SUMMARY

Vibrant and Healthy Kids

ALIGNING SCIENCE, PRACTICE, AND POLICY TO ADVANCE HEALTH EQUITY

Committee on Applying Neurobiological and Socio-Behavioral Sciences from Prenatal Through Early Childhood Development: A Health Equity Approach

Jennifer E. DeVoe, Amy Geller, and Yamrot Negussie, *Editors*

Board on Population Health and Public Health Practice

Health and Medicine Division

A Consensus Study Report of

The National Academies of
SCIENCES • ENGINEERING • MEDICINE

THE NATIONAL ACADEMIES PRESS
Washington, DC
www.nap.edu

THE NATIONAL ACADEMIES PRESS 500 Fifth Street, NW Washington, DC 20001

This activity was supported by a contract between the National Academy of Sciences and the Robert Wood Johnson Foundation (#72444). Any opinions, findings, conclusions, or recommendations expressed in this publication do not necessarily reflect the views of any organization or agency that provided support for the project.

International Standard Book Number-13: 978-0-309-49338-3
International Standard Book Number-10: 0-309-49338-2
Digital Object Identifier: https://doi.org/10.17226/25466
Library of Congress Control Number: 2019948065

Additional copies of this Summary are available in limited quantities from the Health and Medicine Division, 500 Fifth Street, NW, Washington, DC 20001.

Copies of *Vibrant and Healthy Kids*, from which this Summary was extracted, are available from the National Academies Press, 500 Fifth Street, NW, Keck 360, Washington, DC 20001; (800) 624-6242 or (202) 334-3313; http://www.nap.edu.

Printed in the United States of America

Suggested citation: National Academies of Sciences, Engineering, and Medicine. 2019. *Vibrant and healthy kids: Aligning science, practice, and policy to advance health equity*. Washington, DC: The National Academies Press. https://doi.org/10.17226/25466.

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COMMITTEE ON APPLYING NEUROBIOLOGICAL AND SOCIO-BEHAVIORAL SCIENCES FROM PRENATAL THROUGH EARLY CHILDHOOD DEVELOPMENT: A HEALTH EQUITY APPROACH

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Title: Chasing Sunshine
Artist: Stephanie Kohli (Weston, Wisconsin)
Year: 2017
Medium: Mixed Media

Artist statement:

This piece is based off of my daughter running in our garden. Feeding children the best quality food and letting them explore nature in community gardens is a beautiful way to help them shine.

This artwork was submitted as part of the National Academy of Medicine's Visualize Health Equity Community Art Project nationwide call for art. This call for art encouraged artists of all kinds to illustrate what health equity looks, sounds, and feels like to them. More information on this project can be found at nam.edu/VisualizeHealthEquity.

Reviewers

This Consensus Study Report was reviewed in draft form by individuals chosen for their diverse perspectives and technical expertise. The purpose of this independent review is to provide candid and critical comments that will assist the National Academies of Sciences, Engineering, and Medicine in making each published report as sound as possible and to ensure that it meets the institutional standards for quality, objectivity, evidence, and responsiveness to the study charge. The review comments and draft manuscript remain confidential to protect the integrity of the deliberative process.

We thank the following individuals for their review of this report:

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PAUL G. SPICER, The University of Oklahoma

Although the reviewers listed above provided many constructive comments and suggestions, they were not asked to endorse the conclusions or recommendations of this report, nor did they see the final draft before its release. The review of this report was overseen by **ROBERT M. KAPLAN,** Stanford University, and **BOBBIE BERKOWITZ,** University of Washington. They were responsible for making certain that an independent examination of this report was carried out in accordance with the standards of the National Academies and that all review comments were carefully considered. Responsibility for the final content rests entirely with the authoring committee and the National Academies.

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Preface

All children deserve the opportunity to meet their full health potential and lead fulfilling lives. Our nation's future depends on it. Yet, there are millions of children in the United States who are not afforded this opportunity today. While spending a record amount of money on health care services, the United States has the worst infant mortality rate among 19 similar wealthy nations, and the U.S. maternal mortality rate in 2018 was our highest since 2000. Although the United States is one of the richest nations in the world, in 2015 more than 9.6 million children lived in families with annual incomes below the poverty line (based on the Supplemental Poverty Measure), with approximately 2.1 million living in deep poverty. The highest rates of poverty were found among Hispanic, African American, and American Indian/Alaska Native families. This is deeply concerning because poverty during pregnancy and childhood is directly tied to poor health and developmental outcomes. Our nation's health disparities, of which there are many, are directly linked to what happens in early childhood and prenatally (and even earlier). For all children to lead fulfilling lives, we need to first achieve health equity as a nation, and to do so, we must focus on the youngest, and most vulnerable, in our nation. We also need to look beyond health care for solutions; while health care is necessary to improve health outcomes, fixing health care alone will not address health inequities.

A multitude of factors, from the macro to the micro levels, contribute to the divergent health trajectories that children experience. A child's health ecosystem is influenced by social, economic, cultural, and

environmental factors that impact healthy development and well-being. These influences start before birth and have an impact throughout an individual's life and across generations. Exposure to positive influences consistently and longitudinally increases the likelihood of health production, while exposure to negative influences decreases opportunities to be healthy. The timing of these exposures in life also matters—the prenatal to early childhood period is one of the most sensitive times for children to get on the right track to meet their full health potential. Lifelong and multigenerational health disparities are a result of children in this critical age group lacking access to positive opportunities (such as high-quality early care and education, stable and safe housing, and healthy foods) that promote health combined with a preponderance of negative influences that harm health trajectories. Children's health is inextricably linked to family health and community health. For many communities, population health disparity gaps are widening. Persistent, additive disadvantages and early adversity are significant contributors to the widening gaps. Past historical injustices, such as segregated schooling laws, redlining, and assimilation policies, continue to impact children due to structural injustices put in place in the past that persevere today and continue to create barriers to health for those who live in contexts that undermine their opportunity to reach their health potential. This has led to persistent childhood (and lifelong) health disparities. Communities of color have much higher rates of preterm birth, infant mortality, chronic disease (e.g., diabetes), and exposure to adverse childhood experiences, to name just a few.

In preparing this report, the committee took seriously its charge to review the ways in which early life stress affects health, the pathways by which health disparities develop and persist, and the roadmap needed to get all children on positive health trajectories. Scientific discoveries have built a solid base of evidence about what impacts children's health trajectories positively and negatively—now is the time to apply and advance science to chart a course of action to get all children back on track for health. During the committee's time reviewing the scientific evidence for how to translate the best science into action to positively impact health during early childhood, we strove to close the disconnect between evidence and practice in the nation today. While some scientific evidence has laid the groundwork for actionable practice, policy, and systems solutions, other emerging scientific findings are ripe for further research and inquiry. The committee also acknowledged that achieving and sustaining health equity is a long-term goal with many interrelated strategies and tactics. Thus, we included some recommendations that can be feasibly implemented more quickly by a focused group of actions, while other recommendations may take longer and will require broad support from many different actors at all levels of society.

This report details the latest scientific information about factors impacting health and how to achieve equitable promotion of health for all children. Multilevel and multipronged strategies focused on prevention, early detection and referral, and mitigation are needed to gain momentum toward achieving health equity. These strategies involve intervening at the policy, system, and program levels—this will ultimately require a concerted effort from the nation to distribute resources where they are needed and change policies to better align with the science and evidence. With this in mind, where possible, the committee sought to leverage existing resources or systems that serve children as platforms by which to improve and scale services for children. Furthermore, intentional strategies to understand and reduce inequitable outcomes, access, and experiences across communities of different races, linguistic backgrounds, income groups, genders, and geography are needed. Taking action requires a life course lens, multisector collaboration, and ongoing measurement of outcomes that can be assessed longitudinally and across multiple generations. What science teaches us about sensitive periods and the plasticity of the brain and body provides a clear path for action—if we follow that path regarding prevention and mitigation of adversity during this crucial life period, we can turn the tide for our nation's children. This report provides a roadmap for doing so.

