPR policy/practices were significantly lower in Europe/Central Asia compared to North America (aRR:0.86, 95% CI:0.76-0.99), and were not associated with shortage of staff, ICU beds, or resources (Table 3b).

The percentage of respondents who reported not performing CPR *at all* in COVID-19 patients varied by region (from 1% North America to 57% in Sub-Saharan Africa). A number of factors were considered when deciding prospectively whether to perform CPR, including: clinical severity (66% of respondents), comorbidities (31%), and patient age (18%). Among

those who do perform CPR, respondents were split in their practices whether to base the decision on family or surrogate wishes vs physician determination. North America was the only region in which most respondents (67%) performed CPR based on family or surrogate wishes; in all other regions the majority of respondents stated that this decision is made by the treating physicians (100% Sub-Saharan Africa, 88% South Asia, 75% Latin America/Caribbean, 74% Europe/Central Asia). When critical decisions have to be made regarding withholding or withdrawing life-sustaining treatments, 16% of respondents allowed families less participation in decision-making for COVID-19 patients compared to other ICU patients (11% in North America and East Asia/Pacific compared to 22% in Europe/Central Asia and 27% in Latin America/Caribbean). Half of respondents (48%) reported consulting palliative care for COVID-19 patients in the ICU, with the highest proportion in North America (61%). In contrast, not consulting palliative care for critically ill COVID-19 patients despite availability of palliative care was reported by 50% of respondents from Europe/Central Asia vs 8% from North America. Overall, 39% felt that palliative care consultations have increased during the pandemic (45% in North America vs. 18% in Europe/Central Asia).

Provider Concerns

The most common concerns among HCPs included transmitting infection to their families (61%), emotional distress/burnout (52%), concerns about their own health (44%), and experiencing social stigma from their communities (21%). All HCPs concerns were highest in North America. A substantial minority (11%) expressed worries about their financial situation, most commonly in Latin America/Caribbean (24%) and South Asia (22%). Most HCPs (65%) stated that caring for COVID-19 patients was mandatory at their institution. When not in the

hospital, 12% of HCPs reported relocating to a separate residence from their families to protect them, and an additional 53% reported taking extra precautions while at home (Table S4).

In multivariate regression, emotional distress and burnout was significantly associated with female gender (aRR:1.16, 95% CI:1.01-1.33) and being a nurse (aRR: 1.31 (95% CI:1.13-1.53) (Table 4). Compared to providers who had cared for <10 COVID-19 patients, those who had cared for 10-50 and >50 patients had a 17% and 28% higher risk of burnout, respectively. Pandemic severity or time from peak within a respondent's country were not associated with burnout. Providers experiencing poor communication from their supervisors had a 30% higher likelihood of reporting burnout (95% CI:1.09-1.55). Limited availability of PAPR and shortages of nurses were associated with a 30% and 18% increased risk of burnout, respectively. Providers in Europe/Central Asia were 14% less likely to report burnout compared to providers in North America (95% CI:0.75-1.00).

DISCUSSION

In this global survey of ICU providers during the COVID-19 pandemic, shortages of ICU staff and resources were frequently reported, as were emotional distress and burnout. Participants reported that the pandemic has changed practices around MV and CPR, in part based on resource availability. In addition, over half of the respondents reported concerns about their own health and their families' health. Finally, our results highlight substantial variation across regions. For example, providers in North America reported higher levels of emotional distress or burnout, despite reporting fewer shortages of resources, and were also more likely to base CPR and other critical decisions on family wishes compared to other world regions. Our results, which underscore the psychological burden on HCPs, complement recent reports about provider well-being from China, Italy, and the United States amidst the pandemic[18–21,22], as well as studies before the pandemic (3-50% burnout rates across various types of ICU providers)[23-26].

We found modifiable and non-modifiable predictors of burnout that may inform targeted interventions to improve provider experiences and protect their mental well-being. First, across all regions, female HCPs and nurses were more likely to experience burnout. Second, provider burnout was independently associated with having cared for a larger number of COVID-19 patients. Interestingly, we did not find an association between pandemic severity and burnout. This likely indicates that the number of COVID-19 patients an individual has cared for is a more reliable predictor of this individual's experiences than the number of COVID-19 patients in a given region. Finally, burnout was associated with reporting a shortage of ICU nurses, insufficient PAPR availability and poor communication from supervisors. Another recently published survey of 9,120 ICU clinicians from the US found that the perceived need for both PPE masks and ICU staffing shortages exceeded all other resource challenges [22]. Further analysis

of our data showed that insufficient access to PPE was the strongest predictor of all provider concerns in the US (data not shown). Communication in the COVID-19 era poses a major challenge, given the need to constantly adapt and implement new policies while remaining transparent to all affected HCPs.

Strengths of this study include its large sample size consisting of interprofessional HCPs at the front line of the pandemic in 77 countries. Furthermore, it was conducted during a time when many countries were severely affected by COVID-19, and we were able to capture the highest number of responses in many of the most affected countries (based on case numbers, mortality and case fatality rates). To our knowledge, this is the first global survey to comprehensively assess of the pandemic's impact in regard to ICU resources, practices and provider well-being.

