AMERICAN THORACIC SOCIETY DOCUMENTS

A Research Agenda to Mitigate Racial and Ethnic Disparities in U.S. Critical Care Medicine

An Official American Thoracic Society Research Statement

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Abstract

Background: Racial and ethnic disparities exist in critical illness outcomes in the United States.

Objectives: To identify research priorities for reducing disparities in U.S. critical illness outcomes.

Methods: A 22-member multidisciplinary committee participated in virtual workshops to appraise the literature and discuss opportunities for structural changes to reduce disparities in critical illness outcomes. The co-chairs conducted content analysis of workshop recordings to identify research priorities, then committee members completed a survey to rate the feasibility and potential impact on health outcomes of each priority. Research priorities were classified as *highly* feasible and/or *highly* impactful if ⩾85% of responses indicated agreement or strong agreement.

Results: The committee identified 35 research priorities to reduce U.S. critical care disparities in the following categories: mechanisms of disparities, research outcomes, data sources, and research methods. Nearly all priorities related to data sources and research methods were considered highly impactful. Research priorities considered both highly impactful and highly feasible were as follows: *1*) mechanisms: examining variability in *a*) evidence-based care and *b*) clinician communication; *2*) research outcomes: the use of hierarchical outcomes that evaluate patient-relevant trade-offs; and *3*) research methods: the use of *a*) multicenter studies to address center-level variation and structural barriers to equity, *b*) qualitative and mixed methods to center the patient and family voice, *c*) interdisciplinary research teams that incorporate the broad expertise necessary to address complex social problems, *d*) directed acyclic graphs to promote causal inference, and *e*) quality improvement collaboratives comprising multiple stakeholders working together to achieve equitable outcomes.

Conclusions: These results offer a roadmap for future critical illness health equity research.

Keywords: critical illness; health equity; health disparities; United States; consensus workshop

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Overview

Approximately 5 million people are admitted to U.S. ICUs each year. Death is common, and among those who survive, subsequent morbidity is also common. Morbidity can include physical disability, cognitive impairment, mental health illnesses, and financial toxicity.

Although advances in the management of critically ill patients have reduced overall mortality and morbidity, racial and ethnic disparities persist in U.S. critical illness outcomes. Risk of critical illness, access to critical care, the quality of that care, and the consequences of critical illness remain unequally distributed within American society. Growing attention to racial and ethnic disparities during and after critical illness demands scientists think critically about research goals moving forward. This research summarizes current evidence regarding inequities in critical care delivery and outcomes, and describes a multidisciplinary committee process to identify priorities for future research in four areas: *1*) mechanisms that underlie disparities and can be targeted for the future development of structural and organizational interventions to reduce disparities, *2*) well-defined outcomes that assess meaningful differences in patient-centered care outcomes, *3*) data resources needed to better elucidate the complex factors driving inequities, and *4*) research methods to advance the identification of disparities and development of interventions to address disparities. This statement provides a research agenda and recommendations for clinicians and scientists to design and conduct rigorous research, with a goal of eliminating racial and ethnic inequities in critical care delivery and outcomes in the United States.

Key Conclusions and Recommendations

Priority areas for research. MECHANISMS. Priority mechanisms included measuring variability in adherence to evidence-based care and continuing to explore the role of patient–clinician or family–clinician communication in treatment decisions. Although considerable attention has been devoted to disparities in communication in end-of-life care, communication also may play a role in other disparate critical care experiences and outcomes.

OUTCOMES. Hierarchical outcomes (e.g., outcomes that incorporate multiple endpoints and trade-offs between endpoints) were considered highly impactful and feasible, as they take into consideration how patients, families, and health systems balance complex, interconnected needs and resources. Hierarchical outcomes can also overcome the equity-relevant challenges encountered with individual outcomes; for example, hospital readmission may be an undesirable outcome only insofar as patients have access to high-quality outpatient care.

DATA RESOURCES. Many novel data resources were expected to have high potential impact on reducing U.S. critical illness disparities, but all were limited by contemporary feasibility concerns. For example, the committee expressed interest in the inclusion of minority-serving hospitals in research networks and the use of longitudinal data and individual- and structural-level equity variables to holistically model health risks and impacts. However, these priority areas were believed to be infeasible at present because improved measure development and research infrastructure would first be needed.

METHODS. Priority research methods included the use of directed acyclic graphs (DAGs), qualitative and mixed-methods designs, interdisciplinary research teams, multisite studies, and quality collaboratives.

Recommendations. INCLUDE DIVERSE PERSPECTIVES. Relevant experts include patients, families, and community members (i.e., through qualitative and mixed-methods, community-based participation research); minority-serving hospital administrators who may face greater or unique resource limitations (because of the collinearity of race, ethnicity, and wealth in the United States); social scientists and other interdisciplinary colleagues, who have a longer tradition than biomedical scientists of engaging in mechanistic and interventional equity scholarship; and health system administrators, regulators, and policymakers, who are instrumental to implementation. Regarding methodological diversity, there are many potential strategies to support interdisciplinary science, such as the inclusion of social scientists in clinical departments and clinician professional societies, a commitment to training clinician–social scientists in medical scientist training programs and other similar programs, and grant programs that require interdisciplinary team science.

Use measures that promote whole-person care. These include the use of hierarchical outcomes that more accurately represent the trade-offs that all critically ill patients face and that may be magnified with social disadvantage, as well as the use of measures that recognize social, financial, and life-course risks for and impacts from critical illness (e.g., financial toxicity, biosocial pathways, social drivers of health).

Focus on causal inference. Committee members recommended the use of DAGs to precisely and comprehensively identify factors causally related to disparate health outcomes. They also highlighted a need to not only describe disparities (e.g., systematic measurement error in medical devices) but also link them to patient outcomes (e.g., increased mortality), as the former may compel action solely on a moral basis, while the latter demands action.

Build datasets for health equity research. Nearly all data-related topics were believed to have high potential impact but were limited by feasibility barriers, suggesting an urgent need for improved data resources. Building harmonized datasets with sufficient detail that capture patient-, clinician-, and system-level contributors to disparities from multiple institutions will require concerted effort, intentional inclusion of diverse institutions (e.g., minority-serving, community, and rural hospitals), and standardized measurement of social risk factors. Consolidation in the healthcare market may advance the goal of large, contemporary, and inclusive data sources as healthcare systems acquire community and rural hospitals and increasingly coalesce on a small number of electronic health record vendors. Efforts to organize additional equity-focused registries may be best coordinated by national critical care organizations.

Expand the narrative of critical illness. Much of the existing critical care disparities scholarship has focused very narrowly on an ICU stay as a defining moment in a person’s life rather than considering a person’s life course and social network as punctuated by an episode of critical illness. Thinking about the risk factors that lead to critical illness (e.g., biosocial pathways such as lifetime trauma or environmental exposures) and the support structures that enable recovery (e.g., health-related social needs, caregiver resources) may better inform critical illness prevention efforts, care delivery in the ICU, care transitions from ICU, and recovery services.

Maintain a focus, even if long term, on intervention development and testing. The primary goal of disparities research is reducing and even eliminating inequities in healthcare processes and outcomes. As such, we recommend prioritizing descriptions of disparities that also identify actionable targets for policy or intervention. We suggest that proposals and papers of descriptive research explicitly identify how the knowledge gained will uncover mechanisms of disparities or inform interventions to promote equity. Critical care researchers can also consider how to translate and pilot effective equity-building interventions from other areas of medicine. Finally, attention to intervention implementation will be essential to advancing equity in critical care, as many healthcare interventions are developed in well-resourced institutions and may have limited fidelity in resource-limited settings.

Affirm health equity as critical to and inseparable from public health. Prioritizing health equity research cannot be accomplished by scientists alone, and population health cannot be achieved without sustained attention to health among socially disadvantaged populations. Health systems, critical care professional organizations, journal editorial boards, private foundations, and philanthropists must remain committed to addressing systemic barriers to good health. In addition, a commitment to health equity can be affirmed by incorporating health equity scholars and a focus on unequal health outcomes into all aspects of organizational missions.