The committee is grateful to the Robert Wood Johnson Foundation for appreciating the need for this work and for supporting putting science into action. The committee welcomed this unique opportunity to shine a brighter spotlight on cutting-edge developmental science about how children develop and grow. Furthermore, we appreciated the opportunity to deepen our understanding about how the key principles and tenets of this critical scientific evidence base on optimal development can be made more accessible to prime the public, practitioners, and policy makers for action. It is the committee's hope that this report's bold recommendations will move our nation to practices and policies that center this science, hand in hand with equity, to advance health and well-being for all.

Jennifer E. DeVoe, *Chair*
Committee on Applying Neurobiological and Socio-Behavioral Sciences from Prenatal Through Early Childhood Development: A Health Equity Approach

Acknowledgments

The committee wishes to thank and acknowledge the many individuals and organizations that contributed to the study process and development of this report. To begin, the committee would like to thank the Robert Wood Johnson Foundation—the study sponsor—for its support of this work.

The committee found the perspectives of multiple individuals and groups immensely helpful in informing its deliberations through presentations and discussions that took place at the committee's public meetings. Speakers provided presentations on the state of the science in several domains and offered promising models for action, which informed the committee's work; these include (in order of appearance) Dwayne Proctor, Paula Braveman, Fernando Martinez, Phil Fisher, Sarah Barclay Hoffman, Robert Kahn, Suzanne C. Brundage, Megan Smith, Lee Beers, Neal Halfon, Milton Kotelchuck, Ron Haskins, Greg Miller, Greg Duncan, Jessica Pizarek, Helena Sabala, Anne Mauricio, and Elisa Nicholas. The committee also heard policy perspectives from state Representative Ruth Kagi, state Senator Elizabeth Steiner Hayward, Bobby Cagle, and state Senator David Wilson—the committee greatly appreciates the perspectives they brought to the discussions.

The committee's work was enhanced by the technical expertise and support provided by Marisa Gerstein Pineau, Petra Jerman, and Nat Kendall-Taylor, who served as consultants. The committee expresses its gratitude to Angela Diaz, who shared her time as a liaison from the Committee on the Neurobiological and Socio-Behavioral Science of Adolescent Development and Its Applications.

Importantly, the committee heard from a number of caregivers who shared their personal stories and experiences with the committee. These discussions helped ground the committee in the lived experiences of the complex issues that the committee needed to tackle in this report, and the committee is incredibly grateful for their bravery in sharing their experiences in a public forum. Thank you to Abraham Gomez, Shalice Gosey, Lori Hernandez, Ana De Jesus, Yesenia Manzo-Meda, Maria Rodgers, and discussants Alexa Bach, Jennifer Eich, Patricia McKenna, and Reggie Van Appelen.

The committee thanks the National Academies of Sciences, Engineering, and Medicine staff who contributed to the production of this report, including study staff Amy Geller, Yamrot Negussie, Sophie Yang, Anna Martin, Pamela McCray, and Rose Marie Martinez. Thanks go to Mary Jane Porzenheim, summer intern, and other staff in the Health and Medicine Division who provided additional support, including Carla Alvarado, Alina Baciu, Aimee Mead, Andrew Merluzzi, Cyndi Trang, Alexis Wojtowicz, and Hayat Yusuf. The committee thanks the Health and Medicine Division communications staff, including Jeanay Butler, Greta Gorman, Nicole Joy, Sarah Kelley, and Tina Seliber. This project received valuable assistance from Stephanie Miceli (Office of News and Public Information); Misrak Dabi (Office of Financial Administration); and Clyde Behney, Lauren Shern, and Taryn Young (Health and Medicine Division Executive Office). The committee also appreciated the collaboration with the study staff for the concurrent study on adolescence; thanks to Emily Backes, Dara Shefska, and Liz Townsend. Appreciation also goes to the National Academy of Medicine (NAM) Culture of Health Program team for their collaboration and support: Charlee Alexander, Kyra Cappelucci, and Ivory Clarke. The committee was also fortunate to have support from Ebony Carter (NAM Norman F. Gant/American Board of Obstetrics and Gynecology Fellow), who contributed her time and expertise throughout the report's development.

The committee received valuable research assistance from Daniel Bearss, Senior Research Librarian (National Academies Research Center). At the end of the report process, Daniel Bearss passed away. Daniel was a dedicated, meticulous, and respected colleague, and he will be missed by the study team, who are incredibly grateful for his contributions to this report and the National Academies.

Finally, the National Academies staff offers additional thanks to the executive assistants and support staff of committee members, without whom scheduling the multiple committee meetings and conference calls would have been nearly impossible: Iris An, Gatanya Arnic, Mai Castillo, Saúl Cruz, Dhiana Dhahrulsalam, Justin Farmer, Lynne Lathbury, Suzanne Lee, Lauren Oujiri, Kathy Rentie, Katie Rivers, and Lorena Segarra.

Acronyms and Abbreviations

ABC	Attachment and Biobehavioral Catch-Up Intervention
ACE	adverse childhood experience
ACH	Accountable Communities of Health
ADHD	attention-deficit/hyperactivity disorder
AI/AN	American Indian/Alaska Native
ASD	autism spectrum disorder
BPA	bisphenol A
BRFSS	Behavioral Risk Factor Surveillance System
CDC	U.S. Centers for Disease Control and Prevention
CHIP	Children's Health Insurance Program
CPS	Child Protective Services
CRH	corticotropin-releasing hormone
CVD	cardiovascular disease
DLL	dual-language learner
ECE	early care and education
ECHO	Environmental influences on Child Health Outcomes
ED	emergency department
EEG	electroencephalogram
EHB	essential health benefit
EITC	Earned Income Tax Credit

HAS	high-achieving school
HHS	U.S. Department of Health and Human Services
HomVEE	Home Visiting Evidence of Effectiveness
HPA	hypothalamic-pituitary-adrenal
HUD	U.S. Department of Housing and Urban Development
IOM	Institute of Medicine
IPV	intimate partner violence
IUGR	intrauterine growth restriction
LBW	low birth weight
MBH	mental and behavioral health
MIECHV	Maternal, Infant, and Early Child Home Visiting Program
MLP	Medical-Legal Partnership
NFP	Nurse-Family Partnership
NHANES	National Health and Nutrition Examination Survey
NICU	neonatal intensive care unit
NRC	National Research Council
OECD	Organisation for Economic Co-operation and Development
PTSD	posttraumatic stress disorder
RCT	randomized controlled trial
SDOH	social determinants of health
SES	socioeconomic status
SNAP	Supplemental Nutrition Assistance Program
SPM	Supplemental Poverty Measure
SSA	U.S. Social Security Administration
SSI	Supplemental Security Income
TANF	Temporary Assistance for Needy Families
TIC	trauma-informed care
WIC	Special Supplemental Nutrition Program for Women, Infants, and Children

Summary

ABSTRACT

Health inequities have persisted in the United States, and the factors that drive these inequities from preconception through early childhood are complex, interconnected, and systemic; they result from exposures and experiences that children and families encounter throughout their lives and across multiple generations. These exposures accumulate over the life course to exert a cumulative effect on health that is probabilistic, not deterministic. That is, the odds of good health are never fixed; individual exposures, experiences, and choices help set and adjust them over time. Specific subgroups of the population have varying rates of exposure to positive and negative experiences that shape choices and opportunities throughout the life course; therefore, from the very beginning, certain groups have different odds for good or poor health outcomes. Among the factors that may buffer negative outcomes in the early childhood period, supportive relationships between children and the adults in their lives are essential. Furthermore, reducing health disparities by addressing root causes, such as poverty and racism, is foundational to advance health equity.