Several limitations need to be considered. First, the lack of a clearly defined sample introduces a substantial risk of response and sampling bias. We specifically targeted our distribution strategy to reach HCPsworking in ICUs, but our convenience sampling approach may have limited the generalizability of our results. *Also, since the survey was anonymous, we cannot exclude the possibility that respondents took the survey more than once.* Second, the majority of respondents were from North America and Europe/Central Asia, with low representation from low/middle income countries (LMICs). Future studies will need to specifically target LMICs to assess COVID-19's effects in the context of resource-constrained health systems. Third, our survey was only available in English, and language barriers might have resulted in inaccurate responses and contributed to low numbers of participants in some countries. *Additionally, responses reflect the views of individual respondents but may not be representative of all HCPs in any given country, particularly in countries with few participants*.

Fourth, respondents were mostly from large urban centers, which are likely to have more resources than rural hospitals. However, these regions were also hardest hit in the COVID-19 pandemic. Fifth, reported practices during COVID-19 are rapidly changing as ICUs and HCPs continue to adjust to the burden imposed by the pandemic, so responses might differ within the 15-day time window in which the survey was distributed. Also, practices captured in this survey were perceived by the respondents rather than reflecting actual practices. Sixth, changes in CPR practices might not purely reflect ICU resource utilization, but rather represent measures to ensure the safety of HCPs. Finally, practice differences within regions, such as involving families in decision-making or limiting life-sustaining therapy, likely reflect cultural and medicolegal differences rather than a differential effect of the pandemic[26].

Our findings suggest an important need to create collaborative strategies for ventilatory support in resource limited settings, in particular in anticipation of surges affecting LMICs[27], as well as repeated surges in countries that are currently relaxing their strict measures to mitigate spread. Finally, our study emphasizes the personal sacrifices by HCPs, especially nurses, on the front lines worldwide, and the need to proactively support them by implementing interventions to promote mental health and well-being.

INTERPRETATION:

COVID-19 has significantly impacted ICU practices, resources and staff. Across all regions, the reported lack of ICU nurses was higher than that of intensivists, and the use of standard diagnostic tests has been largely limited in COVID-19 patients.

High rates of provider emotional distress and burnout are reported across geographic regions. Providers in North America report the highest levels of emotional distress or burnout, despite

reporting fewer shortages of resources, and they were also more likely to base CPR and other critical decisions on family wishes compared to other world regions.

Mechanical ventilation is largely limited based on restricted ventilator availability. Strategies for allocating ventilatory support will be important in light of anticipated surges in developing countries. Female HCPs, nurses, and those reporting lack of ICU nurses, PAPRs, and experiencing poor communication were at highest risk for burnout. Targeted interventions to support healthcare providers by addressing modifiable risk factors such as insufficient access to PPE and poor communication, are needed.

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Guarantor statement: On behalf of all authors, the corresponding author affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

Author Contributions:

Drs. Wahlster, Patel, Sharma and Creutzfeldt had full access to all of the data and take responsibility for the integrity of the data and the accuracy of the data analysis.

All authors contributed substantially to the study design, data acquisition and analysis, as well as interpretation. Drs. Sharma and Kassebaum performed the statistical analysis. Drs. Wahlster and Creutzfeldt wrote the manuscript and all authors edited the manuscript.

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Tables (below):

Table 1: Respondent Characteristics (all and by World Bank region)

Table 2 Summary of data by region

Table 3 Univariate and multivariate predictors of a) limiting mechanical ventilation and b) changes in CPR policy

Table 4: Univariate and multivariate predictors of emotional distress and burnout

Figure legends:

Figure 1: World Maps displaying a) number of survey respondents per country; b) percentage of HCPs reporting an insufficient number of intensivists per country, c) percentage of HCPs reporting an insufficient number of ICU nurses by country, d) percentage of HCPs reporting an insufficient number of ICU beds by country, e) percentage of HCPs reporting limited availability of ventilators by country.

Figure 2: ICU Resource Utilization of a) PPE, b) oxygenation strategies, and c) medical tests and procedures in COVID-19 patients.

Supplementary Appendix

1. Supplementary Figure 1: Flow diagram of survey respondents
2. Supplementary Table 1: Number of respondents per country, timing from COVID-19 peak and severity index by country.
3. Supplementary Table 2a: Number of countries in each peak category
4. Supplementary Table 2b: Number of countries in each severity category
5. Supplementary Table 3: Responses stratified by provider type.
6. Supplemental Table 4: List of Reported Institutions by country, number of respondents per institution
7. Full Survey with Electronic Link

Table 1: Respondent characteristics by region[†]

