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Advancing Early Childhood Development: from Science to Scale

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A good start in life will ensure a sustainable future for all

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For the *Lancet* Series on **Child Development in Developing Countries (2007)** see http://thelancet.com/series/child-development-in-developing-countries

For the *Lancet* Series on **Child Development in Developing Countries (2011)** see http://thelancet.com/series/child-development-in-developing-countries-2

For the **Human Capital Summit** see http://live.worldbank.org/human-capital-summit

In 2007, the first *Lancet* Series on early childhood development reported that worldwide more than 200 million children younger than 5 years were failing to reach their developmental potential. In 2011, a second Series identified gaps in implementation and coverage of early childhood development interventions, and presented new evidence on the causes and effects of developmental inequities in early childhood. Crucially, the opportunity to amplify early childhood development interventions is in the first 3 years of life if stimulation through parenting, educational support, and adequate health nutrition is provided.

The Lancet now publishes a third Series, Advancing Early Childhood Development: from Science to Scale.[1–3] This new Series, led by Linda Richter from the University of Witwatersrand, South Africa, brings together the work of 45 authors from 22 global institutions—and from academic disciplines ranging from neuroscience, psychology, and paediatrics to biology, global health, and economics.

The Series describes the latest evidence about linkages between early care and development and progress towards global commitments on early childhood development. Interventions that are most beneficial through the life course are reviewed, and how to scale up early childhood development programmes globally is examined.

There are challenges to delivering early childhood development interventions and services that are not specifically addressed in the Series. In an increasingly unstable world where conflict and humanitarian crises are widespread, it will be important to ensure practical solutions to implementation in these settings. Also, there is a huge unmet need of children with physical and learning disabilities, which has clear relevance to child development. New ways for how the health system caters for these individuals will be crucial to address.

The message that child health and childhood development services should be integrated is made throughout the Series. It will be important to deliver on this recommendation, and to see what can be achieved on existing child health and survival platforms with community-based health workers and others in the first 1000 days of a child's life. With the multitude of actors and initiatives in early childhood development today, governance is both a challenge and an opportunity, as pointed out by Yusra Shawar and Jeremy Schiffman[4] in a Health Policy paper to accompany the Series.

Perhaps the most important message of the Series is the cost of inaction. If children are unable to fulfil their social and developmental potential, this not only harms their futures, but also the societies in which they live. The economic case for countries to invest in the early years is clear. In recognition of that reality, the Series is being launched on Oct 5, 2016, in advance of the first Human Capital Summit: Investing in the Early Years for Growth and Productivity, hosted by the World Bank. Heads of state and ministers of finance from high burden countries who have signalled their intent to ramp up investments in early childhood development services and reduce chronic malnutrition will attend. Countries include Guatemala, Côte d'Ivoire, Tanzania, Cameroon, Ethiopia, Indonesia, Madagascar, Pakistan, and Senegal.

It is the collective responsibility of governments, families, and all development health partners to guarantee that every individual starting life in every corner of the world is given the family care, education, health services, and nutrition to do so. As the Series is launched in several countries over coming months, *The Lancet* hopes that the messages representing

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almost a decade of cumulative work of early childhood development practitioners and researchers will be heard—and acted upon.

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1 Black MM, Walker SP, Fernald LCH, et al, for the *Lancet* Early Childhood Development Series Steering Committee. Early childhood development coming of age: science through the life course. *Lancet* 2016; published online Oct 4. http://dx.doi.org/10.1016/S0140-6736(16)31389-7.

2 Britto PR, Lye SJ, Proulx K, et al, and the Early Childhood Development Interventions Review Group, for the *Lancet* Early Childhood Development Series Steering Committee. Nurturing care: promoting early childhood development. *Lancet* 2016; published online Oct 4. http://dx.doi.org/10.1016/S0140-6736(16)31390-3.

3 Richter LM, Daelmans B, Lombardi J, et al, with the Paper 3 Working Group and the *Lancet* Early Childhood Development Series Steering Committee. Investing in the foundation of sustainable development: pathways to scale up for early childhood development. *Lancet* 2016; published online Oct 4. http://dx.doi.org/10.1016/S0140-6736(16)31698-1.

4 Shawar YR, Shiffman J. Generation of global political priority for early childhood development: the challenges of framing and governance. *Lancet* 2016; published online Oct 4. http://dx.doi.org/10.1016/S0140-6736(16)31574-4.