Biologically, a number of critical systems develop in the prenatal through early childhood periods, and neurobiological development is extremely responsive to environmental influences during these stages. This report provides an overview of the core concepts of brain development and other body systems relevant to understanding the impact of early life adversity, including the mechanisms that link early life experiences to later outcomes. This information can be used by the public and policy makers to better inform effective actions for advancing health equity.

The committee provides both short- and long-term recommendations in several key areas that can be leveraged to improve health outcomes for children and families. Recommendations aimed at supporting caregivers include implementing paid parental leave and strengthening and expanding home visiting programs. Recommendations for creating supportive and stable early living conditions include improving economic security through increases in resources available to families to meet their basic needs; increasing the supply of high-quality affordable housing; and supporting and enforcing efforts to prevent and mitigate the impact of environmental toxicants. To maximize the potential of early care and education (ECE) to promote better health outcomes, the committee recommends developing a comprehensive approach to school readiness that explicitly incorporates health outcomes, developing and strengthening curricula that focus on key competencies of educators, and improving the quality of ECE programs and expanding access to comprehensive high-quality and affordable ECE programs. The committee recommends leveraging the health care system to make care in the preconception through early childhood periods more continuous, equitable, integrative, and comprehensive by transforming services to apply a life course perspective and address the social, economic, cultural, and environmental determinants of health. To mitigate the early life drivers of health inequities, there is no one-sector solution—the complex and interconnected root causes call for coordination across multiple sectors. Therefore, the committee provides recommendations for sector alignment and collaboration, as well as the need for child- and family-serving sectors to enhance detection of early life adversity, improve response systems, and develop trauma-informed approaches.

The committee identifies knowledge gaps and recommends multidisciplinary research efforts to bring new ideas and practical approaches to advance efforts to achieve health equity. However, substantial advances in knowledge in the past 20 years make it clear that policy makers, health providers, business leaders, and others in the public and private sectors do not need to wait any longer to take action.

Health inequities by race, ethnicity, socioeconomic status, geography, and other important demographic characteristics have persisted in the United States despite increasing evidence about their contributions to poor health. Research shows that exposures to factors that shape health trajectories can start early and are multigenerational; thus, the preconception, prenatal, and early childhood periods are critical to setting the odds for lifelong health. Importantly, science can inform actions in policy and practice to advance health equity[1] and reduce health disparities.

[1] Health equity is the state in which everyone has the opportunity to attain full health potential and no one is disadvantaged from achieving this potential because of social position or any other socially defined circumstance.

Neurobiological and socio-behavioral research indicate that early life experiences shape prenatal and early childhood development, and these experiences have a powerful impact on the developing brain and peripheral organ systems that impact health outcomes across the life course.

When different groups vary in their exposures to key experiences (both positive and negative), their odds for positive health diverge systematically over time, producing disparities in health outcomes across the life-span and across generations. These exposures accumulate over the life course to exert a cumulative effect on health that is probabilistic, not deterministic. That is, the odds of positive or negative health are never fixed; individual exposures, experiences, resilience, and choices help set and adjust them over time. Individuals' distinct contexts also shape their choices and opportunities, and thus they have different odds of experiencing positive or negative health outcomes over time. Because the odds of these exposures are affected by policies and systems, advancing health equity will require more than individual-level interventions. It will necessitate systems-level changes, including changes to laws and policies and investment of resources, to improve the odds of positive experiences and reduce the odds of adverse exposures for all populations, especially those experiencing the most adversity.

Scientific evidence shows that prevention and early intervention are effective for children on at-risk developmental trajectories. Recent advances in science, technology, data sharing, and cross-disciplinary collaboration present opportunities to apply this emerging knowledge systematically to practice, policy, and systems changes. Given the burgeoning science available to advance health equity during early development, the Robert Wood Johnson Foundation, as part of its Culture of Health Initiative, asked the Health and Medicine Division of the National Academies of Sciences, Engineering, and Medicine to

1. Provide a brief overview of stressors that affect prenatal through early childhood development and health;
2. Identify promising models and opportunities for translation of the science to action;
3. Identify outcome measures to enable subgroup analyses;
4. Develop a roadmap to apply the science to tailored interventions (i.e., policies, programs, or system changes) based on biological, social, environmental, economic, and cultural needs; and
5. Provide recommendations in these areas, including how systems can better align to advance health equity.

To respond to this charge, the Committee on Applying Neurobiological and Socio-Behavioral Sciences from Prenatal Through Early Childhood

Development: A Health Equity Approach was formed. The committee applied a health equity frame and built on the concepts of the 2017 report *Communities in Action: Pathways to Health Equity*. As identified in the 2000 National Research Council and Institute of Medicine report *From Neurons to Neighborhoods: The Science of Early Childhood Development*, prenatal through early childhood are critical phases of development that have lifelong impacts on health and well-being. This report reviews the science that has emerged since that landmark report.

The health of both men and women before they have children is important for not only pregnancy outcomes, but also the lifelong health of their children; thus, the committee included the preconception period as an important focus of the report. The committee also adopted the life course approach to its work because an individual's health status and outcomes reflect the accumulation of experiences over the life-span. This approach takes into account an individual's larger social, economic, and cultural context and acknowledges that the life trajectory may be changed, negatively or positively, through interactions between the brain, body, and environment. Protective factors (such as stable, high-quality caregiver relationships and economic security) support positive, or flourishing, trajectories; risk factors (such as exposure to abuse, neglect, or racism) exacerbate the likelihood of poor trajectories.

Children in the United States may be perceived to be healthier now than in the past because they are much less likely to encounter the major infections and debilitating diseases of past generations and are typically able to recover fully from "acute" childhood illnesses. However, ailments of the past have been supplanted with chronic physical (e.g., diabetes, asthma, obesity) and socio-emotional (e.g., depression, anxiety) conditions, with large subsets of U.S. children facing barriers to positive mental and physical health and well-being as a result of poverty, food insecurity, unsafe or unstable housing, neighborhood segregation, and other substantial adversities (such as adverse childhood experiences) in the first few years of life.

Children who are born and raised in poverty are at particularly high risk for poor health outcomes, more problems in early development (e.g., lack of readiness for school at age 5, diagnoses of developmental delays and/or disorders), and higher rates of most childhood chronic conditions (such as mental illness, developmental disabilities, obesity, and asthma). Early adverse experiences may have intermediate effects on school readiness, weight, and physical and/or mental well-being and contribute to chronic disease and poor functioning in adulthood. In fact, these impacts are cumulative, and adults who experience adversity in childhood have substantially higher rates of heart disease, lung disease, metabolic syndrome, and other costly health conditions.

CONCEPTUAL MODEL

The committee's conceptual model (see Figure S-1) served as a unifying framework for its approach to this report. It is important to note that risk and protective factors can be transferred intergenerationally, which makes parents and other family and community primary caregivers a central focus of interventions to improve child health. Within the context of the life course, the diagram's nested circles illustrate the complex sociocultural environment that shapes development at the individual level and the opportunities for interventions to improve individual health and developmental outcomes, as well as population health, well-being, and health equity. Individual social and biological mechanisms and culture operate and interact within and across the three levels.