	East Asia & Pacific (N=243)	Europe & Central Asia (N=630)	Latin America & Caribbean (N=45)	Middle East & North Africa (n=50)	North America (N=1696)	South Asia (N=27)	Sub-Saharan Africa (N=9)	Total (N=2700)
Gender								
Female	83 (34 %)	380 (60 %)	14 (31 %)	26 (52 %)	1251 (74 %)	9 (33 %)	4 (44 %)	1767 (65 %)
Male	158 (65 %)	244 (39 %)	30 (67 %)	23 (46 %)	432 (25 %)	16 (59 %)	5 (56 %)	908 (34 %)
Non-binary	0 (0 %)	2 (0 %)	1 (2 %)	1 (2 %)	1 (0 %)	1 (4 %)	0 (0 %)	6 (0 %)
Not disclosed	2 (1 %)	4 (1 %)	0 (0 %)	0 (0 %)	12 (1 %)	1 (4 %)	0 (0 %)	19 (1 %)
Years in clinical practice								
Mean (SD)	18.4 (9.05)	15.7 (9.78)	16.9 (9.24)	14.3 (10.6)	11.6 (9.40)	17.7 (11.0)	12.7 (7.25)	13.3 (9.79)
Number of COVID-19 patients cared for								
< 10	217 (89 %)	163 (26 %)	25 (56 %)	20 (40 %)	676 (40 %)	19 (70 %)	7 (78 %)	1127 (42 %)
10 - 50	26 (11 %)	380 (60 %)	16 (36 %)	20 (40 %)	819 (48 %)	8 (30 %)	2 (22 %)	1271 (47 %)
> 50	0 (0 %)	86 (14 %)	4 (9 %)	10 (20 %)	201 (12 %)	0 (0 %)	0 (0 %)	301 (11 %)
Hospital setting								
Rural, <100 beds	1 (0 %)	6 (1 %)	2 (4 %)	5 (10 %)	33 (2 %)	2 (7 %)	0 (0 %)	49 (2 %)
Rural, ≥100 beds	12 (5 %)	28 (4 %)	1 (2 %)	2 (4 %)	89 (5 %)	0 (0 %)	0 (0 %)	132 (5 %)
Urban, no teaching, <200 beds	4 (2 %)	19 (3 %)	8 (18 %)	4 (8 %)	83 (5 %)	3 (11 %)	0 (0 %)	121 (4 %)
Urban, no teaching, ≥200 beds	25 (10 %)	69 (11 %)	5 (11 %)	3 (6 %)	244 (14 %)	6 (22 %)	0 (0 %)	352 (13 %)
Urban, teaching, <200 beds	6 (2 %)	34 (5 %)	9 (20 %)	3 (6 %)	78 (5 %)	1 (4 %)	0 (0 %)	131 (5 %)
Urban, teaching, ≥200 beds	195 (80 %)	473 (75 %)	20 (44 %)	33 (66 %)	1168 (69 %)	15 (56 %)	9 (100 %)	1913 (71 %)
Qualification								
Attending Physician	181 (74 %)	295 (47 %)	34 (75 %)	29 (58 %)	349 (20 %)	23 (85 %)	6 (66 %)	907 (34 %)
Physician in training	21 (9 %)	59 (9 %)	2 (4 %)	11 (22 %)	109 (6 %)	3 (11 %)	2 (22 %)	207 (7 %)
Nurse	30 (12 %)	248 (39 %)	1 (2 %)	8 (16 %)	738 (47 %)	1 (4 %)	1 (11 %)	1077 (40 %)
Advanced Practice provider	5 (2 %)	22 (3 %)	0 (0 %)	1 (2 %)	183 (11 %)	0 (0 %)	0 (0 %)	211 (8 %)
Respiratory therapist	6 (2 %)	5 (1 %)	8 (18 %)	1 (2 %)	277 (16 %)	0 (0 %)	0 (0 %)	297 (11 %)

[†]Number of respondents in each category vary slightly as some responses optional; multiple responses possible per respondent regarding area of specialization so most frequent subspecialties are reported. Years in clinical practice includes years in training. Regions are categorized using the World Bank classification of countries.

Table 2: Provider perceptions regarding supplies, treatment of COVID patients, and concerns by region†

