

Intensive Care Unit Equity and Regionalization in the COVID-19 Era

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As the coronavirus disease (COVID-19) pandemic battered metropolitan areas from Los Angeles to New York, media reports described disturbing gaps in care quality across the rich-hospital-poor-hospital divide. A *New York Times* report, “Why Surviving the Virus Might Come Down to Which Hospital Admits You,” interwove narratives of overstretched staff and insufficient equipment in intensive care units (ICUs) serving low-income and minority communities with descriptions of stark differences in COVID-19 mortality rates among New York City hospitals (1). News reports have similarly drawn attention to strained hospitals in hard-hit rural areas, including instances of patients waiting days for transport to ICU care at larger hospitals—sometimes not arriving at all.

The pandemic has exposed many fault lines in American health care. Inequality in ICU access is one that should be urgently addressed.

ICUs and the Inverse Care Law

The pandemic has struck oppressed communities the hardest: neighborhoods



with high proportions of Black, Hispanic, low-income, and uninsured residents have experienced a far higher burden of COVID-19 (2). Yet, such communities also tend to be served by less well-resourced hospitals and often have less ICU infrastructure. Black-serving hospitals have \$5,197 in physical resources for patient care per bed day, compared with \$8,325 at White-serving hospitals (3). Nearly half of low-income neighborhoods lack even a single ICU bed, compared with almost no high-income neighborhoods (4). In New York City, bed density is highest in the richest borough (Manhattan), which also had the lowest COVID hospitalization burden in the deadly first wave (5). Rural areas have about half the ICU beds per capita as urban areas after adjustment for age (6). It would hardly be surprising to learn that such a mismatch between the supply of healthcare infrastructure and the need for it—a phenomenon known more generally as the “inverse care law” (7)—contributed to disparities in COVID-19 outcomes.

And indeed, multicenter cohort studies have demonstrated wide variability in hospital-level outcomes for patients critically ill with coronavirus (8–11). An analysis of claims data concluded that the worse outcomes of hospitalized Black Medicare beneficiaries with COVID-19 might be explained by deficiencies of the hospitals where these patients were treated (9). Similarly, a multicenter cohort study found that hospitals’ risk-adjusted mortality for ICU patients with COVID-19 ranged from 6.6% to 80.8% (8); it also found higher odds of death in hospitals with fewer ICU beds (8), although this was not

demonstrated in a larger claims-based study (11).

In light of such evidence, one proposed reform would offer incentives for the admission (or transfer) of more patients with severe COVID-19 to the “right” hospitals—large academic “marquee” centers—and their diversion away from less well-resourced hospitals that may provide substandard care for acute respiratory distress syndrome (ARDS) (12), an approach known as regionalization. Such regionalization of services is already the norm in advanced trauma care, organ transplantation, and specialized surgery.

Regionalization: An Adequate Solution?

Before leaping to a policy that would centralize COVID-19 ARDS care, several key issues must be considered. First, it is important to recognize that much hospital-level variability in COVID-19 ICU outcomes is explained by patient-level physiological factors (10) likely to be missed by analyses that rely on administrative data for risk adjustment (much less by the crude comparisons of hospital mortality reported in the media). Individuals long excluded from the health system will also have higher rates of comorbid illness—including undiagnosed conditions that will be missed in such analyses—that can contribute to worse outcomes; they may also have lower vaccination rates. Parsing out care quality from the complex web of confounders is hence particularly difficult in the case of COVID-19.

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Table 1. Pandemic-related intensive care unit equity/distribution problems and potential solutions

Problem	Potential Policy Solutions	Examples
Hospital ICU overload during surges	Regional ICU organization to facilitate load balancing	ICU care coordinated at the regional level in Picardy, France during its COVID-19 surge; centralized 24-h on-call ICU dispatcher with real-time access to ICU bed availability at all regional hospitals received all bed requests, provided critical care consultative services, and located ICU beds as needed (14) Coordinated regional management of ICU resources in Tyrol, Austria, including a centralized COVID-19 ICU coordinator who facilitated transfers and hospital unit occupancy benchmarks (15) Hospitals in New Mexico organized into a hub-and-spoke system connecting each hospital to a regional hub; a Central Command Center facilitated interfacility transfers (16)
Regional ICU overload during surges.	Nationally coordinated patient transport away from overloaded regions Creation of reserve ICU capacity usable for future national health disasters and pandemics	Patients in the Grand Est region of France were transported to other regions via collective airborne medical evacuation (up to 6 patients per flight), with eligible patients selected day before flight by intensivists (13) Ranbam Hospital in Haifa, Israel includes a three-story parking lot that can be rapidly converted to a 2,000-bed hospital (17)
Disparities in access to specialized ICU services	Regional planning of tertiary ICU needs/capacity like ECMO Inadequacies in ICU physician workforce in rural localities	Use of mobile teams deployed to community hospitals to initiate ECMO and transfer to tertiary centers (14) Expansion of tele-ICU services (including consultative support) to community hospitals
Geographic inequities in hospital infrastructure	Equitable financing of patient health care regardless of income, race/ethnicity Equitable hospital financing, including for financially tenuous rural hospitals Capital investment planning; increased investment in medically underserved communities	Single-tier universal health financing (e.g., health systems in multiple peer nations) Global hospital budgeting (e.g., Veterans Health Administration and Canadian national health insurance) Hospital construction was publicly financed for decades under the Hill-Burton Act after WWII An explicit policy of boosting allocation of health resources to more deprived areas in the UK led to a fall in geographical disparities in medically amenable mortality over time (18)