Structural inequities operate at the outer level, the "socioeconomic and political drivers." Structural inequities are deeply embedded in policies, laws, governance, and culture; they organize the distribution of power and resources differentially across individual and group characteristics (i.e., race, ethnicity, sex, gender identity, class, sexual orientation, gender expression, and others). The next level represents social, economic, cultural, and environmental states (i.e., the social determinants of health [SDOH]). In the model, these interdependent factors are

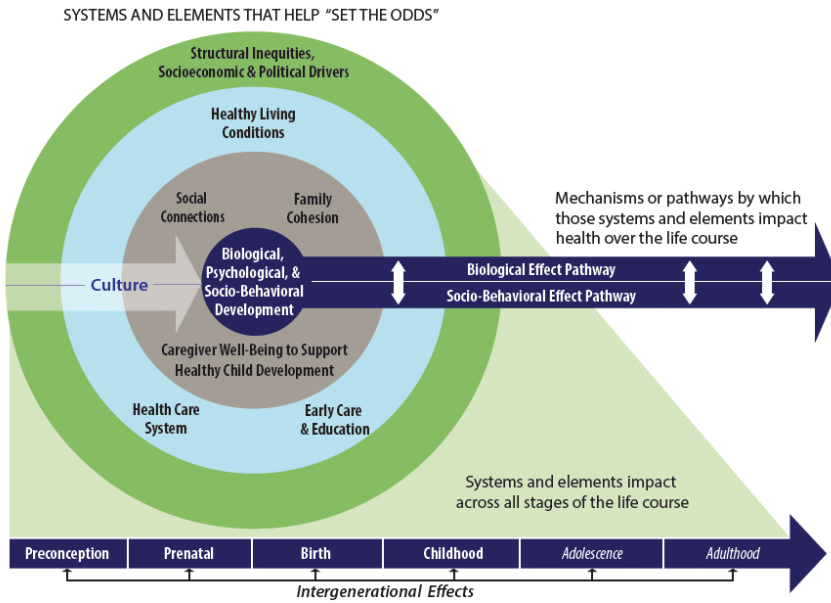

FIGURE S-1 Leveraging early opportunities to advance health equity across the life course: A conceptual framework.

grouped into three domains—healthy living conditions, health care, and education. These domains were identified by the committee based on the available evidence and existing resources as important for targeting prenatal and early childhood interventions and are the primary foci of Chapters 5–7. The next level represents the factors that most directly and proximally shape children's daily experiences and routine patterns: family cohesion and social connections, which also affect access to critical resources for health, well-being, and development in early life (see Chapter 4). The innermost circle and crosscutting arrows—biological, psychological, and socio-behavioral development—are the focus of Chapters 2 and 3.

THE SCIENCE OF EARLY DEVELOPMENT: CORE CONCEPTS

Based on its review of the science, the committee updated and adapted the core concepts from the 2000 report *From Neurons to Neighborhoods* and identified 12 core concepts of early development, with a focus on health equity. The evidence underlying these concepts is described in Chapters 2–4, and this evidence guided the committee in its development of recommendations that apply the science of early development. In brief, these concepts include the following (see Chapter 1 for more detailed descriptions of each concept):

1. Biology–environment interaction impacts health and development.
2. Brain development proceeds in well-defined but continuous steps.
3. Major physiological systems develop rapidly during pregnancy and early childhood.
4. The early caregiving environment is crucial for long-term development.
5. The developing child plays an important role in interactions and development.
6. The development of executive functions is a key aspect of early childhood development.
7. Trajectories—positive or negative—are not immutable.
8. There is variability in individual and group development.
9. Experiences across environmental contexts play a significant role in early development.
10. Disparities in access to critical resources matter.
11. Health outcomes are the result of experiences across the life course.
12. Early interventions matter and are more cost effective than later ones.

A large body of recent research provides insights into the mechanisms by which early adversity in the lives of young children and their families can change the timing of sensitive periods of brain and other organ system development and impact the "plasticity"[2] of developmental processes. In the past two decades, there has been a convergence of research that has led to many of the advances described in this report. First, a wave of neurobiological studies in model systems and humans found that responses to pre- and postnatal early life stress are rooted in genetic and environmental interactions that can result in altered molecular and cellular development that impacts the assembly of circuits during sensitive periods of development. The demonstration that certain systems involved in cognitive and emotional development are more sensitive to early disturbances that activate stress response networks, such as the frontal cortex, hippocampus, amygdala, and the hypothalamic-pituitary-adrenal axis, provided a basis for both short- and long-term functional consequences of early life stress.

Many of the new scientific advances in neuroscience are still in development, and more research is needed to apply these new findings in clinical and public health practice and to use them to inform policies. In particular, greater effort and support are needed to develop, implement, and evaluate programs based on scientific discoveries regarding the optimal timing for interventions. However, new research has clarified that altered nutrition, exposure to environmental chemicals, and chronic stress during specific times of development can lead to functional biological changes that predispose individuals to manifest diseases and/or experience altered physical, socio-emotional, and cognitive functions later in life. The committee provides information about major biological responses to stressors and new discoveries that have contributed to advancing knowledge about how and when to intervene to improve health outcomes for children.

ROADMAP FOR APPLYING AND ADVANCING THE SCIENCE OF EARLY DEVELOPMENT

With the goal of decreasing health inequities, the broad question this report addresses is, "For those children who are placed at risk for negative outcomes, what can be done—guided by science-based evidence—to expediently and effectively move each of them toward positive developmental health trajectories?" In this report, the committee provides

[2] The process by which neurons within the brain change their gene expression, cellular architecture and connections with other neurons, and function in response to experiences and changes in the environment (i.e., change over time).

recommendations for practice, policy, and systems changes to achieve this goal. The roadmap the committee has put forth includes a suite of key strategies to advance health equity[3]:

- **Intervene early**—In most cases, early intervention programs are easier to implement, more effective, and less costly.
- **Support caregivers**—This includes both primary caregivers and caregivers in systems who frequently interact with children and their families.
- **Reform health care system services to promote healthy development**—Redesign the content of preconception, prenatal, postpartum, and pediatric care while ensuring ongoing access, quality, and coordination.
- **Create supportive and stable early living conditions:**
  - **Reduce child poverty and address economic and food security,**
  - **Provide stable and safe housing, and**
  - **Eliminate exposure to environmental toxicants.**
- **Maximize the potential of early care and education to promote health outcomes.**
- **Implement initiatives across systems to support children, families, other caregivers, and communities**—Ensure trauma-informed systems, build a diverse and supported workforce, and align strategies that work across sectors.
- **Integrate and coordinate resources across the education, social services, criminal justice, and health care systems, and make them available to translate science to action.**

In this report, the committee provides a range of recommendations for practice, policy, and systems changes, including recommendations that will take time and sustained commitment to achieve and recommendations that could be implemented immediately or in the near term. Some of the committee's recommendations will be difficult to implement; however, the degree of difficulty in implementing any given recommendation does not determine the value of pursuing it. Where possible, the committee also recommends or highlights ways to leverage existing programs that either embrace the core scientific principles laid out above or have a strong basic structure from which to build.

[3] Note that recommendations are not always presented in numerical order, as the summary has grouped them by topic in some cases; however, all report recommendations are presented.

Supporting Family Cohesion and Social Connections

The construct of resilience[4] from developmental science is important, as it implies the ability to correct what otherwise might have been negative trajectories, given major life stressors. To set the foundation for the committee's considerations on the topic of supporting family systems, the committee discusses universal principles of human development pertaining to the broad domain encompassing children's psychological and behavioral adjustment (see Chapter 4). For example, for children, the single most important factor in promoting positive psychosocial, emotional, and behavioral well-being is having a strong, secure attachment to their primary caregivers—usually their mothers. Strong attachment presupposes effective parenting behaviors in everyday life, and "effective parenting" changes in complexity with development over time.

There is an urgent need to develop preventive interventions well suited for fathers and other male caregivers; existing approaches that are developed for and tested with women cannot be assumed to generalize to other caregivers with equal effectiveness (e.g., in the successful recruitment, retention, and support of men and fathers who take care of young children).

Recommendation 4-1: Federal, state, and local agencies, along with private foundations and philanthropies that invest in research, should include in their portfolios research on the development of preventive interventions that target fathers and other male caregivers. Special attention should be given to the recruitment, retention, and support of men and fathers parenting young children from underserved populations.

