Eunice Kennedy Shriver National Institute
of Child Health and Human Development

Advances in Pediatric Trauma and Critical Illness Research:

BUILDING THE FIELD— ADVANCING THE SCIENCE

STRATEGIC PLAN

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The NICHD Pediatric Trauma and Critical Illness Branch (PTCIB) supports research and research training in pediatric trauma, injury, and critical illness across the continuum of care.

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Section 1: Introduction

The NICHD Mission

Since its inception in 1962, the *Eunice Kennedy Shriver* National Institute of Child Health and Human Development (NICHD) has dedicated its research to understanding the dynamic biological, behavioral, and social processes that dictate physical, emotional, and cognitive growth (U.S. Department of Health and Human Services, 2000). Research supported by the NICHD endeavors to increase our understanding of development from before birth through adolescence and beyond, with the goal of increasing the health and well-being of all individuals. The mission of the NICHD is to ensure that every person is born healthy and wanted, that women suffer no harmful effects from reproductive processes, and that all children have the chance to achieve their full potential for healthy and productive lives free from disease or disability, and to ensure the health, productivity, independence, and well-being of all people through optimal rehabilitation. While the Institute creates the knowledge to understand the complex interplay of processes that transform cells into healthy functioning individuals, it also generates knowledge that sheds light on processes that foster less than optimal health conditions and behavioral outcomes for infants, children, and adolescents. Indeed, fundamental elements of the mission are to understand why and how these outcomes exist; to support research that seeks to ameliorate the effects of the factors that impinge on well-being; and to generate novel solutions, interventions, and therapies that ultimately lead to the healthy functioning of all infants, children, youth, and families.

The NICHD Vision: The Next Decade

To achieve this mission, the NICHD engaged in a visioning process to identify bold new ideas that the Institute would pursue over the next 10 years. These ideas would give rise to an ambitious agenda through which the most promising theoretical frameworks, research hypotheses, collaborative opportunities, and multidisciplinary perspectives designed to address critical knowledge gaps, develop novel tools and resources, and improve health and well-being would be inspired and supported.

From the visioning process arose the call for a new entity within the NICHD to address some of the most compelling causes of morbidity and mortality in the pediatric population. This new entity would be the home for critical analyses of these problems, generating new knowledge, and testing hypotheses and evidence-based solutions in the areas of pediatric trauma (both physical and psychological), injury prevention, and critical illness.

The Pediatric Trauma and Critical Illness Branch was established in 2012 to address the compelling needs of traumatized, injured, and critically ill children and their families. Given the statistics on trauma

and critical illness cited in specific sections of this plan, the need for a greater investment in the prevention, mitigation, and care of these conditions was recognized. While in its history the NICHD had made investments in the areas of childhood trauma and critical illness, the research and career development training had been supported within different Branches and without a unified mission. Several meetings were held to advise the Institute's leadership on critical priorities that would help the NICHD achieve its vision for the next decade and chart the scientific course for the newly established Branch. Members of the Branch also met with National Institutes of Health (NIH) colleagues and other representatives of federal agencies to determine areas of mutual interest and priority. Building on this guidance and on the Institute's history of supporting research and training in the areas of childhood trauma, injury prevention, and critical illness, the Institute created the new Branch and appropriately named it the Pediatric Trauma and Critical Illness Branch, or PTCIB. From this history and these deliberations arose the Branch's vision and mission statements:

VISION

To reduce all forms and aspects of childhood trauma, injury, and critical illness and, in doing so, improve the health and well-being of all children, families, and society to the greatest extent possible.

MISSION STATEMENT

Through transformative research, education, training, and collaboration, we aim to prevent and reduce all forms of childhood trauma, injury, and critical illness to enhance healthy outcomes across the continuum of care.

To accomplish this mission, the Branch's overarching goals are to:

1. Support research that advances scientific knowledge, highlights and addresses research gaps, and fosters collaborative inquiry processes leading to discoveries that improve the quality of life of children and families that have experienced trauma and/or critical illness.
2. Support the training of researchers, physicians, clinicians, practitioners, and scientists in all disciplines related to the Branch's continuum-of-care model.
3. Educate the public regarding all aspects of childhood trauma and injury, including prevention and critical illness.
4. Disseminate novel research findings to inform the research field, enhance clinical knowledge, and improve practice in areas of the Branch's mission.
5. Identify opportunities of mutual interest across federal agencies, within the NIH, and through public-private partnerships to advance the goals of the Branch.

Section 2:
The PTCIB: New Beginnings

The PTCIB began with research transferred from other Branches in the Institute on topics related to its mission and goals. From the Child Development and Behavior Branch, we obtained projects on child maltreatment, violence, and traumatic stress in children and families, as well as studies on emergency medical services to children and research on injury and injury prevention. We also obtained projects from the Institute's National Center for Medical Rehabilitation Research, which managed the Pediatric Critical Care Research Program and projects on acute rehabilitation. Taken together, these projects formed the basis for the PTCIB's emerging research agenda.

With this foundation in place, the next step was to take these discrete projects and examine the extent to which their aims coalesced around particular scientific themes and topics. We identified three interdependent areas of research that served as the starting point for building the field and advancing the science over which we have stewardship. These were the Pediatric Critical Care Research Program, which focused on research projects aimed at better delineating the pathophysiology of critical illness and which links pediatric critical care medicine and science to the epidemiology, prevention, and treatment of serious childhood injury and critical illness; the Pediatric Trauma and Emergency Care Research Program, which supported research designed to advance the science of emergency medical and trauma care for pediatric populations with the goal of reducing morbidity and mortality in children; and finally the Pediatric Injury and Violence Research Program, which focused on inflicted injuries such as acute forms of child maltreatment and interpersonal and community violence.

The Continuum of Pediatric Trauma and Critical Illness Research: A Guiding Framework

The Branch's broad mission calls attention to the need for an organizing framework to guide the work of the Branch over the next 5 years and to help identify its hallmark science. Toward that end, we have adopted the concept of the continuum of care to focus our efforts and to ensure a unified and cohesive approach for launching the Branch's strategic research agenda. This concept is used in a variety of disciplines to underscore the importance of coordination, continuity, and multidisciplinarity in the care of vulnerable, injured, and critically ill children and their families. As its name implies, supported research centered on the continuum of care must foster broad examinations of the factors that elucidate the psychosocial and physiologic markers of risk for trauma, physical injury, or critical illness. In our view, this will allow for a better understanding of the factors that impinge on children's well-being and safety and for developing efficacious strategies to prevent or mitigate risks.

The continuum-of-care framework will also guide our efforts toward understanding how to treat or manage mental or physical health conditions once trauma or critical illness has occurred. Such an understanding must include an appreciation of the support systems and processes in the community, the hospital, or other clinical settings that must be in place to take advantage of key windows of opportunity for secondary prevention and intervention. Within these contexts, the Branch intends to support research that highlights effective practices, treatment guidelines, and other strategies to:

- Prevent trauma (psychological and physical), with emphasis on high-risk or vulnerable populations.
- Prevent disease or underlying disorders from progressing to critical Illness, disability, or death.
- Prevent the effects of traumatic experiences from progressing to mental illness, high-risk behavior, disease, disability, or death.
- Improve treatment modalities to optimize patient outcomes and minimize or eliminate negative sequelae of critical illness.