	East Asia & Pacific (N=243)	Europe & Central Asia (N=630)	Latin America & Caribbean (N=45)	Middle East & North Africa (N=50)	North America (N=1696)	South Asia (N=27)	Sub-Saharan Africa (N=9)	Total (N=2700)
Perceived lack of ICU resources by region								
Shortages reported								
Intensivists	40 (18 %)	115 (20 %)	15 (37 %)	13 (29 %)	191 (12 %)	7 (30 %)	4 (50 %)	385 (15 %)
ICU Nurses	52 (24 %)	277 (47 %)	15 (37 %)	14 (31 %)	432 (27 %)	13 (57 %)	3 (38 %)	806 (32 %)
ICU beds	25 (13 %)	63 (13 %)	11 (34 %)	10 (29 %)	150 (11 %)	10 (50 %)	3 (50 %)	272 (13 %)
PPE availability limited								
Gloves	22 (10%)	27(5%)	4 (11 %)	5 (11%)	4 (3%)	0 (0%)	2 (24%)	101 (4%)
Gowns	56 (26%)	133 (24%)	11 (29%)	16 (37%)	348 (24%)	8 (36%)	6 (75%)	578 (24%)
Surgical Mask	34 (16%)	70 (12%)	4 (10%)	6 (14%)	201 (14%)	1(5%)	4 (50%)	320 (13%)
Eye protection	95 (45%)	213 (38%)	18 (47%)	22 (51%)	561 (37%)	13 (59%)	7 (87%)	929 (39%)
Face Shield	117 (57%)	256 (45%)	20 (53%)	23 (54%)	627 (42%)	11 (50%)	6 (75%)	1050 (44%)
N95	127 (60%)	285 (53%)	17 (45%)	26 (61%)	877 (58%)	14 (64%)	6(75%)	1362 (57%)
PAPRs	80 (38%)	147 (27%)	9 (24%)	13 (31%)	825 (55%)	1 (5)	0 (0%)	1075 (46%)
Ventilator supplies limited								
Mechanical ventilators	21 (10 %)	87 (17 %)	11 (31 %)	13 (34 %)	102 (7 %)	6 (27 %)	3 (43 %)	243 (11 %)
NIPPV	29 (14 %)	156 (30 %)	20 (57 %)	15 (38 %)	239 (17 %)	10 (45 %)	3 (43 %)	472 (21 %)
HFNC	29 (14 %)	189 (37 %)	15 (43 %)	14 (37 %)	271 (19 %)	9 (41 %)	0 (0 %)	527 (23 %)
Changes in Resource Utilization and Provider Concerns								
Limiting mechanical ventilation	32 (16 %)	161 (31 %)	7 (20 %)	13 (33 %)	140 (10 %)	7 (32 %)	2 (29 %)	362 (16 %)
CPR policy changes								
Unchanged	59 (29 %)	210 (41 %)	12 (34 %)	16 (41 %)	460 (32 %)	7 (32 %)	2 (29 %)	766 (34 %)
New policy implemented	83 (41 %)	198 (38 %)	11 (31 %)	12 (31 %)	547 (38 %)	5 (23 %)	2 (29 %)	858 (38 %)
No policy change but practice has changed	59 (29 %)	109 (21 %)	12 (34 %)	11 (28 %)	421 (29 %)	10 (45 %)	3 (43 %)	625 (28 %)
CPR in COVID-19 patients								
Not performed	18 (9 %)	19 (4 %)	7 (20 %)	4 (10 %)	17 (1 %)	5 (23 %)	4 (57 %)	74 (3 %)
Physicians determine	123 (61 %)	368 (71 %)	21 (60 %)	22 (56 %)	450 (32 %)	15 (68 %)	3 (43 %)	1002 (45 %)
Families determine	60 (30 %)	130 (25 %)	7 (20 %)	13 (33 %)	961 (67 %)	2 (9 %)	0 (0 %)	1173 (52 %)
Allow families to participate in critical decisions for COVID-19 patients								
More than other ICU patients	14 (7 %)	17 (3 %)	1 (3 %)	5 (13 %)	74 (5 %)	4 (18 %)	3 (43 %)	118 (5 %)
Same as other ICU patients	165 (82 %)	386 (75 %)	24 (71 %)	25 (64 %)	1189 (84 %)	13 (59 %)	3 (43 %)	1805 (81 %)
Less than other ICU patients	21 (10 %)	112 (22 %)	9 (26 %)	9 (23 %)	155 (11 %)	5 (23 %)	1 (14 %)	312 (14 %)
Palliative care consults for COVID-19 patients								

> 50% of patients	9 (5 %)	31 (6 %)	1 (3 %)	5 (14 %)	411 (30 %)	1 (5 %)	1 (17 %)	459 (21 %)
< 50% of patients	42 (22 %)	111 (22 %)	9 (26 %)	4 (11 %)	416 (31 %)	0 (0 %)	2 (33 %)	584 (27 %)
Do not consult palliative care	83 (44 %)	249 (50 %)	11 (32 %)	15 (43 %)	105 (8 %)	7 (35 %)	1 (17 %)	471 (22 %)
No palliative care specialists available	19 (10 %)	59 (12 %)	9 (26 %)	7 (20 %)	48 (4 %)	11 (55 %)	2 (33 %)	155 (7 %)
Not sure	36 (19 %)	48 (10 %)	4 (12 %)	4 (11 %)	376 (28 %)	1 (5 %)	0 (0 %)	469 (22 %)
Palliative care consults								
More than prior to pandemic	6 (12 %)	26 (18 %)	3 (30 %)	3 (33 %)	371 (45 %)	1 (100 %)	1 (33 %)	411 (39 %)
Provider concerns								
Emotional distress and burnout	73 (30 %)	305 (48 %)	19 (42 %)	22 (44 %)	974 (57 %)	9 (33 %)	3 (33 %)	1405 (52 %)
Worried about infecting family at home	122 (50 %)	345 (55 %)	21 (47 %)	25 (50 %)	1119 (66 %)	17 (63 %)	5 (56 %)	1654 (61 %)
Worried about own health	10 (31 %)	80 (50 %)	3 (43 %)	5 (38 %)	91 (65 %)	6 (86 %)	1 (50 %)	196 (54 %)
Social stigma from community	37 (15 %)	91 (14 %)	6 (13 %)	7 (14 %)	434 (26 %)	4 (15 %)	0 (0 %)	579 (21 %)
Feel that hospital unable to keep me safe	36 (15 %)	107 (17 %)	7 (16 %)	7 (14 %)	433 (26 %)	6 (22 %)	2 (22 %)	598 (22 %)
Poor communication from supervisors	30 (12%)	134 (21%)	3 (7%)	8 (16%)	366 (22%)	4 (15%)	2 (22%)	547 (20%)
Worries about financial situation	20 (8%)	36 (6%)	11 (24%)	6 (12%)	212 (13%)	6 (22%)	0 (0%)	292 (11%)