Early childhood development: the foundation of sustainable development

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Momentum for improving early childhood development has grown since *The Lancet* published the landmark Series, Child Development in Developing Countries in 2007, followed by Child Development in Developing Countries 2 in 2011. As shown in this new Series, Advancing Early Childhood Development: from Science to Scale,[1–3] between 2000 and 2015 the number of scientific publications on topics central to early childhood development increased substantially, about a third of countries had adopted multisectoral policies on early childhood development, and there has been an increase in funding for early childhood development.[1] Yet, few countries have institutionalised mechanisms to implement these policies, services remain fragmented and of variable quality, and programmes at scale are rare and poorly evaluated. Compelling new evidence in two areas strengthens our resolve to act to reach pregnant women and young children with holistic early childhood development services (panel).

First, new research in early human development shows that epigenetic, immunological, physiological, and psychological adaptations to the environment occur from conception, and that these adaptations affect development throughout the life course.[2] This knowledge calls for an approach targeting caregivers and children with effective interventions during sensitive times across the life course, with the period from conception to age 2–3 years being of particular importance.

Second, evidence on long-term outcomes from low-income and middle-income countries shows that a programme to increase cognitive development of stunted children in Jamaica 25 years ago[4] resulted in a significant, 25% increase in average adult earnings. Conversely, long-term follow-up of children from birth shows that growth failure in the first 2 years of life has harmful effects on adult health and human capital, including chronic disease, and lower educational attainment and adult earning.[5] Moreover, deficits and disadvantages persist into the subsequent generation,[6,7] producing a vicious inter-generational cycle of lost human capital and perpetuation of poverty. These findings shine light on the transformative potential of early childhood development programmes in low-income and middle-income countries. Only by breaking this cycle will the Sustainable Development Goals (SDGs) be achieved.

The past two to three decades have seen great improvements in child survival. As a result of global efforts to achieve the Millennium Development Goals, under-5 child mortality dropped by 53% between 1990 and 2015.[8] Yet, this Series shows that the burden of risk for poor developmental outcomes remains extremely high, affecting an estimated 250 million children (43%) younger than 5 years in low-income and middle-income countries, and rising to over two-thirds of children in sub-Saharan Africa.[1] These estimates are based on just

***Panel*: Key messages from the Advancing Early Childhood Development Series[1–3]**

The burden and cost of inaction is high

Although fewer than 6 million under-5 child deaths occur each year, about 250 million children in low-income and middle-income countries suffer suboptimal development due to poverty and stunting alone.[1] A poor start in life limits children's abilities to benefit from education leading to lower productivity and social tensions in the long term.[2] Consequences affect not only present but also future generations. For individuals, it predicts a loss of about a quarter of average adult income per year while countries may forfeit up to two times their current gross domestic product expenditure on health.[3] Many countries already feel the drag on their economies of poor human development, more so if they risk losing the dividend gained by improved child survival.

Early means early

Child development starts at conception and the development of the young child's brain is dependent on good nutrition and on certain types of experiences.[2] Most families provide these experiences for their young children, but many cannot because of stresses and conditions that interfere with their ability to parent. The influence of some of these factors starts during the preconception period. Families must be supported to provide nurturing care; they need material and financial resources, and the knowledge, time, and skilled assistance when required. Families can be supported through the adoption of national policies, affordable quality childcare, and provision of population-based services.

A start can be made through health

Expanding existing maternal and child health services to include interventions that promote nurturing care is an important entry point for multisectoral collaborations that support families and reach very young children.[2] Essential among these are strengthened maternal, infant, and young child nutrition, for growth and health; child protection, for violence prevention and family support; social protection, for family financial stability and capacity to access services; and education, for quality early learning opportunities.

Scale up what we know works

The Series shows that it is possible to move from small-scale civil society initiatives to nationwide programmes that are effective and sustainable.[3] Government leadership and political prioritisation are a prerequisite. Governments may choose different pathways for achieving early childhood development goals and targets, from introducing transformative whole-of-government initiatives to enhancing existing services progressively.[3]

For the *Lancet* **Series** on **Child Development in Developing Countries (2007)** see http://thelancet.com/series/child-development-in-developing-countries

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two known risks for which we have global data: extreme poverty and stunting. Adding other risks to young children's development, such as low levels of maternal schooling and physical maltreatment, substantially raises exposure to risks for poor development outcomes in many parts of the world.[3]

Nurturing interactions are crucial to mitigating these risks. A young child's developing brain is activated and patterned by the nurturing care of trusted adults.[2] Nurturing interactions comprise attentive responses to young children's efforts to connect to and learn about their world, and involve efforts to present children with age-appropriate learning experiences in a safe and mutually enjoyable way. Nurturing care takes place in the context of families and through service providers across many sectors—eg, health, nutrition, education, child and social protection—that provide the essential care for children to survive and to thrive.