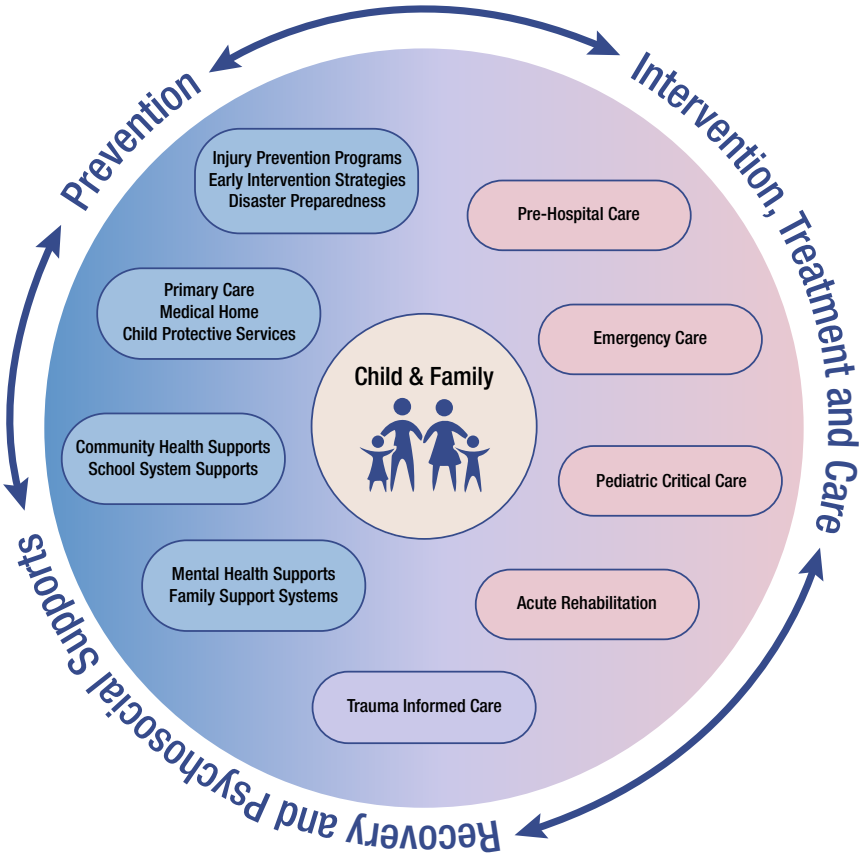
Finally, utilizing this framework allows the Branch to support research exploring such important empirical questions as these examples:

- How do we best prevent and treat self-injurious behaviors in adolescents?
- Which "on the ground" interventions are best suited to mitigate exposure to hazards to ensure that children who are exposed to these hazards rebound as quickly as possible?
- What processes or tools and interventions are needed to accurately assess the causes and severity of pediatric injuries, prevent re-injury, and manage such injuries in a way that promotes optimal recovery?
- Which interventions can decrease mortality and/or morbidity from a critical illness and ensure a return to optimal physical and psychological functional health status?

Questions such as these require multidisciplinary collaborations to deepen our understanding of the mechanisms of child trauma and critical illness and to advance the science that will hasten the discovery of novel interventions, therapies, tools, and technologies with the goal of preventing, treating, and reducing childhood trauma, critical illness, and their negative sequelae.

With the well-being of the child and family as the central focus of our research agenda, the continuum-of-care graphic on the next page depicts how this framework will guide our work and help us achieve the Branch's strategic goals over the next 5 years.

Continuum of Care Research



Scientific Areas of Interest in Research on Pediatric Trauma and Critical Illness

There has been increasing awareness and greater acknowledgment in the scientific and clinical practice communities that the psychological and physiologic needs of children who have experienced psychological trauma, physical trauma, or critical illness differ from the needs of adults who have experienced the same. Thus, a major priority of the Branch is to support research elucidating these differences, thereby increasing our understanding of the pathophysiology and psychology of trauma and critical illness to optimize treatment outcomes and prevent future difficulties in children. Because childhood is such a crucial time in human development, the Branch deems research that sheds light on factors that both promote and threaten health and well-being a high priority.

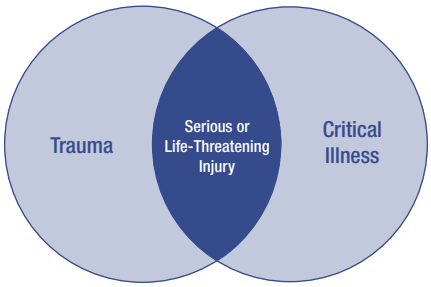
Emphasis on these factors is important because injury is a leading cause of death and disability among children worldwide (Peden et al., 2008). In the United States, unintentional injuries account for more than one-third of fatalities among children and adolescents between 1 and 19 years of age; for newborns and infants under the age of 1 year, these injuries are the fifth leading cause of death (Child Trends Databank, 2014). These include injuries caused by falls, motor vehicle crashes, pedestrian and cyclist accidents, fires and burns, drownings, firearms, poisonings, and participation in sports.

Psychological trauma also has profound effects on a child's well-being. Psychological trauma can be the result of exposure to violence—such as child physical or sexual abuse, domestic violence, or assaults—or the result of natural disaster, accidents, or war. Young children also may experience traumatic stress in response to painful medical procedures or the sudden loss of a parent or caregiver, as indicated by the International Society for Traumatic Stress Studies (2000). Importantly, psychological and physical trauma may interact, with psychological trauma complicating recovery from physical injury and the physical injury causing distress and psychological trauma.

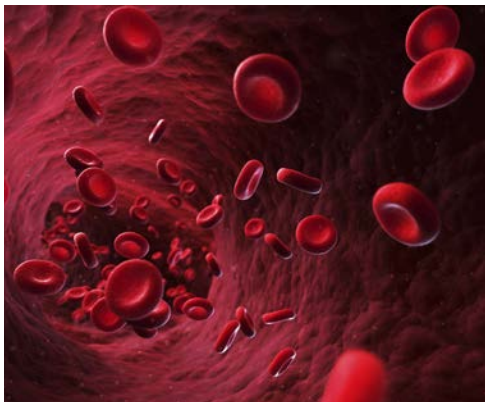
Critical illness in childhood includes diseases or injuries that pose threats to life, limb, or organ through common pathways such as respiratory failure, cardiovascular collapse, severe infection, neurological emergencies, or multisystem organ failure. Children with critical illnesses have unique needs that require specialized care and equipment, generally provided in a pediatric intensive care unit (PICU). A conservative estimate is that 1 in 500 children will require intensive care annually in the United States (Shudy et al., 2006). Importantly, the number of specialized units for children has increased in recent years in this country, and the rates of mortality in the PICU have dramatically decreased (Randolph, Gonzales, Cortellini, & Yeh, 2004). Nevertheless, children and families affected by critical illness and injury are at risk for morbidity and mortality, and the stress of such illnesses affects the entire family.