†Number of respondents in each category slightly different due to missing data and some responses being optional

Table 3: Univariate and multivariate predictors of limiting mechanical ventilation and changes in CPR policy†

	RR (95% CI)	P value	aRR (95% CI)	P value
a) Mechanical ventilation limited in COVID-19 patients				
Region				
North America	Ref.		Ref.	
East Asia & Pacific	1.58 (1.07-2.33)	0.02	2.25 (1.05-4.85)	0.04
Europe & Central Asia	3.17 (2.53-3.98)	<0.001	2.95 (2.30-3.79)	<0.001
Latin America & Caribbean	2.09 (0.98-4.45)	0.06	1.83 (0.76-4.41)	0.17
Middle East & North Africa	3.38 (1.91-5.96)	<0.001	2.93 (1.15-7.46)	0.02
South Asia	3.55 (1.66-7.57)	<0.001	4.20 (1.52-11.6)	0.01
Sub-Saharan Africa	2.89 (0.72 -11.7)	0.14	2.90 (0.61-13.8)	0.18
Reported lack of 3s				
Limited availability of PAPR	1.62 (1.12-2.32)	0.01	1.49 (0.98-2.27)	0.06
Limited ventilator availability	2.99 (2.39-3.74)	<0.001	2.10 (1.61-2.74)	<0.001
Lack of intensivists	1.99 (1.58-2.52)	<0.001	1.11 (0.83-1.50)	0.47

Lack of nurses	1.78 (1.45-2.19)	<0.001	1.07 (0.82-1.39)	0.62
Lack of ICU beds	2.02 (1.56-2.61)	<0.001	1.21 (0.88-1.65)	0.24
Number of COVID-19 patients cared for				
< 10	Ref.			
10-50	1.16 (0.92-1.46)	0.2	1.03 (0.78-1.35)	0.19
> 50	1.73 (1.28-2.35)	<0.001	1.40 (0.98-1.99)	0.06
COVID-19 severity index*				
Less severe	Ref.		Ref.	
Most severe	0.78 (0.60-1.02)	0.07	1.34 (0.69-2.58)	0.38
b) CPR and DNR policies/practice changed since COVID-19				
Region				
North America	Ref.		Ref.	
East Asia & Pacific	1.04 (0.87-1.24)	0.68	1.23 (0.82-1.85)	0.32
Europe & Central Asia	0.87 (0.77-0.99)	0.04	0.86 (0.76-0.99)	0.03
Latin America & Caribbean	0.95 (0.63-1.46)	0.83	1.04 (0.65-1.66)	0.87
Middle East & North Africa	0.87 (0.58-1.32)	0.51	1.02 (0.57-1.82)	0.96
South Asia	1.03 (0.61-1.75)	0.9	1.04 (0.59-1.80)	0.9
Sub-Saharan Africa	1.05 (0.44-2.54)	0.91	1.23 (0.47-3.19)	0.67
Reported lack of 3s				
Limited availability of PAPR	1.14 (0.98-1.34)	0.09	1.12 (0.96-1.31)	0.16
Limited ventilator availability	1.04 (0.89-1.21)	0.61	–	
Lack of intensivists	1.09 (0.95-1.25)	0.22	–	
Lack of nurses	1.11 (0.99-1.23)	0.06	0.89 (0.80-1.00)	0.05
Lack of ICU beds	1.12 (0.96-1.30)	0.14	–	
Number of COVID-19 patients cared for				
< 10				
10-50	1.03 (0.92-1.15)	0.61	–	
> 50	1.08 (0.91-1.27)	0.4	–	
COVID-19 severity index*				
Less severe	Ref.	Ref.		
Most severe	1.02 (0.88-1.17)	0.83	1.19 (0.82-1.72)	0.37

† Severity index: daily deaths by population during the time of survey administration. Physicians in training include residents and fellows. Time from peak (mortality) was not associated with outcomes in univariate or multivariate regressions (data not shown). Variables not statistically associated with the outcomes in univariate regression or whose inclusion did not improve model fit were not included in the multivariate regression.

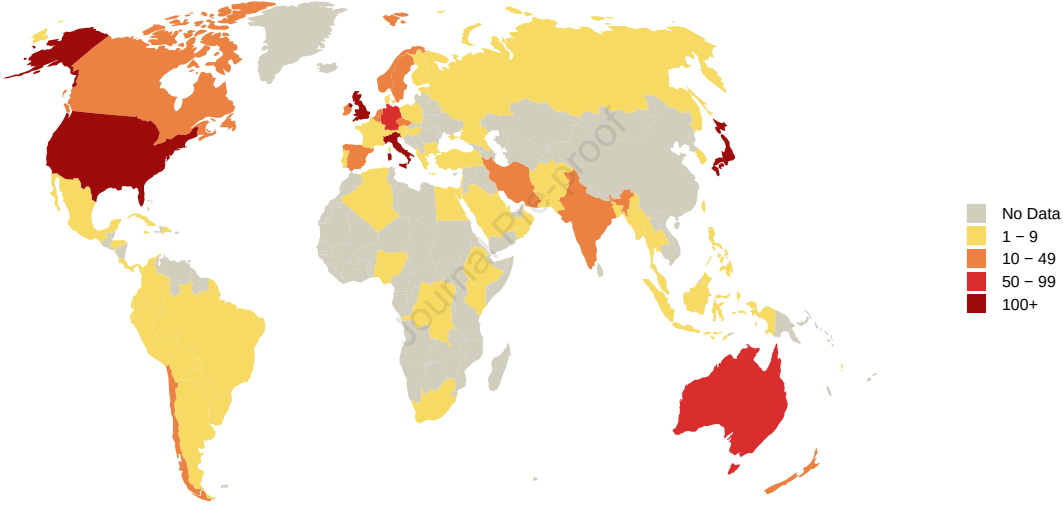
Number of observations for multivariate regressions: Mechanical ventilation limited: N = 2,231; CPR and DNR policies/practice changed since COVID-19: N = 2,230; Emotional distress and burnout: N = 2,477."