Introduction

More than 2 million people from racially or ethnically minoritized groups are admitted to ICUs in the United States each year (1). Compared with White patients, they are more likely to experience delays in antibiotic administration (2), undetected hypoxemia (3–5), incorrect estimation of mortality risk (6, 7), insufficient symptom management (8), low-quality clinician communication (9, 10), and financial hardship (11–13). Most concerning, they are more likely to die during hospitalization (14–16) and within the following year (17–19). If they survive, they are more likely to receive low-quality rehabilitation and experience persistent disability (20–24). Similar disparities are present among critically ill children (25, 26). Disparate risks for critical illness, processes of critical care, and critical illness outcomes demonstrate that access to health, inclusive of critical care, is not distributed equally within our society.

Despite knowledge of racial and ethnic disparities in critical illness outcomes in the United States for more than 30 years (27) and advances in ICU care, disparities have persisted (28). An analysis of more than 1 million admissions to more than 200 U.S. ICUs between 2006 and 2016 revealed that although overall critical illness mortality decreased by 2% per year, there was no change in mortality in hospitals that served a disproportionate share of Black or Hispanic patients (28). Studies further demonstrated that White patients were more likely than patients from racially or ethnically minoritized groups to benefit from 21st-century advances in critical illness management for sepsis, acute respiratory failure, and pneumonia (29–33).

One reason for the lack of improvement in disparate outcomes is that critical care health equity scholarship infrequently identifies or addresses root causes of disparities. For example, although robust evidence demonstrates that variation in hospital or ICU quality (i.e., “center effects”) explains a large proportion of racial and ethnic differences in critical illness outcomes (34–37), few studies have endeavored to identify underlying mechanisms of disparities, such as biased ICU care processes or policies. Even fewer have sought to intervene on culprit mechanisms (38). Indeed, many studies instead focus on patient-level factors, wrongly suggesting that biological differences between racial groups may exist (39) or misrepresenting causal mechanisms (e.g., patient mistrust vs. health system untrustworthiness [39–41]). These are not simply semantic missteps; the focus and language of research can perpetuate harmful stereotypes about patients and incorrectly identify ideal targets for future interventions (42, 43). In addition, there is a substantial imbalance between our extensive documenting of disparities and our infrequent development of interventions to address inequities in the critical care continuum, particularly when compared with fields such as cardiology, cancer screening, and primary care (44–47). Taken together, we contend that better defined research priorities are needed to effectively and efficiently target the production of knowledge most likely to improve equity in critical illness outcomes.

Thus, the objective of this research statement was to identify high-priority research topics for reducing racial and ethnic inequities in U.S. critical care medicine. The narrow focus on the United States was necessary because of its unique healthcare system structure and financing and enduring legacy of racism. When considering inequities in critical care, it is clear that individuals with a racial or ethnic minority identity are at greater risk of developing critical illness, including facing higher rates of chronic disease (48), decreased access to preventive care (49), and chronic stress of social marginalization (50, 51). We noted these important contributors, but to keep a narrow scope, we focused on inequities beginning at inception of critical illness and spanning recovery from critical illness. Racism remains a fundamental cause of socioeconomic inequality, and thus socioeconomic disparities in critical illness treatment and outcomes will have a consistently disproportionate impact on individuals from minoritized racial and ethnic groups (52–55). Thus, socioeconomic disparities were included within the scope of this work insofar as they intersected with racial and ethnic disparities.

To achieve our objective, we leveraged public health critical race (PHCR) praxis (56). PHCR praxis emphasizes structural determinism: that structural elements of systems and institutions largely determine outcomes between different groups. PHCR praxis involves the assessment of contemporary characteristics of racialization and whether racialization has shaped existing knowledge on a topic, including how it has been conceptualized and measured. Its aim is to build knowledge that improves racial equity and interrupts the structural causes of inequities (56, 57). A PHCR framework for our objectives included critically assessing the existing literature, identifying methods and data needed to determine structural deficits, and ascertaining the most promising opportunities for structural changes to reduce racial and ethnic disparities in critical care outcomes.

Methods

Committee Composition

The co-chairs were a White, female sociologist (K.E.H.); a Black, male pulmonary and critical care physician–scientist and hospital administrator (J.D.T.), and an Indian American, female pulmonary and critical physician–scientist (D.C.A.). All were health equity investigators. The co-chairs convened a multidisciplinary committee of 22 individuals with topic expertise in adult and pediatric critical care medicine, emergency medicine, palliative care, nursing science, sociology, rehabilitation science, post–acute care services, social drivers of health, and hospital administration, as well as a wide range of methodological expertise. Committee members were diverse in gender, race, ethnicity, and career stage (Table 1). Many committee members had experience conducting health equity research. In addition, many committee members were clinicians and practiced in varied care settings, including academic, community, federal, and critical access or rural settings. Given the focus of this report on U.S. health inequities, nearly all committee members worked exclusively in the United States. However, two committee members with experience working in the United Kingdom and conducting comparative health systems research were included to share guiding principles that may be transferable among high-income countries. The committee was divided into three working groups, each with one or two assigned leaders: pre-ICU (T.S.V.), in-ICU (C. Brown and A.A.H.), and post-ICU (S.J.). Patient and family representatives were not included in the committee, because monetary compensation for time spent on preparation of this report was not allowed. Potential conflicts of interest were disclosed and managed in accordance with the policies and procedures of the American Thoracic Society (ATS).

Phase 1: Scoping Reviews of Existing Evidence

Working group leaders conducted three separate scoping reviews, focusing on evidence of racial or ethnic disparities in care during *1*) the period between onset of critical illness and ICU admission, *2*) ICU admission, and *3*) recovery after critical illness. Co-chairs and working group leaders met monthly to refine search strategies and review search results.

Scoping reviews used the Ovid MEDLINE, Embase, and PubMed databases and included studies from database inception until at least March 2024. Search strategies included combinations of Medical Subject Headings and title or abstract terms related to *1*) race, ethnicity, and disparities; *2*) critical care and critical illness; and *3*) the care continuum (e.g., prehospital care, emergency services, sepsis, acute respiratory failure, postacute care, rehabilitation, survivorship, post–intensive care syndrome). To increase the efficiency of the search and review process, we also included articles from existing reviews of racial and ethnic disparities in ICU care published in 2022 and 2024 (14, 58).

Table 1. Committee Demographics

Number	22
Gender, *n* (%)	
Female	15 (68)
Male	7 (32)
Race and ethnicity, *n* (%)*	
White	11 (50)
Asian	8 (36)
Black or African American	4 (18)
Middle Eastern or North African	1 (5)
Hispanic	0
Profession (in addition to scientist), *n* (%)*	
Physician	16 (73)
Healthcare or research administrator	3 (14)
Nurse	2 (9)
Sociologist	2 (9)
Physical therapist	1 (5)
Years in current profession, mean (SD)	13 (6)
Engaged in health equity research, *n* (%)	19 (86)
Practice setting, *n* (%)*	
Academic	19 (95)
Federal	4 (18)
Community	3 (15)
Critical access or rural	1 (5)

*Multiple responses were possible.

We included studies involving patients of all ages and all types of critical illness (e.g., medical, surgical, cardiac). Studies conducted exclusively outside the United States were excluded, except when focusing on recovery from critical illness, given the sparsity of U.S. data on this topic. Preprints and articles written in languages other than English were excluded. The pre-ICU group screened 3,486 abstracts and reviewed 393 articles. The in-ICU group screened 817 abstracts and reviewed 169 articles. The post-ICU group screened 949 abstracts and reviewed 40 articles. Group leaders then wrote brief summaries of their reviews, keeping in mind the PHCR framework and reporting whether studies considered structural or systemic mechanistic factors associated with identified disparities. Brief summaries of each scoping review were disseminated to the whole committee before committee meetings to ensure a shared understanding of the existing literature.