We recognize that trauma is understood in terms of either psychological processes or physical injury and studied through different disciplinary perspectives. Likewise, we realize there are significant overlaps and inextricable links between research in trauma and critical illness and that approaches to the treatment and care of childhood trauma are logically understood and studied from both perspectives. Furthermore, research in these areas must consider both the nature and severity of the injury.

We further recognize that, while there are aspects of trauma and critical illness unique to these two areas, there are also many commonalities and thus an interrelationship between these two areas of study. Serious or life-threatening injuries in children provide the most obvious example of this interrelationship and the overlapping areas of scientific inquiry.



Our aim is to call attention to both the distinctive and overlapping areas of science to encourage multidisciplinary collaboration that will lead to new and innovative methods of identifying, understanding, preventing, and treating conditions associated with or stemming from these areas. Toward that end, we will support research and training on (1) the distinctive aspects of psychological and physical trauma, the ways in which these aspects interact in care and treatment, and the sequelae of these interactions and (2) critical aspects of life-threatening illness and injury in children and their concurrent and subsequent effects on families.



Section 3:
The PTCIB Strategic Research and Training Agenda

Over the next 5 years, the Branch will both deepen its investigations into critical questions that help it achieve its mission and expand its scientific program areas to pursue new lines of inquiry. Thus, going forward, we will build on our current scientific interests under the auspices of our two broad areas: Pediatric Critical Care and Pediatric Trauma. The programmatic foci that served as the foundation for the Branch will now be included in these broad areas. The Pediatric Critical Care Research Program will support basic, clinical, and translational research elucidating the pathophysiology of pediatric critical illnesses and severe life-threatening injuries while examining their prevention, care, and mitigation. This program will also support research on topics involving the full spectrum of critical illness and trauma, ranging from prevention and risk identification to minimization of morbidity and mortality and optimization of functional and psychological outcomes for critically ill children and their families.

Similarly, the programs of research in Pediatric Trauma will, over the next 5 years, support basic, epidemiological, clinical, and translational research, in this instance highlighting specific injury mechanisms, the nature and severity of injuries resulting from these mechanisms, their social and behavioral causes, and the consequences of such injuries. We will also support research that sheds light on the specific tools, technologies, devices, and standards of care needed to address the unique needs of children and to prevent injury from occurring or to mitigate the long-term impact of injury on children's health and well-being. Also supported will be examinations of the various forms of psychological trauma resulting from maltreatment, neglect, family disruption, and exposure to violence or disaster and the effects of psychological trauma on recovery from traumatic physical injury.

The following sections describe the 5-year goals, objectives, and strategies for the two programmatic areas described above.

Pediatric Critical Care Research Program

The Pediatric Critical Care Research Program will continue to support investigator-initiated research and training opportunities designed to inform the practice of clinicians who work to stabilize, diagnose, and manage the treatment and care of critically ill children, from infancy through adolescence, regardless of the care setting. Such research is focused on investigating the safety

and efficacy of treatment and management strategies as well as the pathophysiologic basis of life-threatening pediatric trauma and critical illness, including (but not limited to) sepsis, multiple organ dysfunction syndrome, acute lung injury, and traumatic brain injury (TBI). In addition, we will support research focused on the care of critically ill children with complex chronic health problems as well as research addressing the physical and psychosocial aspects of critical illness and injury for children and their families, including but not limited to stress and coping, bereavement, and palliative care.

To address significant knowledge and practice gaps in the field of pediatric critical care over the next 5 years, this program will target four strategic areas of research: (1) developing a better understanding of the etiology and pathophysiology of critical illness and life-threatening injury among children, (2) developing a better understanding of the physical and psychosocial effects of critical illness and life-threatening injury on children and their families, (3) finding effective therapies and treatments across the continuum of care, and (4) building capacity among researchers in the field to pursue understudied questions in pediatric critical illness and life-threatening injury. The strategic goals and objectives set forth below elaborate on these priorities.

STRATEGIC GOAL #1

To support research and training that addresses research and knowledge gaps in the understanding of the etiology and pathophysiology of critical illness and life-threatening injury among children.

Objective 1.1: To support research and training in multiple organ dysfunction syndrome.

Multiple organ dysfunction syndrome is a leading cause of death and disability in children, but because it is not related to a single organ system, it is often understudied. This syndrome is associated with a number of pathologic conditions, including sepsis and trauma.

The Branch currently supports research on multiple organ dysfunction syndrome, including pediatric sepsis-induced multiple organ failure. The strategy under the Pediatric Critical Care Research Program is to examine the state of the science of multiple organ dysfunction syndrome and its pathophysiologic process, etiology, and unique phenotypes through collaborative meetings and conferences and to encourage exploratory and developmental research on this cross-cutting but poorly understood topic.

Objective 1.2: To support research and training in understanding pediatric sepsis, its epidemiology, and its management.

Although sepsis is a leading cause of death in children worldwide, the vast majority of studies are conducted in adults (Hartman, Linde-Zwirble, Angus, & Watson, 2013). Much more needs to be known about specific issues related to sepsis in the pediatric population.

The Branch supports research on pediatric sepsis, including basic translational research investigating the use of RNA biosignatures in the emergency evaluation of febrile infants, but new strategies will be employed to support more basic research directed toward developing a better understanding of the

pathophysiology of sepsis and carrying out translational and clinical trials of interventions to improve outcomes among children with sepsis.

Objective 1.3: To support research and training in TBI.

According to the Centers for Disease Control and Prevention (CDC), TBI is the leading cause of traumatic death in American children. The highest combined rates of TBI-associated emergency department visits, hospitalizations, and deaths occur in children age 5 or younger followed by adolescents between 15 and 19 years of age (Faul, Wald, & Coronado, 2010).

The Branch currently supports research assessing the utility of intracranial pressure monitoring in TBI. The Pediatric Critical Care Research Program will increase research activity on the problem of TBI by encouraging more basic and translational research, as well as clinical trials and observational studies, to inform the development of evidence-based treatment guidelines and to increase our knowledge of effective therapies for pediatric TBI. In addition, the PTCIB plans to collaborate with other Branches within the NICHD to identify mutual areas of interest and shared priorities with regard to TBI.

Objective 1.4: To support research and training in the area of acute lung injury among critically ill infants and children.

Acute lung injury is an important cause of morbidity and mortality in children admitted to PICUs. Most therapeutic management strategies in this area, however, are extrapolated from research in adult populations (Bateman & Arnold, 2000), and more work is needed that specifically targets appropriate management strategies for children.

As of now, the Branch supports a number of projects related to pediatric respiratory failure, including research focused on the use of decision support tools in mechanical ventilation, studies aimed at better predicting and assessing upper airway obstruction, and work related to evaluating critical asthma. Over the next 5 years, the Pediatric Critical Care Research Program will collaborate with other Institutes to better understand acute lung injury in infants and children, and to examine the efficacy of such treatments as mechanical ventilation and pulmonary adjuvant therapies.