Table 4: Univariate and multivariate predictors of emotional distress and burnout†

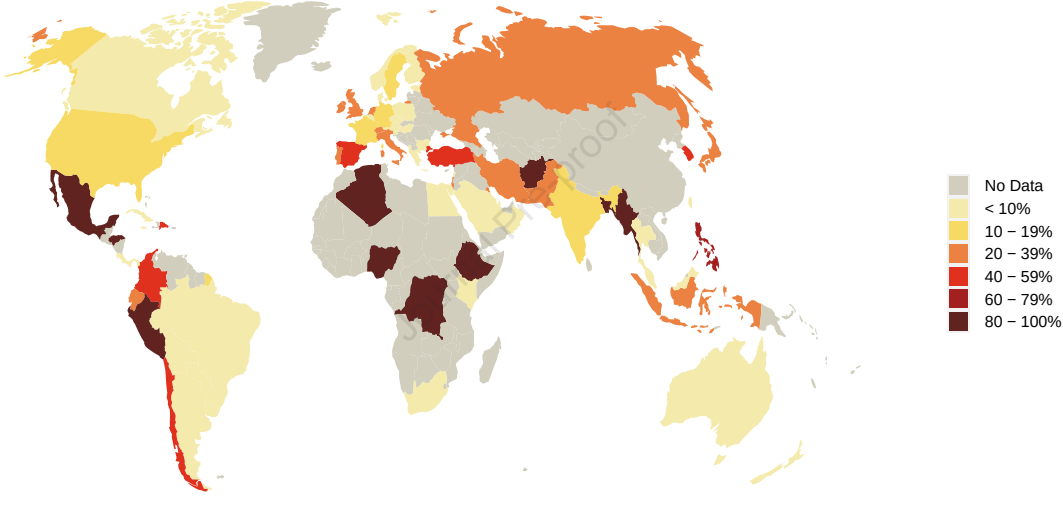
	RR (95% CI)	P value	aRR (95% CI)	P value
Emotional distress and burnout				
Gender				
Male	Ref.		Ref.	
Female	1.36 (1.21-1.53)	<0.001	1.16 (1.01-1.33)	0.03
Region				
North America	Ref.		Ref.	
East Asia & Pacific	0.52 (0.41-0.66)	<0.001	0.85 (0.52-1.37)	0.5
Europe & Central Asia	0.84 (0.74-0.96)	0.01	0.86 (0.75-1.00)	0.04
Latin America & Caribbean	0.71 (0.45-1.13)	0.15	1.07 (0.63-1.80)	0.8
Middle East & North Africa	0.78 (0.51-1.19)	0.25	1.15 (0.63-2.09)	0.65
South Asia	0.56 (0.28-1.11)	0.1	0.84 (0.37-1.90)	0.68
Sub-Saharan Africa	0.58 (0.19-1.80)	0.34	0.89 (0.26-2.98)	0.85
Provider type				
Attending physicians	Ref.		Ref.	
Physicians in training	0.97 (0.77-1.23)	0.82	0.90 (0.71-1.15)	0.41
Nurse	1.45 (1.28-1.65)	<0.001	1.31 (1.13-1.53)	0.01
APP	1.30 (1.06-1.60)	0.01	1.11 (0.89-1.39)	0.35
RT	1.29 (1.07-1.55)	0.01	1.14 (0.93-1.40)	0.2
Poor communication from my supervisors	1.85 (1.66-2.07)	<0.001	1.30 (1.16-1.46)	<0.001
Reported lack of 3s				
Limited availability of PAPR	1.36 (1.15-1.62)	<0.001	1.30 (1.09-1.55)	<0.001
Limited ventilator availability	1.16 (1.00-1.35)	0.04	1.03 (0.88-1.20)	0.71
Lack of intensivists	1.14 (0.99-1.31)	0.06	–	
Lack of nurses	1.34 (1.21-1.50)	<0.001	1.18 (1.05-1.33)	0.01
Lack of ICU beds	1.19 (1.02-1.37)	0.02	–	
Number of COVID-19 patients cared for				
< 10	Ref.		Ref.	
10-50	1.33 (1.18-1.49)	<0.001	1.17 (1.04-1.33)	0.01
> 50	1.41 (1.19-1.68)	<0.001	1.28 (1.06-1.53)	0.01
COVID-19 severity index*				
Less severe	Ref.		Ref.	
Most severe	1.73 (1.45-2.07)	<0.001	1.22 (0.80-1.85)	0.35

† Severity index: daily deaths by population during the time of survey administration. Physicians in training include residents and fellows. Time from peak (mortality) was not associated with outcomes in univariate or multivariate regressions (data not shown). Variables not statistically associated with the outcomes in univariate regression or whose inclusion did not improve model fit were not included in the multivariate regression. Number of observations for multivariate regressions: Mechanical ventilation limited: N = 2,231; CPR and DNR policies/practice changed since COVID-19: N = 2,230; Emotional distress and burnout: N = 2,477."