Specific subgroups of children have unique needs and challenges when adjusting to adversity. Careful attention to potent subculture-specific processes needs to be paid in working with subgroups well known to face serious inequities in relation to mental health—including families experiencing chronic poverty; immigrants; lesbian, gay, bisexual, transgender, and queer (LGBTQ) children; LGBTQ parents; children who are separated from parents due to incarceration, foster care, or other reasons; and children exposed to high achievement pressures, usually in relatively affluent communities.

[4] There are two essential conditions that make up resilience: (1) exposure to significant threat or severe adversity, and (2) achievement of positive adaptation despite major assaults on the developmental process.

Recommendation 4-2: Federal, state, local, tribal, and territorial agencies, along with private foundations and philanthropies that invest in research, should include in their portfolios research on the development of interventions that are culturally sensitive and tailored to meet the needs of subgroups of children known to be vulnerable, such as those living in chronic poverty, children from immigrant backgrounds, children in foster care, and children with incarcerated parents.

In addition to addressing major goals relevant for children in general (e.g., fostering caregiver well-being and minimizing maltreatment), programs need to include components that specifically address unique risk and protective processes within these subgroups of children.

A growing body of evidence suggests that home visiting by a nurse, a social worker, or an early educator during pregnancy and as needed in the first years of a child's life improves a wide range of child and family outcomes, including promotion of maternal and child health, prevention of child abuse and neglect, positive parenting, child development, and school readiness. These positive effects continue well into adolescence and early adulthood. Researchers, program leaders, and policy makers need to focus on expanding the concept of tailored home visiting to advance knowledge on which programs and activities are best for which family, in which communities, and for what outcomes.

Recommendation 4-3: To strengthen and expand the impact of evidence-based home visiting programs,

- **Federal policy makers should expand the Maternal, Infant, and Early Childhood Home Visiting Program.**
- **The Health Resources and Services Administration (HRSA) and the Administration for Children and Families (ACF) should work with program developers to increase flexibility for states and communities, to tailor the program to the needs and/or assets of the community or population being served.**
- **Federal, state, local, tribal, and territorial agencies overseeing program implementation should continue to strengthen programmatic coordination and policy alignment between home visiting, other early care and education programs, and medical homes.**

State policy makers should further expand support for evidence-based home visiting services through the use of general funds, Medicaid, and a combination of multiple funding streams. HRSA and ACF should support research to continue to ensure program effectiveness and accountability

of the expanded program. Expansion of home visiting programs should be done in conjunction with the expansion of other public investments and services.

Intervention trials have shown strong benefits of relational interventions, such as interventions to foster strong attachments, and group-based supports in communities for caregivers and their families. The core components of several effective interventions suggest that in addition to providing particular skills, improving the overall well-being of caregivers (especially mothers) is the most critical "engine" of change.

Recommendation 4-4: Policy makers at the federal, state, local, territorial, and tribal levels and philanthropic organizations should support the creation and implementation of programs that ensure families have access to high-quality, cost-effective, local community-based programs that support the psychosocial well-being of the primary adult caregivers and contribute to building resilience and reducing family stress.

It is necessary to consider measures that should be included in evaluating results of large-scale preventive interventions targeting young children and their mothers. Given the need to identify individuals at risk for early adversity and the toxic stress response, regular brief assessments of the mothers' depressive symptoms, stress, feelings of rejection to the child, any involvement with child protective services, and the degree to which they have positive, buffering relationships in their lives should occur routinely.

Recommendation 4-5: Health care providers who care for pregnant women and children should routinely track levels of individual health and social risk among mothers and children over time, using periodic assessments via a short set of scientifically validated measures.

Leveraging the Health Care System to Promote Health Equity

The health care system can serve as a platform, along with public health and other sectors, to address the social determinants that underlie many health inequities. However, the current health care system focuses mainly on clinical goals and addresses other determinants of health in fragmented and highly variable ways. U.S. health care provides only limited attention to integration of health care for the whole family, health care across the life course, or integration of mental and behavioral health into clinical care. Recognizing that preconception through early childhood are sensitive and important life periods to optimize health outcomes, care

during these periods needs to become more continuous (access), equitable (quality), integrative (delivery), and comprehensive (content); therefore, the committee offers the following recommendations:

Improving Access to Health Care

Recommendation 5-1: The U.S. Department of Health and Human Services, state, tribal, and territorial Medicaid agencies, public and private payers, and state and federal policy makers should adopt policies and practices that ensure universal access to high-quality health care across the life course. This includes

- **Increasing access to patient- and family-centered care,**
- **Ensuring access to preventive services and essential health benefits, and**
- **Increasing culturally and linguistically appropriate outreach and services.**

Achieving this recommendation will require actively promoting inclusion in coverage and care.

Improving Quality of Care

Recommendation 5-2: To expand accountability and improve the quality of preconception, prenatal, postpartum, and pediatric care,

- **Public and private payers should include new metrics of child and family health and well-being that assess quality using a holistic view of health and health equity. Federal, state, and other agencies, along with private foundations and philanthropies that invest in research, should support the development and implementation of new measures of accountability, including key drivers of health, such as social determinants, along with measuring variations by key subgroups to determine disparities;**
- **Public and private payers, including the Health Resources and Services Administration's (HRSA's) Bureau of Primary Care and Maternal and Child Health Bureau, Centers for Disease Control and Prevention, Centers for Medicare & Medicaid Services (CMS), and perinatal and pediatric quality collaboratives, should expand the use of continuous quality improvement, learning communities, payment for**

performance, and other strategies to enhance accountability; and

- **Health care–related workforce development entities should expand efforts to increase diversity, inclusion, and equity in the health care workforce, including diversity-intensive outreach, mentoring, networking, and leadership development for underrepresented faculty and trainees.**

Needed metrics include social determinants and social risk measures; cross-sector developmental measures that move beyond common indicators of child development, including mental and behavioral health; and disparities as explicit measurement domains that hold providers accountable for not just delivering services but also improving outcomes. Workforce development (as noted in bullet 3) will need to be addressed by several entities, including the Accreditation Council for Graduate Medical Education and specialty boards, professional schools, training programs, teaching hospitals, including children's hospitals, and funders of graduate education in health professions (CMS, HRSA, and others).

Organization and Integration of Health Care Services

Recommendation 5-3: The U.S. Department of Health and Human Services, state, tribal, and territorial government Medicaid agencies, health systems leaders, and state and federal policy makers should adopt policies and practices that improve the organization and integration of care systems, including promoting multidisciplinary team-based care models that focus on integrating preconception, prenatal, and postpartum care with a whole-family focus, development of new practice and payment models that incentivize health creation and improve service delivery, and structures that more tangibly connect health care delivery systems to other partners outside of the health care sector.

Achieving this recommendation will require disseminating multidisciplinary team-based care models in community settings; developing integrated models for preconception, prenatal, postpartum, and pediatric care delivery modes; adopting and spreading integrated, whole-family and family-centered care models; developing and using new technologies that improve care and improve accessibility; aligning payment reform with health creation rather than service delivery; and developing systemic and cross-sector collaboration.

Transforming the Content of Care

Recommendation 5-4: Transform preconception, prenatal, postpartum, and pediatric care to address the root causes of poor health and well-being—the social, economic, environmental, and cultural determinants of health and early adversity—and to align with the work of other sectors addressing health equity.

The U.S. Department of Health and Human Services should convene an expert panel to reconceptualize the content and delivery of care, identify the specific changes needed, develop a blueprint for this transformation, and implement a plan to monitor and revise the blueprint over time. Implementation of this recommendation will require

- **An update of clinical care guidelines and standards by the Women's Preventive Services Initiative, Bright Futures, American College of Obstetricians and Gynecologists, American Academy of Pediatrics, American Academy of Family Physicians, and others actively developing clinical care guidelines and standards to include this new content of care;**
- **Medical accreditation bodies, relevant programs, and agencies to develop performance monitoring and quality improvement based on this new content of care;**
- **Clinical care educational authorities, such as the Accreditation Council for Graduate Medical Education, to develop curricula, training, experiences, and competencies based on the updated guidelines; and**
- **Public and private payers to cover services reflecting this new content of care.**

This work should take place in a larger framework of social and reproductive justice and include more diverse voices, especially from communities most affected by adverse birth and child health outcomes. Such a shift will require that the health care system recognize the impact of both adverse and enriching experiences across the life course and cumulative effects on health and well-being by the health care system. It will also require integrating attention to social and environmental determinants as well as trauma assessment and response into clinical practice.