Objective 1.5: To encourage investigator-initiated research on the critically ill child with complex chronic conditions.

Individuals with more than one chronic disease account for two-thirds of America's health care costs. An estimated 15% to 18% of children in the United States have a chronic health condition (Perrin, Bloom, & Gortmaker, 2007). An estimated 70% or more of PICU admissions are for children with chronic conditions, and approximately 50% of PICU admissions are for children with complex chronic conditions (Edwards et al., 2012). Being the most vulnerable to critical illness, these children are at increased risk for morbidity and mortality, and they consume a significant amount of pediatric critical care resources.

Although there is currently a dearth of research in the Branch's portfolio on critically ill children with underlying complex chronic conditions, the Branch is funding research assessing the decision to perform a tracheostomy in these children. The strategy of the Pediatric Critical Care Research Program for the next 5 years is to examine the state of the science of this phenomenon and to better elucidate research gaps and identify specific priority areas of focus, including how best to care for critically ill children with complex chronic conditions and what families need in order to cope with the challenge of caring for these children.

STRATEGIC GOAL #2

To support research that addresses research and knowledge gaps in the understanding of the physical and psychosocial effects of critical illness on children and families, as well as other aspects of critical illness, such as bereavement, palliative care, and ethical considerations related to the complex nature of critical care practice.

Objective 2.1: To encourage research on the physical and psychosocial effects of critical illness on children and their families.

Critical illness in a child creates multiple levels of stress for both the child and the family. The potential interplay between stress and critical illness remains understudied, as are the multifaceted physiologic and psychosocial effects of stress on parents, siblings, and other family members.

The Branch has been supporting research investigating the factors related to the impact of critical illness on children and their families. New strategies will foster research that aims to improve the quality of life for children and their families during and after critical illness, to encourage collaboration with other Institutes to better understand the factors that contribute to stress associated with pediatric critical illness, and to provide a scientific rationale for methods to improve outcomes and quality of life for these children and their families.

Special emphasis will be placed on clinical trials of care aimed at improving outcomes and on strategies for effective communications among caregivers and between caregivers, patients, and their families. Exploratory, clinical, and translational studies will examine the short- and long-term impacts of surviving a critical illness on the physical, psychological, and cognitive functioning of affected children, including optimizing functional outcomes.

Objective 2.2: To encourage research related to the provision of palliative care in the PICU, including end-of-life care and bereavement support.

Pediatric palliative care is a relatively young area of research, and this is reflected in the limited body of scientific literature that informs practice. The Branch has been supporting research related to all aspects of palliative care, including end-of-life care and the study of bereavement in families, but further research is needed in all aspects of this vastly understudied aspect of care.

To encourage and support research in this field, the Pediatric Critical Care Research Program plans to partner strategically with other Institutes and federal agencies to provide the scientific basis for all aspects of palliative care and to improve coping abilities and quality of life for children and their families.

Objective 2.3: To examine the complex nature of providing care to critically ill children, including the ethical issues that are uniquely associated with that care environment.

The complexity of care and the stressful nature of a PICU environment create the potential for a variety of ethical conflicts, such as withdrawal or limitation of care, organ donation, determination of the quality of life, and many others.

As technological advances continue in the care of critically ill and injured children, so too will the need for research in all aspects of this field. Therefore, the Branch is supporting research related to clinician-family communication and decision-making, but further research is needed.

Specific strategies will encourage research to enhance our understanding of the complex care milieu found with pediatric critical illness and life-threatening injury. To this end, the Branch will partner with other Institutes and federal agencies to support research that informs practice focused on minimizing ethical conflict and improving the quality of care provided to children and their families.

STRATEGIC GOAL #3

To advance the science assessing effective therapies and treatments in all aspects of critical illness and life-threatening injury in children.

Objective 3.1: To support research to investigate all aspects of the multidisciplinary care of critically ill children.

The care of critically ill and injured children is dependent upon multidisciplinary collaboration, with a shared commitment to ensuring the best possible chance of optimal functioning after illness and injury. The Branch currently supports investigator-initiated projects in all aspects of care for critically ill children, but new strategies will be implemented to support and prioritize novel and high-impact studies.

Objective 3.2: To support research to identify new therapies and approaches to reduce mortality and morbidity associated with critical illness in children.

Robust data to guide the development of evidence-based treatment guidelines are lacking. New technologies and treatments must be evaluated for their safety, efficacy, cost/risk-benefit ratios, and effects on long-term outcomes for children and their families. Investigator-initiated clinical and translational research on such topics as hemodynamic monitoring, the quality of cardiopulmonary resuscitation, and extracorporeal interventions to provide life support are currently supported in the Program's portfolio. Future priorities will include exploratory, translational, and clinical projects addressing all aspects of care for the critically ill child. Special emphasis will be given to projects with the potential for an immediate impact on clinical outcomes.

Objective 3.3: To target research to reduce and eliminate comorbidities associated with the treatment of critical illness in children, including nosocomial infections and iatrogenic injury.
The administration of intensive care therapies to critically ill children is fraught with the potential for adverse events and iatrogenic injury. Several national campaigns, such as the Surviving Sepsis Campaign, have called for efforts to reduce nosocomial morbidity and mortality.

The Branch supports research aimed at elucidating comorbidities associated with the treatment of critical illness in children, including nosocomial infections and iatrogenic injury. New strategies will encourage needed developmental and exploratory research to shed further light on comorbid conditions. This work will involve collaborations with other Institutes, other federal agencies, and private partners to stimulate and support future study.

STRATEGIC GOAL #4

To increase the capacity among researchers in the field to pursue understudied questions in pediatric critical care.

Objective 4.1: To use a variety of training mechanisms to support the development of a well-trained workforce in the field of pediatric critical care research.
Clinician-scientists[1] who work in pediatric critical care must possess expertise in all but a few pediatric disciplines to coordinate and facilitate care for the sickest children, who typically have a wide variety of problems. Balancing such clinical demands with the opportunity to perform effective research remains a challenge.

The Branch actively supports training programs in (1) pediatric neurointensive care and resuscitation, (2) pediatric emergency medicine, and (3) the development of physician-scientists1 in pediatric critical care and trauma. Over the next 5 years, the Pediatric Critical Care Research Program plans to increase training opportunities to encourage and inform clinician-scientists involved in the study of pediatric critical illness and life-threatening injury.

Objective 4.2: To use both existing and novel funding opportunities to increase career development opportunities for scientists from diverse backgrounds and fields of study.
To develop, sustain, and ensure an effective workforce of clinician-scientists studying pediatric critical illness, investigators at all stages of career development who represent a diverse range of racial, ethnic, and social backgrounds must be supported. Within the general field of pediatric critical care, this diversity must also include a wide spectrum of study.

[1] The Branch wants to expand its physician-scientist training and career development focus to include other health care professionals. The term "clinician-scientists" refers to these professionals.