Phase 2: Committee Meetings

Two committee meetings lasting three hours each were held via videoconferencing software on June 11, 2024, and June 13, 2024. The overall goal of the meetings was to identify research areas that, if prioritized, would promote equity in U.S. critical care medicine. Perspectives of grantors and journal editors were also prioritized for discussion as an acknowledgment that feasibility is enhanced when scientific priorities can be aligned with funding and publication priorities. Meetings were recorded.

The first day comprised an overview of PCHR praxis as a guiding framework for committee meetings and this report, summaries of literature reviews from each of three working groups, and a review of grantor resources to support health equity research (e.g., topics of requests for applications). Finally, committee members met with their assigned working group leaders to discuss existing literature related to pre-, in-, or post-ICU care and priorities within these categories. These breakout groups facilitated discussion of the literature reviews and identified areas for new or further inquiry within each area of the critical care continuum.

The second day comprised a primer on contemporary social science inequity research methods and a discussion of ATS journal editorial priorities for health equity research, which were presented by journal editorial board members. Then, committee members rotated among three breakout groups focused on identifying inadequately characterized mechanisms of critical care inequities, data needed to study critical care inequities, and appropriate outcomes to quantify the impact of critical care inequities. Breakout groups were facilitated by working group leaders using a consistent set of prompts.

Phase 3: Survey Development, Dissemination, and Analysis

Two co-chairs (K.E.H. and D.C.A.) conducted a content analysis of recordings of both committee meetings to develop a comprehensive list of all research priorities proposed by committee members across both days. These were reviewed with working group leads to identify omissions and organize research priorities into distinct categories. A Qualtrics web survey containing these priority areas was then disseminated to all committee members (Table 2). Informed by the PHCR framework and goal of ascertaining the most promising opportunities for structural changes to reduce racial and ethnic disparities in critical care outcomes, members were asked to rate each research area on two criteria – feasibility of research in this area and expected impact on patient outcomes of research in this area – using a 4-item Likert agreement scale (strongly agree, agree, disagree, strongly disagree). The language of feasibility and impact statements varied slightly based on type of research area (*see* Table E1 in the data supplement).

Once the survey was completed by committee members, summary statistics (i.e., mean, SD) of Likert response values were calculated. Research priorities were categorized as highly feasible or highly impactful if $\geqslant$85% of individual responses indicated agreement or strong agreement with that measure. Then, a feasibility–impact matrix was created to prioritize research areas according to survey response values: highly feasible and impactful (highest priority), highly impactful but less feasible (strategic investments), highly feasible but less impactful (foundational), and less feasible and impactful (exploratory). Research priorities were shared with committee members as a form of member checking.

Phase 4: Document Development

Co-chairs and working group leaders wrote the manuscript, which was shared with all committee members for feedback and iterative revision. The ATS Board of Directors approved the present version of the manuscript for publication.

Results

In what follows, we first summarize the literature on disparities across the critical illness trajectory, from the onset of critical illness to post-ICU care and recovery. We include disparities in outcomes and draw attention to disparities in care delivery, which can inform structural opportunities to address inequities. We then review the research priority matrix that resulted from the two-day workshop and committee survey, highlighting the areas considered most impactful and most feasible through the lens of the PHCR framework.

Summary of Disparities between Critical Illness Onset and ICU Admission

Among articles that focused on disparities before ICU admission, common topic areas included trauma (59–68), stroke (69–75), coronavirus disease (COVID-19) (76–94), maternal or neonatal health (95–103), and pediatric health (80, 81, 86, 104–111). The most common outcome of interest within the identified studies was ICU admission (76–87, 89–95, 97, 98, 101, 106–108, 110–113). Other outcomes included critical illness diagnoses (e.g., acute respiratory distress syndrome) (89, 114) and treatments (initiation of antibiotics [112], mechanical ventilation [76–78, 81, 88, 90, 94, 112], and targeted temperature management [115]).

Most studies demonstrated that individuals from racially or ethnically minoritized groups experienced worse outcomes than White patients. For example, patients from minoritized groups, and most commonly Black patients, were more likely than White patients to have severe illness at presentation (106), receive mechanical ventilation (77, 78, 87, 88, 90, 94, 112), and be admitted to ICUs (68, 77–79, 90, 92–95, 97–99, 101, 106–108, 110, 111, 113, 116). Racial and ethnic disparities in triage and acute pain management were also demonstrated across many decades (117–120). These findings were consistent in nearly all studies, although a small subset of COVID-19 studies of ICU admission revealed that White patients were more likely to receive ICU care than minoritized patients

Table 2. Research Priorities

Mechanisms

- **Access to critical care:** Distribution of ICU beds (e.g., absolute scarcity in rural areas) and high-quality ICU beds (e.g., relative scarcity in minority-serving hospitals)
- **Biosocial pathways:** Biosocial risks (e.g., epigenetic aging, air pollution) for critical illness incidence and severity
- **Caregiver support structures:** Availability or capability of caregivers
- **Communication:** Ineffective or biased communication about treatment decisions between clinicians and patients or families
- **Community health–promoting resources:** Community-level social needs or resources (e.g., rehabilitation or recreation facilities)
- **Diagnostic heuristics:** Cognitive biases in treatment decisions (e.g., atypical symptoms of myocardial infarction are more common in women)
- **Health-related social needs:** Individual-level social needs (e.g., housing quality, food insecurity, safety, transportation) or resources
- **Medical devices:** Bias in device (e.g., pulse oximetry, AI) development, function, or implementation
- **Payment policies:** Structure and application of financial incentives (e.g., sepsis compliance measure disproportionately penalize low-resource hospitals, discharge practices to reduce in-hospital mortality)
- **Resource-limited therapies:** Access to ECMO, eCPR, clinical trials, transplant, etc.
- **Risk prediction:** Bias in risk prediction model development, function, or implementation
- **Variability in evidence-based care:** Delays in or incomplete adherence to evidence-based care
- **Variability in other care:** Variability in care processes where guidelines may not exist (e.g., timing of palliative care consultation, thresholds for ICU admission)
- **Workforce diversity:** Limited diversity of the critical care workforce (physicians, nurses, advanced practice providers, etc.)

Outcomes

- **Acute care use:** Including length of stay, ICU admission, and other outcomes
- **Hierarchical outcomes:** Outcomes that incorporate multiple endpoints and trade-offs between these (e.g., quality of death and ICU length of stay)
- **Hospital costs:** Costs borne by hospitals or health systems in care delivery
- **Patient costs or financial hardship:** Healthcare costs borne by patients and families and related financial distress
- **Person-reported health outcomes:** Outcomes directly reported by patients or caregivers (e.g., HRQOL)
- **Person-reported interpersonal outcomes:** Between patients or caregivers and clinicians or systems (e.g., trust, alliance)
- **Post-ICU or survivorship outcomes** (e.g., SF-36 physical functioning, return to work)

Data

- **Individual equity variables:** Inclusion in data of individual-level equity-relevant variables (e.g., SDoH, patient experience measures)
- **Longitudinal data:** Inclusion of longitudinal data to support life course research
- **Minority-serving hospitals:** Inclusion in data of hospitals that serve a disproportionate share of patients from racially or ethnically minoritized groups
- **Structural equity variables:** Inclusion of structural-level equity-relevant variables (e.g., workforce diversity, hospital policies) to ascertain equity-relevant variables
- **Unstructured data:** Inclusion in data of unstructured data (e.g., EHR notes)

Methods

- **Critical framing:** To inform research design and interpretation (e.g., mistrust among patients vs. trustworthiness of clinicians or system)
- **Community-based participatory research:** To center the voices of community members
- **Directed acyclic graphs:** To provide an *a priori* understanding of hypothesized causal mechanisms
- **Interdisciplinary teams:** To incorporate multiple clinical or other disciplinary perspectives
- **Intersectional methods:** To understand the experience and effect of intersectional identities (e.g., Black race and female gender)
- **Multisite studies:** To understand within- and between-institution differences
- **Structural equation modeling:** Or other similar methods to capture complex relationships between variables (e.g., various social drivers of health)
- **Qualitative and mixed methods:** To center the voices of patients and caregivers
- **Quality collaboratives:** To unite multiple stakeholders in collaboratively identifying improvement priorities, deploying interventions, and collecting data

Definition of abbreviations: AI = artificial intelligence; ECMO = extracorporeal membrane oxygenation; eCPR = extracorporeal cardiopulmonary Resuscitation; EHR = electronic health record; HRQOL = health-related quality of life; SDoH = social determinants of health; SF-36 = 36-Item Short Form Health Survey.