Definition of abbreviations: COVID-19 = coronavirus disease; ECMO = extracorporeal membrane oxygenation; ICU = intensive care unit; WWII = World War II.

In addition, parallels between the treatment of acute hypoxemic respiratory failure and the provision of specialized surgical services rest on shaky ground (12). Although patients with major trauma can be triaged by ambulances directly to trauma centers, the typical tempo and progression of respiratory failure make triage by ambulance difficult at the outset of illness. Patients with severe ARDS from COVID-19 who might benefit from extracorporeal membrane oxygenation (ECMO), for instance, usually present to emergency departments with less severe hypoxemia, with deterioration over days culminating in ICU transfer and intubation. Patients, moreover, gravitate to hospitals in their communities. The strain on families (especially poor families) imposed by long travel to visit hospitalized loved ones should also not be discounted. Routinely sorting patients with severe respiratory

failure to tertiary care centers is hence logistically challenging and in some instances will not be desired by patients.

As important, apart from specialized interventions like ECMO, much of what is needed (and evidence based) for the optimal care of most patients with ARDS is within the capacity of well-resourced community hospitals. Some of the interventions described in media reports as evidence of better care at marquee hospitals, such as use of convalescent plasma or specialized beds for proning, have not been shown to improve outcomes. In contrast, two interventions with robust evidence of benefit in ARDS—low-tidal-volume ventilation and manual proning—are well within the capacities of community ICUs with adequate staffing and equipment. As patients with COVID-19 began filling the beds of the safety-net hospital system where I

work, we quickly developed and deployed protocols for proning, as did others.

But perhaps most importantly, the unfortunate reality is that effectively all ICU beds have been needed during severe surges. Indeed, media reports have described patients being transferred hundreds of miles as ICUs overflowed in the hardest-hit areas. Safety-net and community hospitals will often be located in the epicenters of outbreaks; they will be needed during respiratory epidemics, and they need to be prepared.

The Case for Integration, Planning, and Financing Equity

The problem of ICU inequity hence requires a suite of solutions (Table 1), some of which may be achievable in the

short run and others that will require longer-term reorganization and reform.

First, although a simple centralization of care for COVID-19 ARDS is not a solution, expanded use of regional patient transfers is critical. Disseminating ECMO to every hospital is neither feasible nor desirable; regionalization of this service is necessary. More importantly, load balancing is critical to protect hospitals in hotspots from severe capacity strain, which may worsen outcomes (11). Both require regional (indeed national) coordination and planning of patient flow and hospital transfers. For instance, centralized systems that monitor ICU bed availability and triage critically ill patients across hospitals have been rapidly implemented in many regions; transfer of patients by collective air transport and high-speed train, meanwhile, has been used to load balance between regions in Europe

(Table 1) (13–15). In contrast, during surges in many U.S. locales, physicians at overflowing hospitals were often forced to frantically dial every available hospital to find a safer destination for their patients (not always succeeding).

The mismatch between the need for ICU resources and their availability, however, calls for deeper reform. After all, why are hospitals serving disadvantaged communities less resourced to begin with? Multiple factors may be at work (e.g., staffing challenges in rural areas), but the answer can largely be found in an inequitable financing system that rewards the provision of some services to some patients, such as elective surgery for privately insured patients, over others, such as the treatment of pneumonia among the uninsured. Differing payment rates among public and private insurers compound inequities in access, creating geospatial irrationality in the

distribution of healthcare infrastructure. Yet, the solution should not be resignation to this reality, but redistribution. Equitable, universal health insurance and planned investment in health infrastructure focused on community health needs, not profitability, could help achieve this (Table 1).

Moving patients is, in other words, only a partial (and often paltry) answer to inequality; national health planning, operational integration, and the achievement of equity in the distribution of hospital infrastructure are at least as important as we prepare for the next pandemic—and continue to fight this one. ■

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