Current research in the Branch's funded network and investigator-initiated research portfolio is ripe for training and mentoring scholars from diverse backgrounds and fields of study. The Pediatric Critical Care Research Program plans to increase the diversity of Program participants and of those who enter the field of pediatric critical care research through outreach to other disciplines and through collaborations with other funded training programs. In addition, the Program envisions extending training opportunities to applicants from underresourced areas to ensure that the best care and research opportunities are made available to every child regardless of her or his geographic location; to promote training and career development of clinician-scientists in other disciplines involved in the continuum of care, such as pediatric critical care nursing and pediatric psychology; and to leverage existing funded programs and foster opportunities for training and career development by encouraging investigators to apply for diversity and reentry supplements.

Objective 4.3: Through novel funding opportunities, to increase the number of mentors who can provide training and career development support to early-career investigators.

Beyond training in clinical specialty areas, pediatric critical care researchers require mentored training in biostatistics, study design, the presentation of findings, and scientific writing. Recognizing this, the Branch supports career development awards in a wide range of areas of study. Over the next 5 years, the plan is to continue to support a large portfolio of career development awards allowing for quality mentored research and the development of well-trained mentors for the future.

Objective 4.4: Through conferences, meetings, and collaborations, to promote multidisciplinary training opportunities in those program areas that have high scientific priority.

The ability to convene investigators from a wide variety of fields of study and diverse areas of expertise is vital to the advancement of a cross-cutting, multidisciplinary area of research such as pediatric critical illness. The Branch plans to continue and to expand its support for conferences to identify key knowledge gaps to inform and direct future research initiatives in the field of pediatric critical care research and to provide opportunities for scientists to share their expertise.

Pediatric Trauma Research Program

The Pediatric Trauma Research Program (which incorporates the Pediatric Injury and Violence Research Program and the Pediatric Trauma and Emergency Care Research Program) will continue to support investigator-initiated research aimed at advancing the science of trauma and injury prevention and care for pediatric populations, with the goal of reducing morbidity and mortality in children.

The Program will focus on the full continuum of care, from prevention through treatment and then through acute rehabilitation. It will support research on both inflicted and unintentional injuries, on the diagnosis and treatment of acute forms of child maltreatment—including abusive head trauma, sexual abuse, victimization, physical and psychological abuse, and all forms of child neglect—and on the effects of both man-made and natural disasters. Over the next 5 years, the Program will also place particular emphasis on violence and violence-related injuries and on the prevention, treatment, and biomedical outcomes of violence. Efforts to develop new methods and measurement tools to improve clinical outcomes will be among the Program's priorities.

Thus, basic research, as well as epidemiologic, intervention, and treatment studies, will be the hallmarks of the Pediatric Trauma Research Program. To advance the field of research in pediatric trauma, including the prevention, acute care, and treatment of both physical and psychological injury, over the next 5 years the Program will target five strategic goals.

STRATEGIC GOAL #1

To support research and research training on the epidemiology, prevention, and treatment of unintentional traumatic injuries in children.

Objective 1.1: To support research on the epidemiology and prevention of unintentional traumatic injuries in those areas where there are gaps in knowledge.

Injury is a leading cause of death and disability in children in the United States, particularly among children and young adults ages 1 to 21 years (CDC, 2013). The vast majority of these injuries can be classified as unintentional incidents, including but not limited to trauma from motor vehicle collisions, poisoning, and drowning. Although much is known about the epidemiology of injuries, new risks are emerging, and less is known about the interplay of factors (individual, physical, environmental, and social) affecting risk. The Branch currently supports research on the identification of severe injuries, but much more research is needed to shed light on the prevalence of and risk factors for such injuries.

The Program's strategy, therefore, is threefold:

1. Support basic research on the pathophysiology of trauma and on the prevention of injury, secondary injury, and comorbidities.
2. Continue to study the causes of unintentional traumatic injuries and associated risk factors to fill gaps in the evidence base and guide interventions.
3. Study medical errors that may occur during the treatment of unintentional traumatic injuries, and identify ways to reduce errors in both prehospital and hospital settings.

Objective 1.2: To support research on disparities in injury patterns, treatment, and outcomes.

It is well documented that disparities exist in injury rates by age, gender, race, socioeconomic status, and geographic location. However, minimal research on this topic is currently being conducted. We plan to continue investigating the epidemiology and prevention of injuries in specific populations, including studies of disparities in occurrence, treatment, and outcomes of trauma.

Objective 1.3: To promote targeted research efforts on potentially severe injuries in pediatric patients such as TBI, major penetrating trauma, major blunt trauma, blast injury, and crush injury.

TBI is the leading cause of traumatic death in children, accounting for 6,200 deaths and 60,000 hospitalizations annually in the United States (Faul, Xu, Wald, & Coronado, 2010). Serious penetrating injuries include injuries to the head, chest, and abdomen, often caused by stabbing or a gunshot. Blunt abdominal trauma is often the result of a motor vehicle crash.

Currently, the Branch has a modest portfolio of research on potentially severe injuries in pediatric patients, with most of the projects focused on TBI. Research suggests that significant strides have been made in decreasing TBI-related mortality, but there remains a need for a better understanding of normal and pathological brain function as well as recuperative processes in order to promote better assessments and develop new therapeutic techniques and interventions designed to reduce the burden of injury and improve outcomes for children.

To address identified research needs, we will collaborate with other Branches within the NICHD to identify mutual areas of interest and support and apply several strategies for enhancing research on potentially severe injuries in children, including the following:

- Enhance support of research on serious penetrating injuries.
- Expand support of research into the assessment of TBI, including diagnostic imaging of pediatric patients.
- Promote research to better understand the optimal care of patients after TBI and other potentially severe injuries.
- Encourage support for basic and clinical research on TBI, including markers of TBI, forces, protective gear, treatment, and outcomes.

Objective 1.4: To support clinical and translational research to determine optimal diagnostic and treatment strategies for pediatric trauma patients from prehospital care through emergency care. This includes best practices, treatment algorithms, and practice guidelines.
In 2013, nearly 10 million children aged 0 to 21 years were treated in an emergency department (ED) for an injury, making injury the leading cause of pediatric ED visits (CDC, 2013). Among children treated in an ED, more than 90% are treated in nonpediatric hospitals (Chamberlain, 2013). Children comprise less than 5% of patients cared for by emergency medical services (EMS) but account for 30% of patients cared for in EDs (Foltin, 2014). A recent article indicates that currently, only 73 hospitals in the United States are either Level I or II American College of Surgeons pediatric trauma centers, even though the risk of patient mortality is 25% lower in a Level I trauma center than in an undesignated hospital (Husain, 2014).

It is well-documented in the field of research on prehospital emergency care that evidence regarding best practices for administering medical procedures is drawn largely from the adult literature. Research supported by the Branch will focus on the unique treatment needs of children in prehospital emergency care contexts and will strengthen its portfolio of research on the effectiveness of prehospital procedures for pediatric populations. The Branch also will encourage studies on the effectiveness of out-of-hospital interventions and their impact on the health outcomes of injured children.