Nurturing care can break down under conditions of extreme poverty, family and societal conflict, discrimination, and other forms of individual and social stress. Policies to support families, such as paid parental leave, time at work for breastfeeding, and the provision of free pre-primary education, can relieve pressures on families and enable them to care for their young children in ways that promote development.[3]

For **Scaling Up Nutrition** see http://scalingupnutrition.org/

For the **Global Partnership to End Violence Against Children** see http://www.end-violence.org/

Services that deliver effective and feasible interventions for children and their caregivers are also essential.[2] This Series shows that the cost of two such interventions, Care for Child Development and Thinking Healthy, added to an integrated maternal and child health and nutrition package of services is affordable; it would cost an additional US$0·5 per person per year (equivalent to 10% of the estimated existing costs) to scale up these interventions.[3,9]

Ideally, early childhood development services must be provided holistically across all relevant sectors to enable young children to thrive. Some countries have adopted multisectoral policies and are beginning to implement them. Other countries are expanding one set of services, such as social protection or pre-primary education, creating a wedge for the introduction of other services.[3] Ultimately, action is required across health and nutrition, education, and social and child protection.

In all settings, however, the health sector has unique advantages that allows it to support early childhood development immediately. It has extensive contact with pregnant women and with young children and their families, and enables the implementation of interventions that promote physical and cognitive development during the first 1000 days of a child's life. Many existing maternal and child health and nutrition services have been shown to benefit not only child survival and health but also child development, including cognition, and additional evidence-based early childhood development interventions can feasibly and affordably be integrated into existing services.[2,3]

UN agencies, the World Bank Group, and others have signalled their willingness to move forward on this front. The UN Secretary-General's Global Strategy for Women's, Children's and Adolescents' Health 2016–2030 and its objectives of survive, thrive, and transform provide a roadmap, including for multisectoral action with monitoring by an Independent Accountability Panel.[10] Similarly, the Global Partnership for Education 2020 embraces early childcare as a core SDG 4 component to achieving equitable lifelong learning opportunities for all.[11] A global Early Child Development Action Network aims to advance progress and complement these strategies, together with other global initiatives, including Scaling Up Nutrition and the Global Partnership to End Violence Against Children.

As lead authors of this Series, we call upon all stakeholders to step up strategic and equitable investments in early childhood development. The SDGs provide the vision and the multisectoral framework, while the findings of this Series map pathways for action towards ensuring that every child can realise their right to development and to achieve their full human potential.[12] We have the knowledge, the resources, and the opportunities. We must act now to lay the foundation for a lifetime of health and wellbeing—for the benefit of today's children, tomorrow's adults, and for future generations.

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1 Black MM, Walker SP, Fernald LCH, et al, for the *Lancet* Early Childhood Development Series Steering Committee. Early childhood development coming of age: science through the life course. *Lancet* 2016; published online Oct 4. http://dx.doi.org/10.1016/S0140-6736(16)31389-7.

2 Britto PR, Lye SJ, Proulx K, et al, and the Early Childhood Development Interventions Review Group, for the *Lancet* Early Childhood Development Series Steering Committee. Nurturing care: promoting early childhood development. *Lancet* 2016; published online Oct 4. http://dx.doi.org/10.1016/S0140-6736(16)31390-3.

3 Richter LM, Daelmans B, Lombardi J, et al, with the Paper 3 Working Group and the *Lancet* Early Childhood Development Series Steering Committee. Investing in the foundation of sustainable development: pathways to scale up for early childhood development. *Lancet* 2016; published online Oct 4. http://dx.doi.org/10.1016/S0140-6736(16)31698-1.

4 Gertler P, Heckman J, Pinto R, et al. Labor market returns to an early childhood stimulation intervention in Jamaica. *Science* 2014; **344:** 998–1001.