(84, 85, 91), whereas others showed no difference in ICU use by race or ethnicity (82, 83, 89). These inconsistencies were also noted in pediatric critically ill populations with COVID-19 (80, 81, 86).

Obstetric and neonatal critical illness. Studies examining maternal or neonatal health also had inconsistent findings in terms of disparities. Asian, Pacific Islander, Black, and Hispanic patients seemed to have the most access to maternal and neonatal ICU care (102, 103, 121). This finding may have been attributable to residence in dense, urban areas and access to larger hospitals. However, birthing persons and newborns from minoritized groups were more likely to experience peri- or postbirth events (e.g., cesarean and preterm delivery, hemorrhage) that resulted in ICU or neonatal ICU admission (95, 97–101).

Underrepresented populations. The literature on critically ill Native American patients and patients with non-English preferred languages was mixed and limited. Although Native Americans tended to have the least access to critical care services (102, 121), some studies revealed that Native American and Hispanic patients were less likely to develop acute respiratory distress syndrome than White patients (114). Other studies suggested that seriously ill patients with limited English proficiency experienced disparities in pain assessment and triage (122), although another study found they were more likely to be admitted to ICUs (87). Patients with non-English preferred languages were commonly excluded from research (123).

Potential mechanisms: triage, transfer, and delays. Decreased or delayed access to critical care may contribute to some of the observed differences. For example, longer travel times from rural and congested urban areas were associated with increased mortality among patients with traumatic injuries (59). Studies from urban areas including New York City, Chicago, and Los Angeles demonstrated that census tracts with majority-Black populations were more likely to be located in urban trauma deserts (i.e., areas without trauma centers) (60). In addition to living in trauma deserts, Black and Hispanic trauma patients were more likely to be inappropriately undertriaged and sent to nontrauma centers than White patients with similar injuries (61, 124–126). Lack of access to timely trauma care at level I or II trauma centers was also more likely to occur if a patient was uninsured or from a census block with a high proportion of residents eligible for Medicare or Medicaid (65, 66). Undertriage was associated with increased mortality due to delays in time-sensitive and lifesaving care (64). Among pediatric patients, Black children with fever received lower triage scores than White children (127). In addition, uninsured trauma patients, despite being younger and having lower injury severity scores than those with insurance, had significantly higher mortality. Also, there were significant interactions between underinsurance and Black race or Hispanic ethnicity (62, 63). The roles of ICU admission and quality of ICU care in these disparities was unclear (67).

Similarly, disparities in prehospital stroke recognition by emergency medical services (EMS) personnel were noted. In an analysis of 3,700 stroke patients transported via EMS to hospitals in California, prehospital stroke recognition was lower among Hispanic and Asian patients compared with White patients (69). Only 60% of stroke patients in the United States arrived to the hospital by EMS, and racially minoritized groups had lower rates of use than White patients (70). Similarly lower odds of EMS use in Hispanic compared with White patients were also seen from 2014 to 2019 in the Paul Coverdell National Acute Stroke Program (71).

Five studies reported conflicting results regarding whether Black patients experienced longer wait times in lower resourced or at-capacity hospitals and whether delayed ICU admission was a causal mechanism of increased in-hospital mortality among critically ill Black patients (28, 72, 73, 128, 129). Retrospective studies of ischemic and hemorrhagic stroke patients suggested that Black patients waited longer in in the emergency department and were less likely to undergo computed tomography within guideline-recommended time limits compared with White patients (74, 75), and similar disparities existed in guideline-concordant triage and testing for chest pain (120). The identification of potential root causes of pre-ICU disparities was largely limited to the studies above, describing disparities in access, triage, transfer, and timely goal-concordant evaluation across a range of conditions.

Interventions. A few studies have shown success in reducing pre-ICU disparities, including increasing stroke recognition (130), reducing time to treatment for myocardial infarction (131) and sepsis (132), and the implementation of a national maternal hemorrhage safety bundle (133).

Summary of Disparities during ICU Admission

Studies on disparities during ICU admission largely examined differences by type of organ dysfunction or disease, and focused on respiratory failure, sepsis, traumatic injuries, cardiovascular critical illness, and neurologic critical illness. A separate focus was on serious illness communication and end-of-life care during ICU admission.

Respiratory failure. Challenges were noted in measuring racial and ethnic differences in acute respiratory failure, including inappropriately aggregated racial and ethnic categories (e.g., “non-White”) and variation in the case definition of respiratory failure (134). Still, the evidence suggested that Black patients experienced nearly double the incidence of acute respiratory failure requiring ICU admission (135), as well as longer lengths of stay than White patients (136). Black, Hispanic, Asian American, and Pacific Islander patients also had increased odds of in-hospital mortality from acute respiratory failure than White patients (137). Some studies suggested variability in illness severity at admission was a mechanism for mortality differences (19), although risk prediction scores may also be a source of bias, overestimating illness severity among Black patients (6, 138). Following respiratory failure hospitalizations, Black patients experienced higher rates of readmission than White patients (139–141).

Evidence of prolonged hospitalization for COVID-19 among Black and Hispanic patients compared with White patients was noted (142, 143). Hospital factors were implicated in racial differences in COVID-19 mortality (36).

Sepsis. A recent review concluded that evidence from large, nationally representative cohorts demonstrated higher sepsis mortality among Black patients compared with White patients (33, 34, 137, 144, 145). Disparities in sepsis mortality were also found between Hispanic and White patients despite evidence suggesting no differences a decade earlier (15, 34). Regarding nonmortal outcomes, Black patients experienced greater sepsis incidence, longer hospitalizations, and more readmissions than White patients (136, 144, 146). Adjustment for socioeconomic factors, comorbidities, and geographic differences (144, 147, 148) attenuated racial differences; however, some of these factors may represent modifiable mechanisms to improve equity. For example, hospitals that treat greater proportions of Black patients reported lower adherence to sepsis bundles and antibiotic administration (2, 32).

Cardiovascular critical illness. Patients from racially minoritized groups experienced higher mortality and lower rates of goal-directed therapy and timely revascularization when experiencing acute myocardial infarction and cardiogenic shock (149, 150). After experiencing out-of-hospital cardiac arrest, Black and Hispanic men were more likely to die compared with White men (151). Black and Hispanic patients were also less likely to receive mechanical circulatory support compared with White patients (152). Black and Hispanic patients received more hemodialysis, gastrostomy tubes, and tracheostomies after out-of-hospital cardiac arrest (153) but fewer evidence-based postresuscitation therapies such as cardiac catheterization and targeted temperature management after in-hospital and out-of-hospital cardiac arrest (154).

Neurologic critical illness. Black patients had higher age- and sex-standardized acute ischemic stroke incidence compared with White patients (155–157). Data from the Northern Manhattan Study reported a twofold greater risk of stroke among Hispanic individuals compared with White individuals (158). Differences in care limitations and palliative care were also noted after intracranial hemorrhage. Asian, Hispanic, and Black patients were more like to choose fully restorative care and less likely to receive palliative care compared with White patients (74, 159–161). In a possibly related finding, a nationwide sample demonstrated that Black patients who experienced subarachnoid hemorrhage had lower in-hospital mortality and a lower likelihood of discharge home compared with White patients (162).