There is currently a dearth of Branch-supported studies focused on the effectiveness of EMS and ED systems and staffing in responding to severe or potentially life-threatening injuries in children. This is an important area of research because children have different clinical presentations and needs than adults have. To improve child safety and outcomes, the delivery of care must reflect a knowledge and awareness of the unique needs of this population. Therefore, the Pediatric Trauma Research Program will support projects that examine the impact of EMS system changes on injured children, including changes in safety guidelines and the effectiveness of training, and decisions about pediatric transport, including the appropriate triage. We also plan to support translational research focused on emergency procedures, both stabilizing and life-saving, that are best suited for the pediatric population.

To implement our strategies, we will forge stronger collaborations with the Health Resources and Services Administration, the National Highway Traffic Safety Administration, and other relevant agencies to support targeted research gaps in this area.

Objective 1.5: To build research capacity in the fields of pediatric injury prevention and treatment through support of training and career development award mechanisms.

The Institute of Medicine (1985, 1999) reported that injury is probably the most underrecognized major health problem facing the nation and that injury prevention is the only major field of public health where sustained training programs do not exist. Similarly, the National EMS Research Agenda (2001) underscored two primary barriers that have inhibited the development of a strong research program in EMS: a paucity of well-trained researchers with an interest in EMS research and a lack of reliable funding sources to support such research.

Although the Branch currently supports research training of physician-scientists, many other health professionals are involved and needed in the prevention and treatment of unintentional traumatic injuries in children. Our strategy will include research training for professionals involved across the continuum of care, including professionals in EMS and the ED, psychologists, social workers, nurses, and family support personnel.

STRATEGIC GOAL #2

To advance the science on the diagnosis, treatment, and prevention of all forms of child maltreatment, including physical abuse, abusive head trauma, psychological abuse, sexual abuse, and neglect.

Objective 2.1: To support research focused on the accurate and early detection and diagnosis of child maltreatment, including injuries sustained from the various forms of abuse and health complications that arise from undiagnosed abusive injuries or neglectful behavior.

Maltreated children are at risk for a variety of physical and emotional problems, often depending on their age (Child Welfare Information Gateway, 2013). Children can suffer from brain injury, including concussions, seizures, and death. Children may also develop behavioral and psychological problems,

such as depression, anxiety, and post-traumatic stress disorder (PTSD). Early detection of abuse could help decrease morbidity and mortality related to this major public health problem.

The Branch actively supports research in the detection of physical abuse and the creation of decision rules to discriminate abuse from unintentional injuries in EDs, but there is a dearth of funded research on the effectiveness and broader use of these tools in other health care settings. We intend to build on this research and encourage novel studies on the tools and technologies needed to accurately detect and diagnose abuse using the nature of the bruising, the injury mechanism, and the injury patterns, with a goal of reducing morbidity and mortality. More research on the application of these tools and technologies across the continuum of care is a priority.

Objective 2.2: To support basic, clinical, and translational research on novel diagnostic tools, interventions, therapies, and treatment modalities to prevent, treat, and manage complications from abusive injuries or neglectful behavior.

A systematic review of the literature (Bailhache, Leroy, Pillet, & Salmi, 2013) concluded that evidence on the accuracy of instruments for identifying abused children is both scarce and of low quality. Because the maltreatment of children is most often identified when the children have already suffered serious consequences from this maltreatment, a better understanding of the beginning of child maltreatment and the development of valid screening instruments at subclinical stages remains necessary. Other research suggests that diagnostic imaging studies may provide the first clues to physical abuse. Such studies often help to determine whether abuse has occurred, particularly in the assessment of the infant and young child with evidence of physical injury.

The Branch supports research on the risk for abuse, interventions for abusive parents, and the sequelae of abuse, including links to disease. This research suggests that some adults with chronic conditions may have a history of abuse, particularly sexual abuse and associated trauma. Therefore, an important priority is to support more studies on the long-term health consequences of abuse, particularly sexual abuse and associated trauma.

Other high-priority research will focus on the detection and clinical diagnoses of sexual abuse, including the range of physical indicators. Research shedding light on the symptomatology as it relates to the developmental stage of the child is a priority, as is research on the psychological consequences of these traumatic experiences.

Abusive head trauma, or inflicted neurotrauma, is a burgeoning area of research for the Branch. Studies examining biomarkers and mechanical injuries in both human and animal models are currently supported. Multidisciplinary research examining the neurologic, ocular, dental and craniofacial, biomechanical, physiological, and psychological aspects of this area of science is a high priority. Novel diagnostic methods that would help us more accurately distinguish between abusive injuries and other types of injuries are also a strategy.

Objective 2.3: To support research on aspects of abuse for which the physical and psychological implications are less well understood, including their assessment, sequelae, and prevention.

An estimated 1 in 10 children is sexually abused before reaching the age of 18 (Townsend & Rheingold, 2013). Only 38% of child victims disclose their abuse (London, Bruck, Ceci, & Shuman, 2005). The effects of this type of abuse have long-term and often deleterious outcomes with respect to the psychological and physical health status of the victims. Chronic pain, anxiety and depression, eating disorders, and health risk behaviors such as substance use have been associated with this type of abuse. However, children often do not disclose their abuse and, consequently, care providers often struggle to fully understand the complex interplay between the presentation of behavioral and physical health symptoms. Little is known about the psychological and physical complications associated with frequency and duration of abuse or the particular challenges to achieving developmental milestones, when abuse occurs in infancy and early childhood as compared to adolescence.

The Branch supports epidemiologic, clinical and preventive intervention research on sexual victimization and experiences of abuse. These studies typically examine risk factors for experiencing and perpetrating abuse as well as factors that protect against associated psychological outcomes. Much more research is needed to understand both the physical and psychological trauma related to sexual abuse and the short- and long-term health consequences of this type of abuse. Current studies supported by the Branch have linked such conditions as obesity, cardiovascular health, sleep disturbances, and PTSD with a history of sexual abuse.

Other priorities include support for research aimed at developing and using guidelines to screen for trauma and injuries related to sexual abuse. The Branch also will support long-term studies to shed light on the sequelae of this type of abuse. In addition, very little is known about gender differences in response to trauma stemming from sexual abuse. Studies to support these aspects of abuse exposure are a priority.

To accomplish these objectives, we will collaborate with other Branches within NICHD as well as relevant NIH Institutes and agencies to examine such health concerns as gynecologic health issues, emergency medical response and treatment, HIV and other sexually transmitted infections, and mental health concerns as well as child welfare and justice issues.

Objective 2.4: To support multidisciplinary training and career development in understanding, diagnosing, and treating maltreated children and providing them with social support.

Many different health care professionals help make the diagnosis of child abuse, including licensed mental health professionals, pediatricians, other primary care providers, nurses working in a variety of contexts, psychologists, and social workers. Better training and support is needed to ensure appropriate medical and psychosocial assessments and interventions.