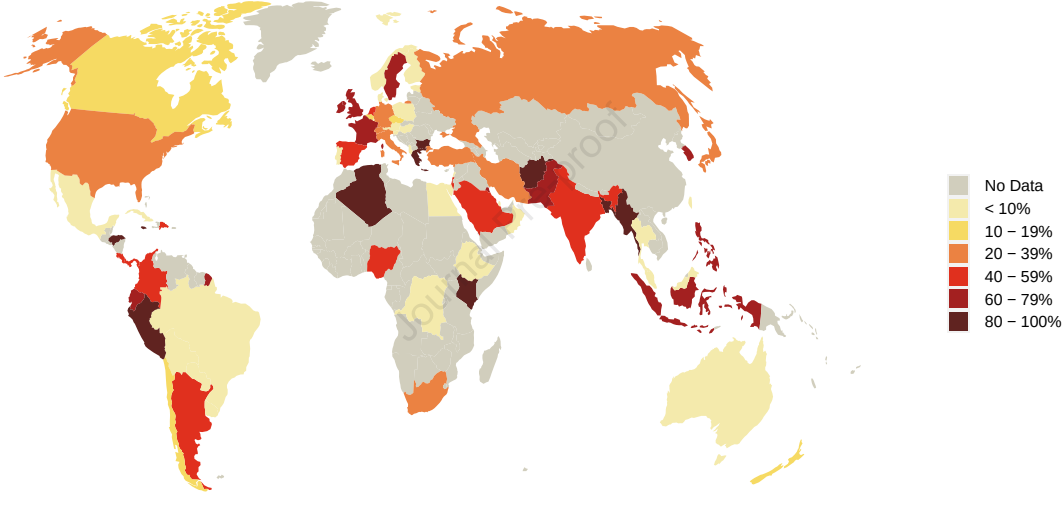
a) Number of survey respondents per country



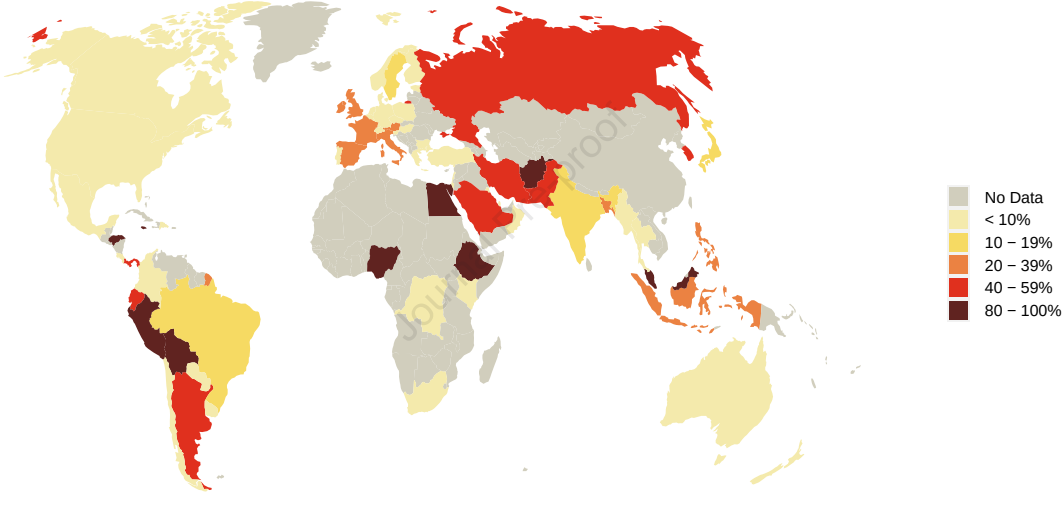
b) Percentage of providers reporting an insufficient number of intensivists by country