5 Martorell R, Horta BL, Adair LS, et al, and Consortium on Health Orientated Research in Transitional Societies Group. Weight gain in the first two years of life is an important predictor of schooling outcomes in pooled analyses from five birth cohorts from low- and middle-income countries. *J Nutr* 2010; **140:** 348–54.

6 Addo OY, Stein AD, Fall CHD, et al. Parental childhood growth and offspring birthweight: pooled analyses from four birth cohorts in low and middle income countries. *Am J Hum Biol* 2015; **27:** 99–105.

7 Walker SP, Chang SM, Wright A, Osmond C, Grantham-McGrego SM. Early childhood stunting is associated with lower developmental levels in the subsequent generation of children. *J Nutr* 2015; **145:** 823–28.

8 UN Interagency Group for Child Mortality Estimation. Levels and trends in child mortality report 2015: estimates developed by the UN Interagency Group for Child Mortality Estimation. New York: United Nations Children's Fund, 2015.

9 WHO, UNICEF, Care for Child Development. Improving the care for young children. Geneva: World Health Organization, 2012.

10 UN Secretary-General. Global strategy for women's, children's and adolescents' health (2016–2030). New York: United Nations, 2015. http://globalstrategy.everywomaneverychild.org/ (accessed Sept 13, 2016).

11 Global Partnership for Education. Improving learning and equity through stronger education systems. Strategic plan 2014–2020. Washington, DC: Global Partnership for Education, 2014. http://www.globalpartnership.org/content/gpe-2020-strategic-plan (accessed Sept 13, 2016).

12 UN. Transforming our world: the 2030 agenda for sustainable development. Version 1 September 2015. New York: United Nations, 2015.

The early years: silent emergency or unique opportunity?

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Today's children will drive growth and development in the societies of tomorrow. We should be deeply concerned, therefore, that an estimated 250 million children (43%) younger than 5 years in low-income and middle-income countries are at risk of falling short of their potential because of adversities they face in their early, formative years.[1]

Helping these children reach that potential by investing in early childhood development—and developing their physical, cognitive, emotional, and social capacities—will benefit not only them but also all of us. Failing to make such investments will have profound implications for children, their families, and their societies, exacerbating inequalities and deepening societal divisions. When it comes to early childhood development, the cost of inaction is high.

The papers published in the *Lancet* Series, Advancing Early Childhood Development: from Science to Scale,[1–3] quantify that cost, showing that children who are not nurtured properly in the early years may forfeit a quarter of their earning capacity as adults. The Series provides a roadmap to successful interventions in early childhood, along with evidence that such interventions contribute directly to ending extreme poverty, boosting shared prosperity, promoting healthy lives and learning, reducing inequalities, and maintaining peaceful societies.

New evidence is presented in the Series to support the concept of nurturing care as a basic right of every child, on the basis of the scientific advancements underscoring the importance of the early years.[2] Thanks to those advancements, we know more than ever before about what works in early childhood when brain development is at its peak. All indications are that we must reach families from—or even before—the time of conception, and that support is vital in the first 1000 days of a child's life. The evidence shows that young children have the best chance of maximising their potential when they are well nourished, responsively cared for, with learning opportunities from birth onwards, and protected from disease, violence, and stress.[1–3]

The Series introduces evidence, as well, that successful policies for early childhood development focus on equipping families with the time, resources, knowledge, and skills they need to provide nurturing care.[3] And it emphasises the importance of well coordinated efforts across sectors, including health, nutrition, education, welfare, social protection, environmental safety and conservation, agriculture, and water and sanitation.

But although we know what has to be done in the early years, our challenge is to provide the necessary resources and opportunities for the most disadvantaged young children and their families. Only with accessible support and services can we accelerate progress for the more than four in ten children worldwide who are seriously limited in accessing what they need for healthy growth, learning, and development.[1,3]

By advocating for interventions throughout the life course—starting with maternal health and prenatal care—we and our partners can make a positive difference in early childhood policies and programmes. If we succeed, more young children around the world will be able to survive and thrive, becoming developmentally ready to reap the full benefits of education when they reach school age.