Although health care plays an integral role in advancing health equity, health care alone cannot meaningfully address health inequities, nor is it the primary actor or leader. Cross-sectoral and multidisciplinary collaboration is essential for decreasing health inequities.

Creating Healthy Living Conditions for Early Development

Reducing or managing caregiver stress is key to giving caregivers the capacity, supports, and resources to care for their children and serve as buffers against adversity. Addressing the primary needs of families and children is critical to achieving this goal. The committee identified four areas of fundamental needs that, if met, would have an impact on health inequities: (1) food security, (2) safe and stable housing, (3) economic stability and security, and (4) safe physical environments.

Food Security

Given the importance of good nutrition for brain growth and development (during the preconception, prenatal, and early childhood periods), the committee concludes that providing resources to ensure families have access to sufficient and healthy foods can improve birth and child health outcomes. Because safety net programs such as WIC and SNAP have been shown to improve birth and child (and adult) health outcomes and to reduce food insecurity, the committee recommends:

Recommendation 6-2: Federal, state, local, territorial, and tribal agencies should reduce barriers to participation in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) and Supplemental Nutrition Assistance Program (SNAP) benefits. Receipt of WIC and SNAP benefits should not be tied to parent employment for families with young children or for pregnant women, as work requirements are likely to reduce participation rates.

Safe and Stable Housing

Evidence suggests that lack of affordable or quality housing, housing instability, and overcrowding have significantly detrimental effects on the health, well-being, and development of infants, children, and families. Housing affordability and quality is an acute problem that disproportionately affects people of color and contributes to health inequities among children. Over half of black and Hispanic renters live in unaffordable housing, and health issues related to poor-quality housing, such as elevated blood lead levels and asthma, are more prevalent among these renters. Current federal housing programs are not adequately funded, and there are not enough safe, affordable housing units in high-opportunity areas. Additional funding for programs can move families out of poverty and allow them to reallocate money for other basic needs that support child health and development. Incentives and/or regulations, along with

enhanced programming, can increase the supply of affordable housing. Recognizing the centrality of housing to health and healthy child development, the committee recommends:

Recommendation 6-3: The U.S. Department of Housing and Urban Development, states, and local, territorial, and tribal public housing authorities should increase the supply of high-quality affordable housing that is available to families, especially those with young children.

Recommendation 6-4: The Secretary of the U.S. Department of Health and Human Services, in collaboration with the U.S. Department of Housing and Urban Development and other relevant agencies, should lead the development of a comprehensive plan to ensure access to stable, affordable, and safe housing in the prenatal through early childhood period. This strategy should particularly focus on priority populations who are disproportionately impacted by housing challenges and experience poor health outcomes.

Recommendation 6-5: The Center for Medicare & Medicaid Innovation should partner with states to test new Medicaid payment models that engage providers and other community organizations in addressing housing safety concerns, especially focused on young children. These demonstrations should evaluate impact on health, health disparities, and total cost of care.

Economic Stability and Security

Children's well-being and life course outcomes are strongly related to family income. Given the strong evidence that economic security matters, an important factor in reducing health disparities in early childhood is to ensure that families with young children have adequate resources. The committee concludes that public programs that provide resources to families in the form of cash, tax credits, or in-kind benefits improve childhood well-being and life course outcomes and that these effects are long lasting. Furthermore, while income support programs that are contingent on employment status or based on earned income have positive benefits for families, they should avoid regulations and policies that might have unintended consequences for childhood outcomes through negative effects on family relationships and attachments, breastfeeding, and caregiver stress.

Additional income support for families with young children through paid parental leave would recognize the special needs of infants and their caregivers. Unpaid parental leave through the Family and Medical Leave

Act does not cover all employees, and most families with low incomes cannot afford to take an unpaid leave.

Recommendation 6-1: Federal, state, local, tribal, and territorial policy makers should implement paid parental leave. In partnership with researchers, policy makers should model variations in the level of benefits, length of leave, and funding mechanisms to determine alternatives that will have the largest impacts on improving child health outcomes and reducing health disparities.

Recommendation 6-6: Federal, state, tribal, and territorial policy makers should address the critical gaps between family resources and family needs through a combination of benefits that have the best evidence of advancing health equity, such as increased Supplemental Nutrition Assistance Program benefits, increased housing assistance, and a basic income allowance for young children.

This recommendation focuses on strategies that are likely to have particularly important impacts on health outcomes for young children. A child allowance would fill in some of the gaps in the current safety net and particularly benefit the lowest-income children and those most at risk of poor health outcomes. The key advantage of a child allowance (over, for example, tax credits) is that funds are available to families on an ongoing monthly basis rather than once per year. In addition, under the current structure of the child and working-family tax credits, the lowest-income families receive few benefits. Children whose parents are in unstable employment or not employed suffer the short- and long-term health consequences of living in poverty. Reducing health disparities requires reaching these children during their earliest years, regardless of parental employment. Increased SNAP benefits and housing allowances would address current inadequacies in both of these programs and provide targeted support for the critical food and housing needs of young children.

Environmental Exposures and Exposure to Toxicants

There are numerous potential environmental toxicants that may be transmitted through the air, water, soil, and consumer products with which food and water come into contact. Many of these occur naturally in the environment (e.g., arsenic, radon, etc.), and many more are released through human-based processes (e.g., heavy metals, chemicals from plastic production and degradation, and particulates). The embryonic, fetal, and early childhood periods represent greater risk than adulthood for adverse mental and physical health outcomes from environmental exposures due to children's smaller size, proportionally large intake of food, air, and water

to body weight, and rapid developmental processes that may be influenced and disrupted by chemicals and toxicants. As a result of toxicant exposures, children may suffer from a variety of developmental problems, chronic conditions, and even premature death. Poverty, substandard and/or unstable housing, minority racial/ethnic status, and proximity to known sources of pollutants heighten children's risk of exposure and poor health and developmental outcomes. The committee identified three areas where current efforts could be improved to prevent and mitigate the impact of environmental toxicants in the prenatal through early childhood periods:

Recommendation 6-7: The Administration for Children and Families, Maternal and Child Health Bureau, and federal and state regulators should strengthen environmental protection in early care and education settings through expanded workforce training, program monitoring, and regulations.

Recommendation 6-8: Professional societies, training programs, and accrediting bodies should support expanded or innovative models for training of prenatal and childhood health care providers on screening, counseling, and interventions to prevent or mitigate toxic environmental exposures.

Recommendation 6-9: Federal, state, local, tribal, and territorial governments should support and enforce efforts to prevent and mitigate the impact of environmental toxicants during the preconception through early childhood period. This strategy should particularly focus on priority populations who are disproportionately impacted by harmful environmental exposures. This includes

- **The U.S. Environmental Protection Agency (EPA) fully exercising the authorities provided by Congress to safeguard children's environmental health under the Toxic Substances Control Act as amended by the Frank R. Lautenberg Chemical Safety for the 21st Century Act.**
- **Continued allocation of resources and technical assistance from the federal government through the Centers for Disease Control and Prevention, EPA, U.S. Food and Drug Administration, and the U.S. Consumer Product Safety Commission to translate existing data and research findings into actionable policies and practices.**
- **Ongoing review and updating of environmental exposure levels by federal agencies to reflect health and safety standards specific to the unique vulnerability of children (from fetal development through early development).**

In Chapter 6, the committee also discusses the role of civil rights strategies to promote healthy communities for developing children.