Serious illness communication and end-of-life ICU care. In the last six months of life, racially minoritized patients were more likely to be hospitalized and admitted to ICUs, to receive mechanical ventilation and cardiopulmonary resuscitation, and to die in-hospital (14, 163–167). It is not definitively known whether such differences in end-of-life care are concordant with patient preferences. Some evidence suggested greater preference for life-sustaining treatments among Black and Hispanic patients (168–173), whereas other studies revealed that Black patients were less likely to receive goal-concordant care regardless of whether they preferred high-intensity or comfort-focused care (174, 175). The role of palliative care use in end-of-life care quality outcomes was also mixed (164, 176–178).

Ineffective serious illness communication, both preceding and during critical illness, was associated with racial inequities in palliative and end-of-life care (179–183). Racially minoritized patients were more likely to experience poor-quality communication during serious and critical illness (9, 10, 184–189). Poor-quality communication, including limited services and resources for patients with limited English proficiency (190) and lack of culturally tailored education and communication tools, contributed to low knowledge about and completion of advance care planning that influenced decisions about ICU therapies (191–194), missed opportunities for clinicians to respond to patient and family concerns (195, 196), goal-discordant patient care, and complicated grief among caregivers (195, 197, 198).

Summary of Disparities during Recovery from Critical Illness

Among the studies that focused on disparities during recovery from critical illness, four major topic areas were identified: functional recovery, hospital readmission, post–acute care service use, and financial and social supportive resources necessary for recovery.

Functional recovery and hospital readmission. In most studies of ICU survivors, minoritized individuals experienced worse impairments in physical functioning, cognitive functioning, and mental health after critical illness (18, 199, 200). Black sepsis survivors were also more likely to be readmitted to hospital than White sepsis survivors (146). Studies of the effect of socioeconomic position, which is highly correlated with race and ethnicity in the United States (201), had similar results (55, 202). Lower socioeconomic position was associated with worse mental health after critical illness (55), and among older adults, with greater disability and dementia in the year after ICU discharge (54). Socioeconomic deprivation was also consistently associated with greater readmission risk after critical illness hospitalization (202, 203). Notably, no studies were found that evaluated differences in in-ICU processes of care and subsequent disparities in post-ICU physical, cognitive, or mental health.

Post–acute care service use. A few studies investigated disparities in post–acute care service use that could adversely affect recovery after critical illness. These found racial differences in the use of long-term acute care hospitals that did not persist after accounting for insurance status, suggesting insurance as an access-related barrier (22). In addition, patients admitted to long-term acute care hospitals located in Black-predominant and more racially segregated neighborhoods were less likely to achieve functional improvement (23). Similar observations were made regarding lower use of home health care and poorer quality of skilled nursing facility care when comparing Black and Hispanic patients with White patients after discharge from the hospital (20, 21).

Financial and supportive service availability. Studies have shown that financial, social, and caregiving structures of support are crucial to recovery from critical illness (24, 204, 205), but the financial costs of caregiving and economic hardship are experienced inequitably according to racial and ethnic identity (206–208).

Summary of Research Priority Matrix

A review of workshop recordings resulted in 35 research topics that were organized into connected but distinct categories: mechanisms, data sources, outcomes, and methods. Table 2 contains a full description of the research topics within each category. Twenty of 22 (91%) committee members completed a survey rating the feasibility and impact of each research topic. Mean feasibility and impact scores are reported in Table 3. Research topics were further categorized as *highly* feasible or *highly* impactful if $\geqslant$85% ($n \geqslant 17$) of individual responses indicated agreement or strong agreement. Figure 1 presents a prioritization matrix of all research topics on the basis of this categorization. Nearly all topics related to methods and data were considered highly impactful.

Summary of Priorities Related to Mechanisms

The committee identified 14 mechanisms of health disparities in critical care medicine that should be prioritized for research (Table 2). Two were deemed highly impactful and highly feasible: *1*) the role of patient–clinician or family–clinician communication in treatment decisions and *2*) variability in adherence to evidence-based care (Table 3).

Patient–clinician or family–clinician communication as a mechanism for disparities in critical care has been studied most in end-of-life care and decision making for life-sustaining treatments (6, 9, 209). Given persistent evidence of differences in communication in end-of-life care (189, 210), communication may also play a role in other disparities in critical care experiences and outcomes. Evidence suggests variation in clinician-to-clinician communication in handoffs (211, 212) and discussion of social determinants of health (213); these may be implicated in patient outcomes and disparities. Furthermore, variation in patient and family education regarding prognosis, recovery timeline, and support services could also contribute to disparities (214–216). Challenges to studying communication include a limited ability to glean sufficient detail from existing data sources, such as electronic health records, and challenges in sharing prospectively collected qualitative data due to clinician and patient privacy concerns. Despite these challenges, significant evidence of communication as a driver of inequities

Table 3. Research Priorities and Committee Ratings

	Impact of Research on This Topic (*n* = 20)		Feasibility of Research on This Topic (*n* = 20)	
Research Gap	**Mean (SD)**	**Agreement* [*n* (%)]**	**Mean (SD)**	**Agreement* [*n* (%)]**
Mechanisms				
Health-related social needs	3.60 (0.60)	19 (95)[†]	3.05 (0.69)	16 (80)
Variability in evidence-based care	**3.50 (0.61)**	**19 (95)**[†]	**3.25 (0.64)**	**18 (90)**[†]
Communication	**3.45 (0.60)**	**19 (95)**[†]	**3.30 (0.57)**	**19 (95)**[†]
Diagnostic heuristics	3.40 (0.60)	19 (95)[†]	2.85 (0.59)	15 (75)
Variation in other care	3.35 (0.75)	17 (85)[†]	3.05 (0.76)	15 (75)
Medical devices	3.30 (0.80)	18 (90)[†]	3.05 (0.69)	16 (80)
Caregiver support structures	3.25 (0.64)	18 (90)[†]	2.75 (0.79)	13 (65)
Payment policies	3.20 (0.77)	16 (80)	3.20 (0.70)	17 (85)[†]
Resource-limited therapies	3.10 (0.72)	16 (80)	3.25 (0.79)	18 (90)[†]
Biosocial pathways	3.10 (0.72)	16 (80)	2.65 (0.75)	12 (60)
Workforce diversity	3.00 (0.92)	14 (70)	3.65 (0.59)	19 (95)[†]
Community health–promoting resources	3.00 (0.79)	16 (80)	2.85 (0.81)	16 (80)
Risk prediction	2.90 (0.79)	15 (75)	3.00 (0.73)	15 (75)
Access to critical care	2.75 (1.02)	13 (65)	3.35 (0.67)	18 (90)[†]
Outcomes				
Post-ICU or survivorship outcomes	3.50 (0.61)	19 (95)[†]	3.20 (0.89)	16 (80)
Patient costs or financial hardship	3.45 (0.83)	18 (90)[†]	3.10 (0.72)	16 (80)
Hierarchical outcomes	**3.40 (0.60)**	**19 (95)**[†]	**3.00 (0.56)**	**17 (85)**[†]
Person-reported interpersonal outcomes	3.40 (0.82)	18 (90)[†]	2.90 (0.85)	14 (70)
Person-reported health outcomes	3.15 (0.75)	16 (80)	3.40 (0.82)	18 (90)[†]
Acute care utilization	2.90 (0.85)	12 (60)	3.50 (0.51)	20 (100)[†]
Hospital costs	2.80 (1.01)	12 (60)	3.15 (0.81)	18 (90)[†]
Data				
Minority-serving hospitals	3.70 (0.47)	20 (100)[†]	2.90 (0.85)	16 (80)
Longitudinal data	3.55 (0.60)	19 (95)[†]	2.80 (0.83)	13 (65)
Individual equity variables	3.40 (0.60)	19 (95)[†]	2.85 (0.67)	14 (70)
Structural equity variables	3.30 (0.66)	18 (90)[†]	2.70 (0.92)	12 (60)
Unstructured data	3.05 (0.69)	16 (80)	2.60 (0.60)	11 (55)
Methods				
Multisite studies	**3.65 (0.49)**	**20 (100)**[†]	**3.15 (0.67)**	**17 (85)**[†]
Qualitative and mixed methods	**3.55 (0.60)**	**19 (95)**[†]	**3.70 (0.57)**	**19 (95)**[†]
Interdisciplinary teams	**3.50 (0.69)**	**18 (90)**[†]	**3.65 (0.59)**	**19 (95)**[†]
Community-based participatory research	3.50 (0.69)	18 (90)[†]	3.25 (0.79)	16 (80)
Intersectional methods	3.35 (0.75)	17 (85)[†]	3.00 (0.73)	15 (75)
Structural equation modeling	3.35 (0.67)	18 (90)[†]	3.00 (0.73)	15 (75)
Quality collaboratives	**3.25 (0.55)**	**19 (95)**[†]	**3.05 (0.60)**	**17 (85)**[†]
Directed acyclic graphs	**3.05 (0.76)**	**17 (85)**[†]	**3.20 (0.77)**	**18 (90)**[†]
Critical framing	3.20 (0.62)	18 (90)[†]	3.15 (0.81)	15 (75)