We, therefore, have committed to making early childhood investments, policies, and programmes an essential part of our support to the countries in which we operate. To that end, we will work to create a continuum of care during the early years by engaging all relevant sectors. And we will help governments develop or strengthen national strategies and action plans aimed at giving every young child a fair chance to thrive. The UN Secretary-General's Global

Nyani Quarmyne/Panos

For the **Global Financing Facility** see http://globalfinancingfacility.org

For the **Early Leaning Partnership** see http://www.worldbank.org/en/topic/education/brief/early-learning-partnership

For the **Global Partnership to End Violence Against Children** see http://www.end-violence.org

For **Scaling Up Nutrition** see http://scalingupnutrition.org

For the **Power of Nutrition** see http://www.powerofnutrition.org

Strategy for Women's, Children's and Adolescents' Health 2016–2030 provides a foundation for such an intersectoral approach.[4]

The early childhood agenda is truly global, because the need is not limited to low-income countries. Children living in disadvantaged households in middle-income and wealthy countries are also at risk. In targeting our investments, we should give priority to populations in the greatest need, such as families and children in extreme poverty and those who require humanitarian assistance. In addition, we have to build more resilient systems in vulnerable communities to mitigate the disruptive influence of natural disasters, fragility, conflict, and violence.[5]

Working together, we can help countries generate synergies and cost savings from well designed, integrated packages of early childhood services. But we must also continue learning from experience to strengthen the quality of programmes focused on the early years. Rigorous research into the delivery of interventions, and their short-term and long-term outcomes, is important for innovation. We need stronger measurement and a new consensus on robust, valid indicators to assess children's cognitive and socioemotional development. Intensified monitoring through nationwide population-based assessments, such as the Multiple Indicator Cluster Survey, among others, is essential for accountability and will help us stay the course.

Advancing early childhood development in this way will require the deliberate allocation of resources and coordination across countries and regions. Partnerships will, therefore, be key to our success. The Early Childhood Development Action Network, launched in April, 2016, is an important one.[6] It brings together stakeholders from the public and private sectors, civil society, academia, professional associations, foundations, donor agencies, and local communities. The new network complements existing partnerships, providing a platform for joint advocacy, learning, action, measurement, and accountability.

We will also keep working to protect and invest in young children through the Global Financing Facility for the UN Secretary-General's Every Woman Every Child initiative, as well as alliances such as the Early Learning Partnership, the Global Partnership to End Violence Against Children, Scaling Up Nutrition, and the Power of Nutrition.

Ultimately, no matter what platforms or partnerships we use to get there, reaching children in the early years is a prerequisite for sustainable development. This *Lancet* Series shows why that is true, and points the way towards giving all young children the care and support they need to reach their potential. It is up to all of us to bring that aspiration closer to reality.

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1 Black MM, Walker SP, Fernald LCH, et al, for the *Lancet* Early Childhood Development Series Steering Committee. Early childhood development coming of age: science through the life course. *Lancet* 2016; published online Oct 4. http://dx.doi.org/10.1016/S0140-6736(16)31389-7.

2 Britto PR, Lye SJ, Proulx K, et al, and the Early Childhood Development Interventions Review Group, for the *Lancet* Early Childhood Development Series Steering Committee. Nurturing care: promoting early childhood development. *Lancet* 2016; published online Oct 4. http://dx.doi.org/10.1016/S0140-6736(16)31390-3.

3 Richter LM, Daelmans B, Lombardi J, et al, with the Paper 3 Working Group and the *Lancet* Early Childhood Development Series Steering Committee. Investing in the foundation of sustainable development: pathways to scale up for early childhood development. *Lancet* 2016; published online Oct 4. http://dx.doi.org/10.1016/S0140-6736(16)31698-1.

4 UN Secretary-General. Global strategy for women's, children's and adolescents' health (2016–2030). New York: United Nations, 2015. http://globalstrategy.everywomaneverychild.org/ (accessed Sept 26, 2016).

5 Every Woman Every Child Everywhere workstreams. From principles to practice: implementing the global strategy for women's children's and adolescents' health everywhere. Meeting report. April 4–5, 2016. http://www.everywomaneverychild.org/images/EveryWhere_AD_Report_for_web-4.pdf (accessed Sept 13, 2016).

6 World Bank Group. Press release: World Bank Group, UNICEF urge greater investment in early childhood development. April 14, 2016. http://www.worldbank.org/en/news/press-release/2016/04/14/world-bank-group-unicef-urge-greater-investment-in-early-childhood-development (accessed Sept 13, 2016).