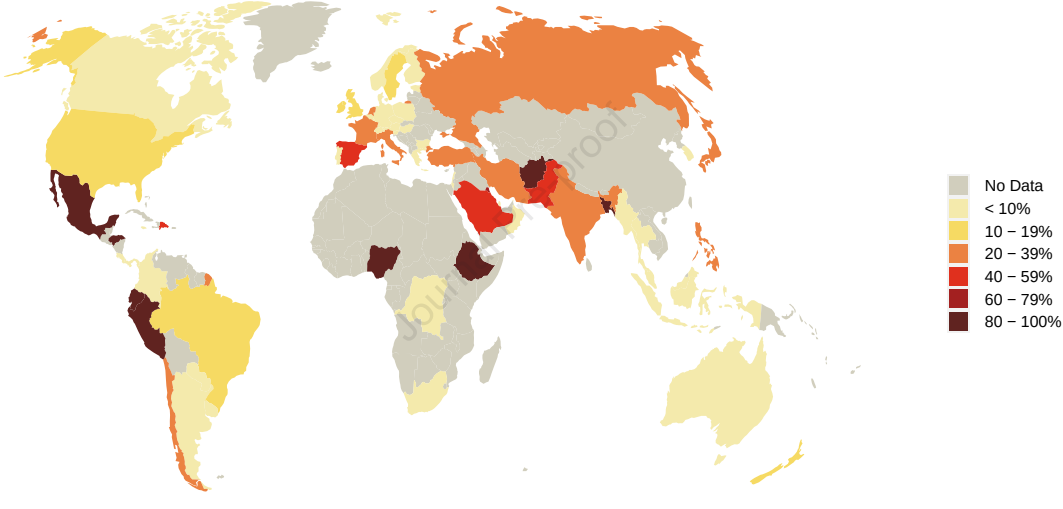
c) Percentage of providers reporting an insufficient number of ICU nurses by country



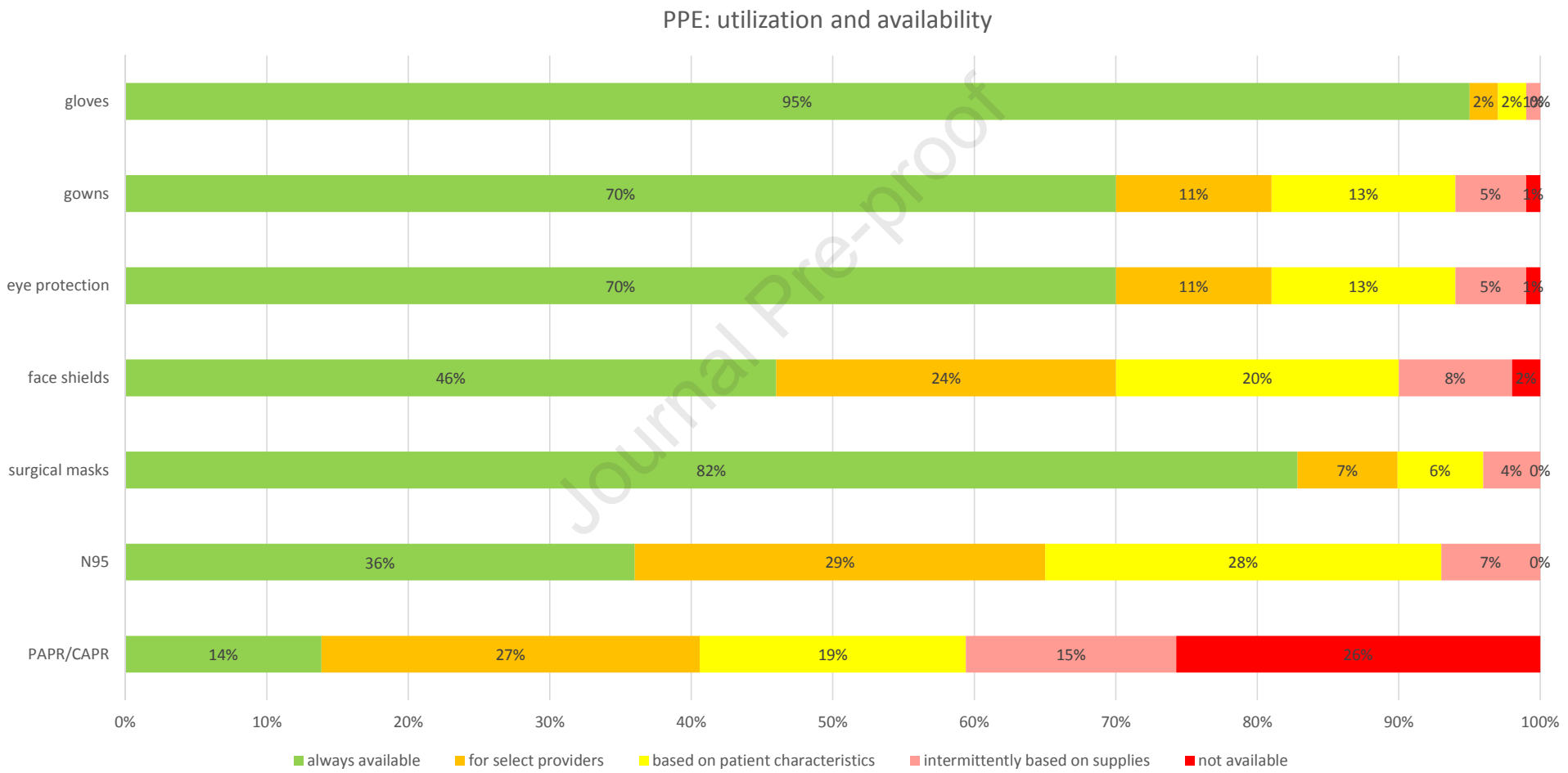
d) Percentage of providers reporting an insufficient number of ICU beds by country



e) Percentage of providers reporting limited availability of ventilators by country



Office2



Slide 1

Office2 These is for all respondents, can make regional ones for the supplement
Microsoft Office User, 21-05-2020