Priorities are arranged in order of impact scores. Items in boldface type represent high-impact and high-feasibility items.
*Agreement was defined as those who agreed or strongly agreed with the statement.
[†] Values represent high-impact items or high-feasibility items.

in care throughout medicine (217) suggests a need to thoroughly consider it in addressing disparities in critical care.

Variability in adherence to evidence-based care may also be a mechanism of disparate critical care outcomes. Outcomes from critical illness are complex and often heavily influenced both by events before and after a patient's ICU stay. However, there is strong evidence that delivery of guideline-concordant ICU care remains uneven (218, 219) and disparate (32, 220–222). Where implementation of evidence-based care can be improved, use of best practice alerts has increased uptake of guideline-concordant care and decreased disparities among racial groups (223, 224). As clinical decision support systems in critical care medicine become increasingly common (225, 226), opportunities to address disparities in the use of evidence-based care should also be prioritized.

Other mechanistic priorities considered highly impactful but less feasible to study were the roles of *3)* caregiver support structures, *4)* health-related social needs, *5)* medical devices (e.g., pulse oximeters), *6)* variation in care for which evidence-based guidelines are not established (e.g., timing of palliative care), *7)* diagnostic heuristics, and *8)* biosocial pathways. Concerns about feasibility centered on the nascency of available methods (e.g., for studying biosocial pathways such as epigenetic aging) and a need to build research infrastructure outside of hospitals (e.g., to identify caregiving resources that affect risk of and recovery from critical illness). Mechanistic priorities considered highly feasible to study but as having comparatively less potential impact on reducing critical care inequities were

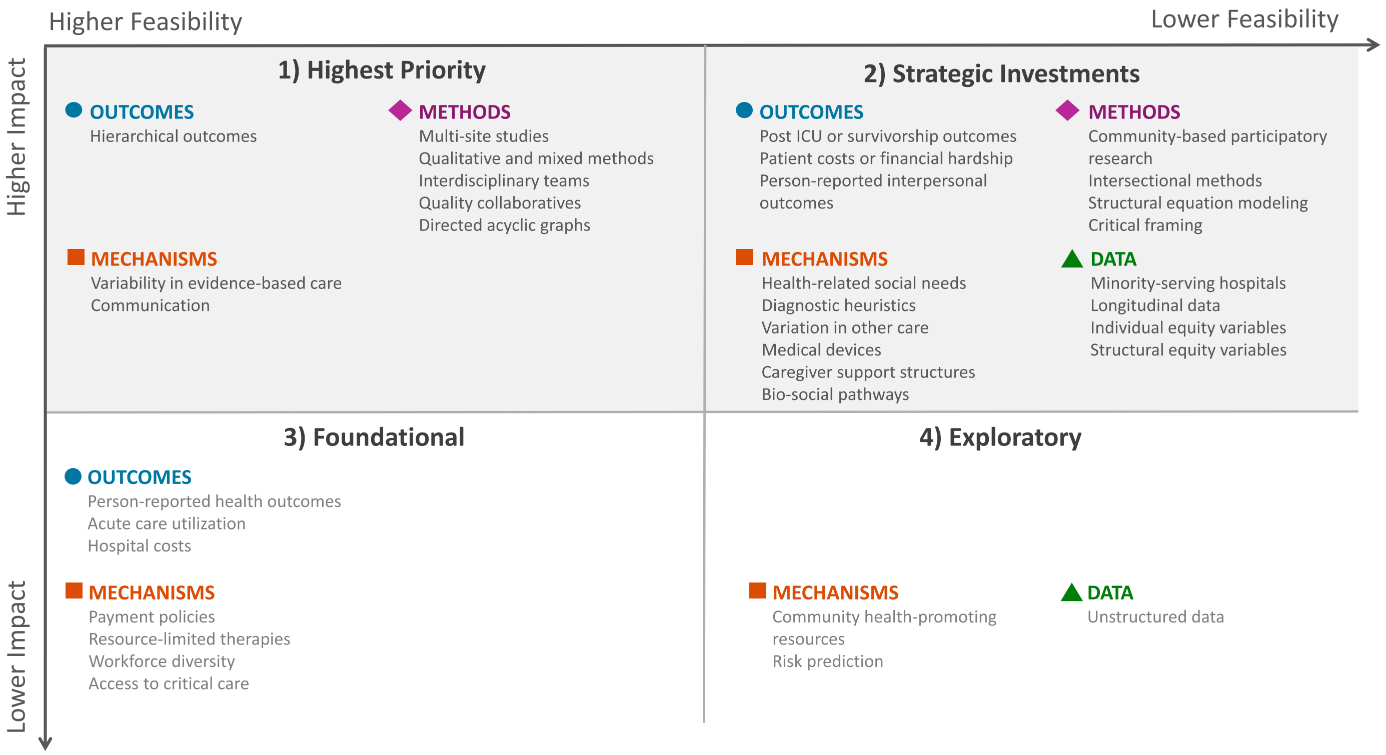

Figure 1. Prioritization matrix of research areas.

9) workforce diversity, *10*) payment policies (e.g., pay for performance, Medicaid eligibility rules), *11*) access to advanced therapies (e.g., extracorporeal membrane oxygenation), and *12*) access to critical care (e.g., ICU bed capacity). Concerns about impact were related to the fact that the power to change many of these mechanisms ultimately lies outside of clinical and research spheres, within regulatory and administrative structures (e.g., payment policies). Finally, two mechanistic topics considered both less feasible and less impactful were *13*) community health–promoting resources (e.g., clean air) and *14*) risk prediction tools.

Summary of Priorities Related to Research Outcomes

The committee identified seven types of research outcomes that would be most likely to advance equity in critical care medicine (Table 2). Of these, one priority was judged to be highly impactful and highly feasible: *1*) the use of hierarchical composite outcomes that incorporate multiple endpoints to address trade-offs between patient-sensitive outcomes (e.g., length of stay vs. readmission risk) (Table 3).

Hierarchical composite outcomes incorporate multiple endpoints ordered by importance into a single ordinal outcome. Hierarchical composite outcomes have been increasingly advocated for in critical care trials because of complex trade-offs between critical illness outcomes (227). For example, there are trade-offs between mortal and nonmortal outcomes (e.g., longevity vs. quality of life) and between hospital-free days and inpatient intensive symptom relief near the end of life, especially among patients who lack robust caregiving support or high-quality hospice care at home (228). Composite outcomes may also better reflect quality of care in circumstances in which, for example, well-resourced hospitals are differentially able to leverage relationships with local hospice agencies to avoid penalties for in-hospital mortality (229). Patient perspectives, inclusive of those from marginalized groups, are critical to the choice and ordering of hierarchical critical care outcomes.