Promoting Health Equity Through Early Care and Education

While most of the attention on early care and education (ECE)[5] has focused on whether it improves children's cognitive and socio-emotional development and academic readiness, research shows that ECE affects various other child health outcomes, including children's physical, emotional, and mental health. ECE programs increase children's cognitive, social, and health outcomes through enhancing their motivation for school and readiness to learn and the early identification and intervention of problems that impede learning. This, in turn, helps children improve their cognitive ability and social and emotional competence, while increasing their access to and use of preventive health care. Access to ECE may lead to lower risk of dropping out of school, greater school engagement, and subsequently better educational attainment, which lead to increased income and decreased social and health risks, resulting in greater health equity.

Allocation of Adequate Resources to Support ECE Programs and Educators

Intentional policies and allocation of adequate resources to support these programs and educators are needed for ECE programs to contribute significantly to a health promotion and equity strategy.

Recommendation 7-1: The committee recommends that early care and education (ECE) systems and programs, including home visiting, adopt a comprehensive approach to school readiness. This approach should explicitly incorporate health promotion and health equity as core goals. Implementing this approach would require the following actions:

- **Federal, state, local, tribal, and territorial governments and other public agencies (e.g., school districts, city governments, public–private partnerships) that have decision-making power over ECE programs should establish program standards and accountability systems, such as a quality rating and improvement system, linked with better school readiness and health outcomes and provide adequate funding and resources to implement and sustain these standards effectively.**

[5] ECE can be defined as nonparental care that occurs outside of the child's home. ECE services may be delivered in center-, school-, or home-based settings.

- **The Office of Child Care and the Office of Head Start at the federal level, along with state, local, tribal, and territorial early care and other education agencies, should assess the full cost of implementing standards that promote health outcomes and equity as described above, including supporting educators' own health and well-being, and work with Congress to align funding levels of the major federal ECE programs—child care subsidy and Head Start—accordingly.**
- **Health and human service entities, the federal Early Learning Interagency Policy Board, state Early Childhood Advisory Councils, and federal, state, local, tribal, and territorial agencies that oversee home visiting and ECE programs should ensure greater programmatic coordination and policy alignment to ensure effective allocation of resources.**
- **The Office of Planning, Research & Evaluation in the Administration for Children and Families, along with the U.S. Department of Education, should examine the feasibility and seek resources to conduct (a) an implementation study to examine the design and implementation of this comprehensive ECE approach that incorporates health standards and (b) an outcomes study that examines the impact on children's school readiness and achievement, and health outcomes, with particular attention to eliminating disparities and gaps prior to school entry.**

Health-Focused Competencies of the ECE Workforce

Policies and systems that prepare and support early childhood educators and program leaders, including those in public schools, need to incorporate the latest evidence about how to support children's school readiness and success by fostering their health and well-being. This would entail providing comprehensive supports and resources to degree granting institutions and preparation programs, including the development of curricula, textbooks, practicum experiences, toolkits, and fact sheets.

Recommendation 7-2: Building off the 2015 Institute of Medicine and the National Research Council report *Transforming the Workforce for Children Birth Through Age 8*, the committee recommends that degree granting institutions, professional preparation programs, and providers of ongoing professional learning opportunities develop or strengthen coursework or practicums that focus on competencies of educators, principals, and early care and education program directors that are critical to children's health, school readiness, and life success.

Access and Affordability to ECE Programs

Maximizing the impact of ECE on positive early childhood development and health and well-being at the community or population level will require increasing public funds for ECE programs. Currently, eligibility for ECE programs is limited, and among eligible families, access is low due to lack of funding and availability of programs and services. Therefore, even if existing publicly funded programs have the resources to provide robust supports that improve young children's health and well-being, these will not reach most children, especially those who live in low-income households or confront adverse experiences and toxic stress.

Recommendation 7-3: Federal, state, local, tribal, and territorial policy makers should work with the U.S. Department of Health and Human Services (HHS), the Office of Head Start, and the Office of Child Care to develop and implement a plan to

a. Improve the quality of early care and education (ECE) programs by adopting the health-promoting standards discussed in Recommendation 7-1, such as building on the performance standards of Early Head Start and Head Start, and
b. Within 10 years, expand access to such comprehensive, high-quality, and affordable ECE programs across multiple settings to all eligible children. Disproportionately underserved populations should be prioritized.

The Secretary of HHS should conduct a process evaluation to inform the expansion effort and, once implemented, conduct rigorous and comparative outcomes studies to ensure that the expansion is having the intended impacts on children and families, with particular attention on what group(s) may be benefiting.

The strategic plan should be modeled after and build on the relevant performance standards of Early Head Start and Head Start, which emphasize mixed settings, the whole child, family and community engagement, transition between home and school, and continuous quality improvement. It should also strengthen those program components discussed in Chapter 7 that lead to stronger school readiness and health outcomes, including mitigation of the impact of adverse experiences and toxic stress for children, families, teachers, and staff. Critical components include a comprehensive social-emotional strategy that encompasses both the classroom (curriculum, teacher training and support) and program/school (leadership, culture and climate) levels and educators who have competencies described in Recommendation 7-2.

Systems Approach

Advancing health equity in the preconception through early childhood periods cannot be achieved by any one sector alone—it will take action, collaboration, and alignment across all sectors that frequently interact with children, families, and the professionals who serve them. Systems are a collection of interacting, interdependent parts that function as a whole. For the purposes of this report, most of the systems are social constructs and are organized around a key functional area (e.g., education, health care, housing). Systems change is not an easy strategy, it seldom yields speedy returns, and it may not be sufficient without an investment of resources designed to take advantage of new and better aligned approaches. However, given that disparities are systematically generated, it is likely a necessary precursor to real and widespread advances in health equity. The committee identified eight crosscutting recommendation areas where multiple sectors need to take action, based on review of the evidence in Chapters 1–7 and the committee's collective expertise. In brief (additional details available in Chapter 8), the committee recommends:

Policy makers and leaders in the health care, public health, social service, criminal justice, early care and education/education, and other sectors should

- **Recommendation 8-1: Support and invest in cross-sector initiatives that align strategies and operate community programs and interventions that work across sectors to address the root causes of poor health outcomes. This includes addressing structural and policy barriers to data integration and cross-sector financing and other challenges to cross-sector collaboration.**
- **Recommendation 8-2: Adopt and implement screening for trauma and adversities early in life to increase the likelihood of early detection. This should include creating rapid response and referral systems that can quickly bring protective resources to bear when early life adversities are detected, through the coordination of cross-sector expertise, as covered in Recommendation 8-1.**
- **Recommendation 8-3: Adopt best practices and implement training for trauma-informed care and service delivery. Sector leadership should implement trauma-informed systems that are structured to minimize implicit bias and stigma and prevent retraumatization. Standards for trauma-informed practice exist in a variety of service sectors, including health care**

and social services; those standards should be replicated and implemented across systems.