State and local agencies receive more than 3 million referrals for child maltreatment each year. Law enforcement and the family court system are also involved in the resolution of the referral process. Because legal and social systems are often engaged when cases of abuse are suspected or substantiated, the Branch has supported research to illuminate the ways in which these systems are engaged, the implications of system involvement for medical professionals, and the impact of this involvement on children's physical and psychological well-being.

The Branch deems engagement with legal and social systems a high priority and an important process in the continuum-of-care model. We will continue to support research in this area with a view toward high-impact research that elucidates best practices for maintaining children's safety and well-being.

STRATEGIC GOAL #3

To encourage studies on the psychological trauma and emotional processes that co-occur with physical trauma and that affect treatment, recovery, and well-being.

Objective 3.1: To encourage research that examines the ways in which physical and psychological trauma interact to affect children's health outcomes and overall well-being.

An estimated 19% of children with injuries also experience significant post-traumatic stress symptoms (Kahana, Feeny, Youngstrom, & Drotar, 2006). However, most research currently supported by the NICHD and the Branch examines psychological and physical trauma independent of their interacting effects. A top priority of the Pediatric Trauma Research Program will be to elucidate the ways in which psychological and physical trauma co-occur and their independent and interacting effects on the recovery process and well-being. The supported research could include studies of pain and anxiety management in the prehospital and ED phases of care.

Objective 3.2: To identify which children are at greatest risk for psychological distress and symptomatology in response to trauma and to develop early-intervention strategies.

An estimated 25% to 61% of children and adolescents have been exposed to at least one trauma, including abuse, violence, death of a loved one, refugee status or war, or life-threatening illness or injury (Copeland, Keeler, Angold, & Costello, 2007). These rates and types of exposures are especially high in urban minority youth. Children's responses to traumas in terms of their resiliency or psychological distress vary widely, however. Some even experience PTSD or develop chronic health or psychological conditions that can interfere with or complicate recovery from these experiences.

The Pediatric Trauma Research Program will support research to elucidate risk factors for psychological distress, particularly in light of multiple or chronic exposures to trauma. The Program will also support the development of a combination of clinical and psychosocial interventions to target those risk factors. In addition, multidisciplinary research that sheds light on factors that promote resilience in children in light of exposure to trauma will be encouraged.

Objective 3.3: To support the development of assessment tools, intervention strategies, and treatment modalities for children whose recovery from physical trauma is complicated by psychological trauma and distress.

An emerging interest in the field is the use of trauma-informed care as a method for bringing together clinicians and researchers involved with psychological and physical trauma to support comprehensive care. To date, no studies have been funded in this area of science.

Multidisciplinary studies examining the effectiveness of delivering trauma-informed care and projects examining the benefits to children of delivering such care are a high priority. We also support the strategy of developing trauma-screening instruments to be used in schools, primary care, and other settings.

STRATEGIC GOAL #4

To support the next generation of research on violence, exposure to violence, and violence-related injuries.

Objective 4.1: To support research on the "contagion of violence" that enhances our understanding of why and how violence is instigated and the role that context plays in its spread.

According to the Institute of Medicine (2012), there has been a shift from the assumption that violence is inevitable to the recognition that violence is preventable. Researchers have recognized the tendency for violent acts to cluster, spread, and mutate—similar to the infectious disease model, in which an agent initiates a specific biological pathway that leads to symptoms of disease and infectivity.

The NICHD has a long history of supporting epidemiologic and outcomes research on violence and exposure to violence, but research initiatives have not yet been initiated that examine factors related to the contagion-of-violence model. To fill this gap, the Program plans to support research to better our understanding of the relationship between multiple forms of violence, as it is important for detecting risk factors for the manifestation of future transmissions of violence. The contagion model could be used to illuminate such pathways.

Objective 4.2: To support research that examines the different types of violence, the effects of acute versus chronic exposure to violence, and the health consequences of such exposures.

Studies have shown that 60% of children have been exposed to some kind of violence (Finkelhor, Turner, Shattuck, & Hamby, 2013). Exposure to violence, whether as a victim or a witness, is often associated with long-term physical, psychological, and emotional harm. Children at high risk for these experiences are often exposed to more than one type of violence. Studies addressing the psychosocial and behavioral antecedents and consequences of violence have been a mainstay in the Institute's portfolio of research, but more research is needed to fully understand the impact of polytraumatic experiences.

The Branch is currently participating in a funding opportunity announcement (FOA) calling for research on the health consequences of violence, particularly violence committed with firearms. To date, few studies have been funded on the acquisition of firearms, injuries due to gun violence, or the potential spread of violence due to the availability of firearms. The Branch will continue calling for research on this topic and will promote investigator-initiated research that addresses the treatment and care of injuries and subsequent health conditions that are due to gun violence.

Also needed is research to determine the most effective ways to prevent the intergenerational transmission of violence. The Branch will build on ongoing research to further illuminate effective prevention and intervention strategies across the continuum of care.

Additionally, we will support research to understand the mechanisms through which chronic exposure to violence relates to negative outcomes, including the psychobiological pathways through which these experiences leave their mark.

STRATEGIC GOAL #5

To increase understanding of the effects of disasters on children and to develop responses and preparedness to prevent trauma from these incidents.

Objective 5.1: To support research on the long-term effects of exposure to disaster on children.

Disasters, including large events like Hurricane Katrina and local events such as house fires, touch millions of children each year. Children who are exposed to disaster are at risk for PTSD and other psychological disorders such as depression (Osofsky & Osofsky, 2013).

The Branch currently supports projects on parent-child processes affecting adjustment following disaster and levels of child aggression following exposure to disaster. An additional strategy will involve support of studies examining the effects of exposure to disaster on biological and psychological processes and the mechanisms through which such trauma affects families.

Objective 5.2: To increase the understanding of appropriate responses to children immediately following a disaster.

Children have unique needs following a disaster, and responders require specialized training to respond appropriately. Currently, only limited research is available on interventions for children immediately following exposure to disaster.

To generate needed data, we will support critically needed research on effective immediate responses to children exposed to disaster. In addition, we recognize that collaborating with response networks, other branches within the NICHD and the NIH, and across relevant federal agencies is an important strategy to address this issue.

Objective 5.3: To develop and evaluate treatments for disaster-related physical and psychological trauma.

Children suffering from disaster-related mental health issues require developmentally appropriate interventions. The Branch has fostered research on interventions using cognitive behavioral therapy following exposure to disaster, but a new priority will be research on the effects of targeted interventions, both psychological and medical, inside and outside of the hospital, for children in the wake of mass casualties and disasters. Greater knowledge is needed about when interventions are provided optimally, which interventions are most successful at different developmental levels, and the mechanisms of successful adaptation.