Other outcome types considered highly impactful but less feasible to incorporate in studies were *2*) interpersonal outcomes (e.g., discrimination, trust), *3*) patient cost or financial hardship outcomes, and *4*) post-ICU survivorship outcomes (e.g., 36-Item Short Form Health Survey, return to work). Expected challenges in use of these outcome types included reliably collecting patient-reported outcomes from a seriously ill patient population (230) and the lack of appropriate measures in some cases (e.g., existing perceived discrimination measures are prone to social desirability bias [231]). Outcome types considered highly feasible to include in studies but potentially less impactful were *5*) person-reported experience outcomes (e.g., health-related quality of life), *6*) hospital costs, and *7*) acute care use. Person-reported experience outcomes were deemed to be somewhat less impactful not on their own merit but because they are not highly valued by journals and funders. Hospital cost and acute care use outcomes were perceived, especially when used in isolation, as potentially being at odds with patient-centered outcomes (232).

Summary of Priorities Related to Research Data

The committee identified five priorities related to data resources (Table 3). Most data-related priorities were considered highly impactful but less feasible, including *1*) the inclusion of minority-serving hospitals in research networks, *2*) the inclusion of equity-relevant variables at the individual (e.g., social determinants of health) level, *3*) the inclusion of equity-relevant variables at the structural (e.g., exposome data) level, and *4*) the use of longitudinal data to evaluate life-course risks for and consequences of critical illness (Table 3). Despite increasing focus on social determinants of health (233), further incorporation of equity-relevant variables into data sources was expected to first require advances in measure development, standardized core outcome sets, and data collection procedures. Another barrier to feasibility identified by the committee was the capital investment required to create longitudinal cohorts and activate minority-serving hospitals to build research infrastructure. A final topic was considered less impactful and less feasible: *5*) the inclusion of unstructured data (e.g., electronic health record notes) in research. Concerns about unstructured data included nascent analytic methods, variability in quality and comprehensiveness of documentation, and the perceived discrepancy between documentation and care provision.

Summary of Priorities Related to Research Methods

The committee identified nine research methods that should be prioritized to advance equity in critical care scholarship (Table 2). All methodological priorities were judged to have high potential impact on patient outcomes. Priorities with high feasibility and high impact included the use of *1*) DAGs, *2*) qualitative and mixed methods, *3*) interdisciplinary teams, *4*) multisite studies, and *5*) quality collaboratives (Table 3).

DAGs are tools for describing researchers' hypotheses about mechanisms that causally influence the outcome of interest (234). DAGs clarify how researchers conceptualize race, racism, and their relationship to other variables often included or "controlled for" in estimates of disparate health outcomes (235). In health equity research, DAGs serve two primary purposes. First, they explicitly demonstrate how race (or other measures of identity) is operationalized in the study, for example, as a patient's reported race, as the clinician's perception of the patient's race, as the racialized experience of being ill and seeking care in a race-conscious health system, or as something else entirely. The second purpose is to properly classify covariates, at minimum, as confounders versus mediators (236). This is an important distinction because the former is not on the causal pathway and requires "adjustment" in the analytic approach. For example, in their assessment of influenza vaccine uptake among U.S. adults, Silva and colleagues (237) used a DAG to properly identify geography as a mediator rather than a confounder of racial disparities. Thus, they avoided "adjusting for" this factor, which would have led them to erroneously underestimate disparities or mask important variation. Although the use of causal diagrams in critical care research has been previously called for by the ATS (238, 239), their use in critical care equity scholarship is limited.

Qualitative and mixed methods are crucial for uncovering mechanisms of racial disparities (240). Although many scientists and scientific journals consider qualitative methods to be less rigorous than quantitative methods, they serve different purposes. Quantitative studies can produce generalizable "breadth" of evidence but offer little insight into causal mechanisms or patient priorities relevant to disparities. Qualitative studies cannot be generalized but are indispensable in understanding the "depth" of perspectives of patients, families, and clinicians (9) and in capturing the fundamental structural factors that can affect patient care processes (241, 242) and shape inequitable care. They have provided vital insight into how and why effective interventions in critical care have failed to be consistently implemented (243) or have been implemented in disparate ways (220). Mixed methodologies combine qualitative and quantitative data to leverage the strengths of both approaches. For example, Aysola and colleagues leveraged mixed methods to examine disparities in emergency department throughput times (217), finding that patient–clinician racial concordance improved throughput for some but not all clinicians. Clinicians without variation in throughput times were more likely to rely on objective criteria for decision making, highlighting both a mechanism and potential solution of inequity. Barriers to increased use of qualitative and mixed methodologies include improving access to robust training in these methods and ongoing perceptions among editors and peer reviewers that such methods are inferior to quantitative methods, which can influence funding and publication success.

Interdisciplinary teams are necessary for high-quality clinical care in ICUs. Similarly, critical care research benefits enormously from interdisciplinary teams (244), which may include experts from many biomedical disciplines, computer science and informatics, social science, and public health. Interdisciplinary teams can better identify opportunities for intervention (245), drive effective quality improvement (246), and identify barriers to effective implementation (247).

Multisite studies of representative institutions are needed because hospital care in the United States is highly segregated (248), racial segregation also often implies unequal distribution of capital resources needed to treat critical illness, and the largest clinical trial sites do not reflect the diversity of the U.S. population or the resource limitations of the majority of U.S. hospitals (249). For example, Asch and colleagues found that higher mortality among Black patients hospitalized with COVID-19 was attributable in part to "differences in the hospitals to which Black and White patients were admitted" (36), corroborating an extensive literature about center-level effects on disparate outcomes (34–37). Studies of single or nonrepresentative institutions that do not reveal disparities in care may discourage further investigation into disparate outcomes or minimize our shared responsibility to address disparate access to high-quality care (32). Although multisite databases are increasingly available (250), they often lack sufficient detail on equity-relevant variables, such as social determinants of health; efforts to augment these data sources should continue (251–253).

Quality collaboratives were also considered a high priority. Quality collaboratives organize multiple stakeholders with shared goals to improve care processes and patient outcomes. They can be organized through professional societies, governments, or healthcare payers. They often focus on problems for which there is "evidence of large variations in care, or of gaps between best and current practice" (254) and for which participating organizations can leverage interventions or strategies that have worked at high-performing sites. They set specific performance improvement targets and collect data across organizations to track changes in practices. Quality collaboratives have been used in critical care research to successfully improve pediatric cardiac arrest prevention and resuscitation practices (255, 256), identify effective staff strategies for ICU bundle implementation (257), assess variation in peripherally inserted central catheters (258), and examine variation in COVID-19 illness severity on admission across hospitals (259). Payer-incentivized quality collaboratives, like Michigan's Hospital Medicine Safety Consortium (260), may be especially compelling for addressing disparities in access to higher quality care, as they offer financial rewards for improved outcomes to both higher and lower resourced organizations. However, quality collaboratives require significant financial support to implement. Even when proven cost effective over time, this may limit the realization of their potential.

Remaining priorities with high expected impact but lower ratings of feasibility included *6*) intersectional methods, *7*) structural equation modeling or similar methods, *8*) critical framing, and *9*) community-based participatory methods (Table 3). Concerns about the feasibility of these methodological approaches centered on the need for expertise that is not often found within biomedical sciences, the relative nascency of some methods (e.g., modeling intersectional identities), and the need for community-based research infrastructure.

Discussion

In this report, a committee of 22 experts summarized evidence showing racial and ethnic disparities throughout the critical care continuum and recommended research priorities to promote equity in U.S. critical care medicine.