- **Recommendation 8-4: Develop a transdisciplinary and diverse workforce to implement culturally competent service delivery models. The workforce should reflect the diversity of populations who will engage in sector services.**
- **Recommendation 8-5: Improve access to programs or policies that explicitly provide parental or caregiver supports and help build or promote family attachments and functioning by engaging with the families as a cohesive unit. For families with intensive support needs, develop programs or initiatives designed to provide comprehensive wraparound supports along a number of dimensions, such as health care, education, and social services, designed to address needs related to the social determinants of health that are integrated and community based.**
- **Recommendation 8-6: Integrate care and services across the health continuum, including the adoption of models that provide comprehensive support for the whole person in a contextually informed manner, leveraging and connecting existing community resources wherever possible, with a focus on prevention.**
- **Recommendation 8-7: Invest in programs that improve population health and in upstream programs that decrease long-term risk and poor health outcomes. These changes should be accompanied by accountability metrics to ensure that the spending is tangibly and demonstrably in service to the goals behind the original funding, but offer more flexibility in how those goals are achieved.**

Crosscutting Research Needs

A tremendous amount is known about what works to advance health equity in early development (and the lifelong benefits of doing so), and efforts to translate this science into action and to scale up effective interventions needs to be accelerated. Many interventions have shown promising results at a small scale but have not been fully tested across multiple settings or in diverse communities and populations. Others have promising preliminary data but require more evidence. In addition, the evidence around systems and policy changes—the work needed to address inequities with a multisector and systems-based approach—remains less certain than programmatic evidence in many cases precisely because it is complex and set in shifting environments that make confident attribution of effects challenging. In Chapter 8, the committee recommends newly designed and adapted

research strategies to help translate science to action across sectors, including needed data to inform subgroup analyses and elucidate the complex causality related to health inequities to better design interventions across sectors.

An important caution, however, is that although targeted research is needed to address population heterogeneity with more precision, enough is already known to act now to advance health equity in the prenatal and early childhood periods. The research recommended below is important to continually improve efforts and increase impact but should not impede action. Here the committee provides guidance on charting the course for future research to better meet the health and social needs of the nation's children in the future and, specifically, to advance health equity.

Recommendation 8-8: The National Institutes of Health, Agency for Healthcare Research and Quality, Centers for Disease Control and Prevention, Health Resources and Services Administration, Centers for Medicare & Medicaid Services, U.S. Department of Education, philanthropies, and other funders should support research that advances the state of the science in several critical ways to advance health equity. Specific actions and research to support include the following:

- **Explore alternative methods to address complex causality.**
- **Expand research into individual differences (heterogeneity) in response to adversity and treatment.**
- **Promote scientific research that includes individuals and families from underrepresented communities.**
- **Promote research that explicitly seeks to understand the interconnected mechanisms of health inequities.**
- **Support research that addresses discrimination and structural racism.**
- **Support research for trauma-informed care and implicit bias training.**
- **Support systematic dissemination and implementation research.**
- **The National Institutes of Health and other relevant research entities should support the development of public–private partnerships, or other innovative collaborations, to**
    - **Build multidisciplinary teams, including but not limited to researchers in neuroscience, endocrinology, immunology, physiology, metabolism, behavior, psychology, and primary care to identify the most relevant factors in a child's complex environment that promote resilience and promote outcomes related to physical and mental health.**

- **Conduct research that measures the impact of chronic stress on all relevant organ systems and determines the specific molecular and biological pathways of interaction during the pre- and postnatal periods, which are directly relevant to potential interventions to address health disparities.[6]**

Many of the items in this recommendation will require recruiting diverse populations, with explicit attention to addressing racial/ethnic and socioeconomic inequities in developmental outcomes.

Measuring Success

The committee has identified a number of measures and indicators that can currently be measured and are important for tracking progress within each of the systems that act as key leverage points for early childhood development discussed in this report. For example, for caregivers, the committee proposes measuring maternal depression and stress, feelings of rejection or hostility to the child, available support for mothers, and any contact with child protective services. However, other measures will be needed. To further the ability for subgroup and other analyses and continuous data collection on both successes and failures, the following are needed (see Chapter 8 for more detail):

Understanding and measuring cumulative exposure. A number of factors impact early life development, ranging from influences in the microsocial or family environment, such as attachment, nurturing, and maternal well-being, to institutional levers, such as access to prenatal care or effective responses to trauma exposure, to macrosocial forces, such as racism and poverty. Effective tools already exist to measure exposure to some of these factors but there are few methods for empirically understanding how exposures to risks or protective factors accumulate and combine over time to establish a cumulative overall risk profile.

Understanding the interaction among developmental pathways. There are few frameworks for understanding the multidirectional relationship between the biological, social-behavioral, and psychological development of young children. In particular, understanding how these interactions may vary across the life course in response to changing plasticity of biological systems, different stages of personal and cognitive development,

[6] For reference, this is Recommendation 2-1 in this report.

and different life conditions and accumulated experiences is critical to building a health equity strategy.

Measuring interactions between systems. Models that can estimate "integrated risk" by combining key data from across the sectors where people live their lives are needed. Similarly, measures that examine results from cross-sector collaboration can help in documentation and accountability.

Improving methods to assess complex causality. Perhaps the biggest challenge facing health equity research is complex causality. Many of the preferred tools of science, such as randomized controlled trials, are designed to control for and isolate single causes rather than embrace complex, interrelated causality that may include multilevel, multidirectional, and nested effects—for which a larger toolbox of strategies is needed. For example, there needs to be greater exploration of effective community-based intervention approaches that use existing resources (e.g., as in "natural experiments").

CONCLUSION

The advances in the science of early development are ready to be acted on—there is no reason to wait for this additional science before taking action. Long-term psychological, behavioral, and physical health is shaped by biological and environmental factors, including their interactions, before conception and throughout the life course. This interplay necessitates action at the practice, policy, and systems levels that takes into account the full range of factors that shape health and well-being. These actions need to be taken before insults to early development occur. The science of plasticity shows that it is never too late to intervene but that early identification and intervention are generally more effective and cost-saving and require less effort. (See Box S-1 for a high-level overview of the report's findings and Table 9-1 for a summary of recommended actions in this report.) Furthermore, these actions need to take a life course, multigenerational approach to decrease health inequity, as children's well-being depends on the well-being of the primary caregivers and the quality of their relationship. Progress toward health equity can be achieved through multipronged, cross-sector interventions that focus on prevention, early detection, and mitigation and that work at the practice, policy, and systems levels to address the SDOH. The committee hopes that the roadmap laid out in this report will catalyze the steps that need to be taken across systems to close the health equity gap and improve the lives of our nation's children.

BOX S-1
Chapter Key Messages

A. **Lessons from the science of early development are clear and actionable.** A tremendous amount is known about how development occurs in the prenatal and early childhood periods. When the science of early development is coupled with a health equity approach to inform decision making, it provides an opportunity to improve outcomes for children and families. (Chapters 1 and 2)

B. **Over time, biological and social-psychological development interact to shape the way health develops over the life course.** Neither is deterministic—health outcomes are never set in stone. Rather, they are probabilistic—together, they cumulatively "set the odds" for good health. (Chapter 2)

C. **Biology and environment work together to affect children's growth and development.** Intervening early—to both prevent and mitigate adverse outcomes—is crucial. During the prenatal and early life periods, critical biological systems that will help shape health across the life course are developed and affected by the early environment. Intervening early, when the plasticity of these systems is at its greatest, is the best way to improve chances of developing in ways that optimize health outcomes. (Chapters 2 and 3)

D. **Ensuring the well-being of caregivers by supporting and caring for them is critical for healthy child development.** Reducing children's exposure to maltreatment is a critical lever, as is promoting nurturing behaviors, fostering self-regulation, and developing coping skills for caregivers and children. (Chapter 4)

E. **Preconception, prenatal, postpartum, and pediatric care needs to be reconceptualized** to address the root causes of health inequities and to better meet the developing health and health care needs of children and their families. Content, quality, and access to care are critical components of change. (Chapter 5)

F. **Families need adequate resources available for meeting basic needs, especially when children are young.** Bolstering resources should not come at the expense of attachment or caregiver well-being, so programs such as paid parental leave, basic support, and housing stability are needed. (Chapter 6)

G. **Early care and education (ECE) can be a platform for delivering or supporting services and interventions to advance health equity.** However, increasing the capacity and resources for ECE professionals is needed. (Chapter 7)

H. **To advance health equity and meet the developmental needs of children, a systems approach, including collaboration and alignment across sectors, is needed,** such as workforce support and training, trauma-informed systems and care, enhanced detection of early life adversity and improved response systems, and integration of care and services across all dimensions of health. (Chapter 8)