Section 4:
Pediatric Trauma, Injury Prevention, and Critical Illness in Global Contexts

Although trauma and critical illness may affect everyone regardless of age, gender, socioeconomic status, or geographic region, some populations are more vulnerable than others. The World Health Organization and the United Nations Children's Fund indicate that children in developing countries are at higher risk for trauma and critical illness, because they are faced with challenges associated with poverty, low income, and other hazardous situations on a daily basis. Pedestrians, particularly children on poorly maintained roads, are vulnerable to injuries from road traffic, a leading cause of death and disability. Young children living in close daily contact with water are at very high risk of drowning. People living in homes lacking safety devices and precautions are more vulnerable to the risk of fires and burns. Children without access to adequate nutrition, clean water, and sanitation facilities are at an increased risk of death from infection such as sepsis and critical illness, as are children without access to necessary vaccines. As the stresses of economic disadvantage and lack of resources have been linked to child maltreatment, children in low- and middle-income countries (LMICs) may be more vulnerable to various forms of child abuse, including human trafficking. Furthermore, exposure to violence and war in some countries may give rise to psychological trauma as well as physical trauma. Unfortunately, there is a paucity of mental-health professionals and other health care providers available to respond to those needs.

For these reasons, the PTCIB deems it important to incorporate issues relevant to the global context into its programs of study in pediatric trauma and critical illness. Although many of these issues are not unlike those experienced domestically, the context for examining these issues and for implementing evidence-based interventions is exacerbated by local challenges. Trauma and critical illness are so devastating in LMICs, in large part, because of inadequate systems of emergency and critical care at both the community and hospital levels as well as inadequate infrastructure. Compounding the problem is the fact that responsibility for injury and disease prevention cuts across many administrative domains, including public health, criminal justice, and road safety (Fogarty International Center, 2010). In light of these publich health concerns, we offer the following strategic goal and objectives.

STRATEGIC GOAL #1

To collaborate with the Fogarty International Center and other NIH Institutes and Centers to determine areas of mutual interest and to identify opportunities where the Branch may make a unique contribution in pediatric trauma, injury prevention, and critical illness research.

The burden imposed by trauma is not confined to the physical consequences of a single, acute event. There is a risk of significant mental health consequences associated with trauma stemming from experiences such as child abuse, criminal victimization, domestic violence, rape, torture, war, terrorism, and both natural and technological disasters. In addition to psychiatric disorders such as PTSD and depression that can last for years, increased risk for severe functional impairment and disability creates a need for interdisciplinary researchers (e.g., public health professionals, psychiatrists, psychologists, nurses, neuroscientists, biologists, researchers in prevention) to identify risk and protective factors for the development and dissemination of innovative models for the prevention and treatment of trauma-related disorders and associated adverse functioning among children and adolescents living in the LMICs (Fogarty International Center, n.d.).

The epidemiology, treatment, and outcomes of critically ill children differ significantly across the spectrum of LMICs. These differences are a call to action to eliminate disparities and to assure optimal therapy across the globe for all critically ill children. More than being seen as simply a call to eliminate disparities in treatment and outcomes, however, these differences should be analyzed and utilized to improve outcomes for both ends of the economic continuum. Much of the practice of injury prevention, pediatric emergency and critical care in LMICs is based on long-standing practices, and evidence-based research is lacking. Equipoise to evaluate such therapies is difficult to achieve, so appropriate inquiry is unlikely to occur.

Thus, over the next 5 years, the PTCIB proposes the following strategic objectives for research in the global community:

- **1.1** To conduct a portfolio analysis of currently funded projects to determine where opportunities exist to supplement or extend the research in LMICs that is of interest to the NICHD and consistent with the Branch's priorities.
- **1.2** To build the field of researchers in the disciplines across the PTCIB research continuum by supporting funding opportunities for training and career development.
- **1.3** To develop relationships with international researchers to determine opportunities for collaboration.
- **1.4** To participate in, or to host an international meeting focused on, the prevention of pediatric injury and best practices in pediatric emergency care and critical care for ill and seriously injured children.
- **1.5** To collaborate with partners throughout the NIH and other federal and international agencies to initiate an FOA calling for interdisciplinary researchers to address the broad spectrum of risks associated with trauma and critical illness among pediatric populations in global contexts.

Section 5:
Summary and Action Steps

Over the next 5 years, the Branch will put forward a number of efforts to achieve its mission and goals.

Scientific Research Initiatives

Through the Pediatric Critical Care Program, the Branch has renewed its focus on collaborative research and training. Both the Collaborative Pediatric Critical Care Research Network and the K–12 Pediatric Critical Care and Trauma Scientist Development Program were recompeted and funded, each for an additional 5-year project period.

The Branch launched a new initiative that will allow us to achieve our goal of building research capacity. The initiative, NICHD Consortium for Research on Pediatric Trauma and Injury Prevention, uses the R24 funding mechanism to create a consortium of collaborative teams to target critical gaps in research on pediatric trauma and injury prevention. Through this initiative, we expect to fund researchers to devise breakthrough ideas, concepts, and approaches to therapies in pediatric trauma and injury research. Through the collective expertise of the funded researchers, we hope to establish a national research agenda on pediatric trauma and injury prevention that will move us closer to bringing to fruition our vision of eliminating all forms of childhood trauma and critical illness.

Going forward, the Branch will use every funding mechanism available to us to initiate programs where the NICHD is the lead Institute. We will also collaborate with other branches within the NICHD and seek out opportunities to join with federal and private partners to collaboratively fund research of mutual interest and priority.

Scientific Conferences and Meetings

Much of the work of the federal program officials is accomplished through “the power of convening.” Scientific conferences and meetings allow us to shine a light on research and training gaps and to convene experts from across the variety of disciplines to share insights on leading-edge research, to lend their expertise to the analysis of new developments in science and clinical practice, and to produce recommendations to guide future research.

The Branch plans to sponsor a conference on multiple organ dysfunction syndrome to elucidate its pathophysiologic process, etiology, and unique phenotypes. We also plan to sponsor jointly held meetings with scientific societies as well as other partners to disseminate information to the scientific community and also to the general public.

Research Portfolio Development

As indicated earlier, the Branch has a growing portfolio of research on a variety of topics in pediatric trauma and critical care. However, we recognize the need to build a portfolio that captures the elements of our continuum of care framework to foster a more comprehensive and collaborative approach to addressing areas where multidisciplinary perspectives are needed.

We will identify targeted areas where focused attention is needed to move toward resolution of seemingly intractable public health problems and will create research programs focused on these targeted lines of inquiry. This will require us to use a combination of strategies, including supporting investigator-initiated research, letting contracts, and soliciting research projects.

Where appropriate, we will participate in trans-NIH funding initiatives and assume secondary assignment on projects of particular relevance to the respective portfolios.

Special Projects

Over the course of the 5 years, the Branch will initiate special projects to help identify scientific areas in which we wish to have a stronger investment or to discern whether such an investment is prudent. These projects may focus on a special population or an emerging public health concern and will be limited in time and scope. The Branch currently supports a special research program on children in military families with special health care needs.

We will also engage with various NICHD offices, such as the Office of Legislation and Public Policy, the Office of Health Equity, the Office of Global Health, and the Office of Science Policy Analysis and Communication, to participate in outreach campaigns, congressional briefings, and other activities to call attention to the specific populations of interest as well as the novel areas of science that we support.

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