Guiding Principles from High-Impact Priorities

From a total of 35 priorities, the committee identified 25 that had the highest potential impact on reducing critical care inequities. These high-impact priorities shared common guiding principles that may inform any future equity-relevant research. First, many impactful priorities focused on the *inclusion of diverse perspectives*, spanning patients, families, and community members (i.e., through qualitative and mixed methods, community-based participation research), minority-serving hospital administrators who may face greater or unique resource limitations (because of the collinearity of race, ethnicity, and wealth in the United States), and social scientists and other interdisciplinary colleagues who have a longer tradition than biomedical scientists of engaging in mechanistic and interventional equity scholarship. Second, several high-impact priorities were related to *measures that promote whole-person care*. These included the use of hierarchical outcomes that more accurately represent the trade-offs that all critically ill patients face and that may be magnified with social disadvantage, as well as the use of measures that recognize social, financial, and life-course risks for and impacts from critical illness (e.g., financial toxicity, biosocial pathways, social drivers of health). Finally, a few priorities deemed to be high impact emphasized the importance of *causal inference*. Committee members recommended the use of DAGs to precisely and comprehensively identify factors causally related to disparate health outcomes. They also highlighted a need to not only describe disparities (e.g., systematic measurement error in medical devices) but also link them to patient outcomes (e.g., increased mortality), as the former may compel action only on a moral basis while the latter demands action.

Common Feasibility Barriers: Opportunities for Strategic Investment

The largest category identified by the committee was that of higher impact, lower feasibility priorities. The 17 priorities within this category may be made more feasible through strategic investments in research infrastructure and purposeful shifts in research focus and perspective.

Building datasets for health equity research. Notably, nearly all data-related topics were believed to have high potential impact but were limited by feasibility barriers, suggesting an urgent need for improved data resources. Building harmonized datasets with sufficient detail that capture patient-, clinician-, and system-level contributors to disparities from multiple institutions will require concerted effort, intentional inclusion of diverse institutions, and standardized measurement of social risk factors. Although academic medical centers may be most likely to have the resources to contribute to these efforts, datasets that do not capture minority-serving institutions, community hospitals, and rural hospitals will fail to fully capture the experiences and outcomes of the most socially marginalized patients. Consolidation in the healthcare market may advance the goal of large, contemporary, and inclusive data sources as healthcare systems acquire community and rural hospitals and increasingly coalesce on a small number of electronic health record vendors (261). Efforts to organize additional equity-focused registries may be best coordinated by national critical care organizations (125, 262), such as the ATS, the American Association of Critical-Care Nurses, the American College of Chest Physicians, or the Society of Critical Care Medicine.

Continuing support for interdisciplinary research. Interdisciplinary perspectives and diverse methods are essential to understanding the complex interplay between health care delivery and social structures which shape access to health and healthcare before and after critical illness. There are many potential strategies to support interdisciplinary science, such as the inclusion of social scientists in clinical departments and clinician professional societies, a commitment to training clinician–social scientists in medical scientist training programs and other similar programs (263), and grant programs that require interdisciplinary team science. In addition to methodological experts, patient and community experts, health system administrators, regulatory bodies, and policymakers are all instrumental to effective research design and intervention development and implementation.

Expanding the narrative of critical illness. The PHCR praxis requires thinking critically about our research narratives as well. How we conceptualize disparities, investigate potential mechanisms, and direct valuable resources for intervention should reflect our prioritization of structural and systemic opportunities to address inequity. For example, much of the existing critical care disparities scholarship has focused very narrowly on ICU as the defining moment in people's lives, rather than considering a person's life course and social network as punctuated by an episode of critical illness. Thinking about the risk factors that lead to critical illness (e.g., biosocial pathways such as lifetime trauma or environmental exposures) and the support structures that enable recovery (e.g., health-related social needs, caregiver resources) may better inform critical illness prevention efforts, care delivery in the ICU, care transitions from ICU, and recovery services. Similarly, we must reflect critically on how we describe and measure phenomena related to discrimination, racialization, and inequity. Positive-deviance studies, for example, that explore trustworthiness or accessibility as structural characteristics, rather than trust or literacy within individuals, may help identify scalable features of systems that best serve socially disadvantaged patients.

Next Frontier: Building Equity-focused Interventions in Critical Care

The primary goal of disparities research is reducing and even eliminating inequities in healthcare processes and outcomes. As such, we recommend prioritizing descriptions of disparities that also identify actionable targets for policy or intervention. We suggest that proposals and papers of descriptive research explicitly identify how the knowledge gained will uncover mechanisms of disparities or inform interventions to promote equity.

We specifically sought to prioritize research areas that would lead to substantial improvements in the delivery of equitable critical care and patient outcomes. This also reflects PHCR framing, which aims to build knowledge that can disrupt the structural drivers of health inequities. Critical care researchers should consider how to translate and pilot effective equity-building interventions from other areas of medicine, including primary care, oncology, and cardiology, into critical care, such as effective use of clinical dashboards (46), health-related social needs screening and connection to social resources (264), use of care navigators (265), and best-practice alerts to address cognitive biases (223).

Attention to implementation will be essential to advancing equity in critical care (266). Many healthcare interventions are developed in well-resourced institutions, potentially limiting fidelity in resource-limited institutions. For example, although implementation of sepsis bundles improves sepsis mortality, these are not implemented evenly (220), suggesting that intervention development and deployment should consider which intervention components (e.g., personnel and other costly resources) are truly necessary for implementation. Furthermore, attention to disparities in intervention effectiveness also warrant attention and adaptation to meet the needs of diverse patient populations. Clinical trials should aim for greater inclusion of minoritized patients and conduct analyses that evaluate heterogeneity of treatment effectiveness by demographic subgroups (267–269).

Finally, we note the presence of a clear scientific consensus that institutional, organizational, environmental, procedural, and technical aspects of care can and do result in unwarranted racial and ethnic differences in care and thereby to health inequity (270). There is further scientific consensus that this can occur even in the absence of explicit racial prejudice or explicit racist animus at the point of care, as in the impacts of trauma deserts or pulse oximeters (271). There is also a clear state-of-the-art scientific consensus that actions that have disparate impact, even in the absence of explicit racial prejudice or explicit racist animus, contribute significantly to racial and ethnic disparities in care. As such, attempts to limit interventions to only those remediating explicit racial prejudice or explicit racist animus cannot be considered scientifically state of the art, and there is scientific consensus that they will not by themselves correct consequential racial and ethnic disparities in U.S. critical care medicine.

Current Challenges: Securing Support from Funders, Publishers, and Clinical Organizations

Prioritizing health equity research cannot be accomplished by scientists alone. Undoubtedly, in the early 2020s, a public commitment to racial equity and greater federal funding for health equity research were a catalyst for this field. However, with the recent deprioritization of diversity, equity, inclusion and accessibility to and disinvestment in biomedical research, public insurance, and public health programs, it will be necessary for health systems and payors, private foundations, critical care professional organizations, and philanthropists to increase financial support for health equity and health equity research. In addition, a commitment to health equity can be affirmed by incorporating health equity scholars and a focus on unequal health outcomes into all aspects of organizational missions.

Publishing health equity research will also require support from editorial boards. Health equity research demands diverse methodological approaches and attention to a broader array of outcomes. For journals to prioritize health equity research, inclusion of research using qualitative and mixed methodologies as well as patient experience outcomes is needed. Although external priorities may be dynamic, journals must make and remain steadfast in their public commitments to health equity (272–276) and match these commitments with editorial decision making that demonstrates the value of health equity research.

Health systems and critical care professional organizations must also prioritize health equity in quality improvement efforts, educational activities, advocacy, and clinical guidelines. ATS and allied professional organizations can serve as powerful, independent voices to support health equity as a critical national priority. Addressing systemic barriers to improving the health of all people must remain an essential part of organizational missions.

Conclusions

This document summarizes current evidence regarding inequities in critical care delivery and outcomes, and describes a multidisciplinary committee process to identify priorities for future research in four areas: *1*) mechanisms that underlie disparities and can be targeted for the future development of structural and organizational interventions to reduce disparities, *2*) well-defined outcomes that assess meaningful differences in patient-centered care outcomes, *3*) data resources needed to better elucidate the complex factors driving inequities, and *4*) research methods to advance the identification of disparities and development of interventions to address disparities. This statement provides recommendations for research practices and investments in research infrastructure that will support a proposed research agenda to eliminate racial and ethnic inequities in critical care delivery and outcomes in the United States. ■

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