Good early development—the right of every child

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Data from the past decade show that millions of women, children, and adolescents have been left behind due to underlying social, economic, and cultural inequities. To address these issues, in September, 2015, the international community adopted the Global Strategy for Women's, Children's and Adolescents' Health, a bold roadmap to end preventable maternal, newborn, and child deaths, including stillbirths, by 2030. The Global Strategy aims to ensure that women, children, and adolescents survive, thrive, and lead lives that are transformative and prosperous.[1] It proposes that at least US$100 billion in demographic dividends can be realised from investments in early childhood and adolescent health and development. Enabling children to develop their full potential, particularly in the first 3 years of life, has high rates of return across the life course. These facts can no longer be ignored.

Only in the past few years have the development and health communities recognised that early childhood development is a solid foundation for human capital development. And now the *Lancet* Series, Advancing Early Childhood Development: from Science to Scale,[2–4] further advances our knowledge of this important issue.

As reported in the first Series paper, about 250 million (43%) children younger than 5 years in low-income and middle-income countries are at risk of not reaching their developmental potential because of extreme poverty and stunting.[2] Knowing this number is important to increase political commitment to, and investment in, early childhood development programmes and to inform implementation of the Sustainable Development Goals (SDGs) and ensure no one is left behind.

Examples of research and policy development in some countries are a promising indication that the global community is waking up to the importance of good early childhood development as a fundamental right of every child. Supporting early childhood development services and programmes allows children to achieve their full potential, including optimum education which is a gateway to their social inclusion and a foundation for sustainable development for all nations. But despite evidence of what works to support early childhood development, and the setting of global and national goals, domestic and global human and financial resource allocation for early childhood development remains insufficient. The evidence presented in this Series makes it clear that this situation must change.

This Series adds new insights about the importance of early childhood development at every stage of a child's life from before conception throughout the life course. When early childhood development stalls, there are critical mitigation interventions across health, nutrition, education, child protection, and social protection sectors that should be accessible to all families and young children. And yet we continue to see an overemphasis on policies and programmes for school readiness at the expense of holistic interventions through the life course, particularly in the first 1000 days of a child's life. If we are to make progress in turning science into practice, policies and programmes need to take a life-course approach and resource allocation must follow suit.

The delivery of early childhood development services cannot be fragmented across different sectors, but should be provided as integrated, multisectoral evidence-based interventions. This Series highlights the importance of a life-course approach and greater integration of the health sector with other sectors, such as nutrition, education, child protection, social protection, and water and sanitation, bringing together multistakeholder partners and combining innovative financing and accountability mechanisms to help achieve the SDGs.

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Political will is essential to advance early childhood development in this way. Investing in early childhood development, integrated with basic family and child health and nutrition, and doing so early, will see individuals and nations overcome poverty and exclusion and progress towards their development goals. All stakeholders must reflect on how seriously they take the cost of inaction. Through the Global Strategy and its accountability framework, all partners are urged to improve early childhood development and be accountable in their national plans. It is up to all stakeholders to make sure we reach the goals of the Global Strategy and the SDGs. This entails careful planning, execution, and monitoring so that no one is left behind, and it requires unprecedented human and financial resources for implementation. We can mobilise these resources by adopting a partnership model that is country led and co-opts the expertise and resources of stakeholders from across multiple sectors.

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1 UN Secretary General. Global strategy for women's, children's and adolescents' health (2016–2030). New York: United Nations, 2015. http://globalstrategy.everywomaneverychild.org/ (accessed Sept 13, 2016).
2 Black MM, Walker SP, Fernald LCH, et al, for the *Lancet* Early Childhood Development Series Steering Committee. Early childhood development coming of age: science through the life course. *Lancet* 2016; published online Oct 4. http://dx.doi.org/10.1016/S0140-6736(16)31389-7.
3 Britto PR, Lye SJ, Proulx K, et al, and the Early Childhood Development Interventions Review Group, for the *Lancet* Early Childhood Development Series Steering Committee. Nurturing care: promoting early childhood development. *Lancet* 2016; published online Oct 4. http://dx.doi.org/10.1016/S0140-6736(16)31390-3.
4 Richter LM, Daelmans B, Lombardi J, et al, with the Paper 3 Working Group and the *Lancet* Early Childhood Development Series Steering Committee. Investing in the foundation of sustainable development: pathways to scale up for early childhood development. *Lancet* 2016; published online Oct 4. http://dx.doi.org/10.1016/S0140-6736(16)31698-1.

Expanding the evidence base to drive more productive early childhood investment

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For the *Lancet* Series on **Child Development in Developing Countries (2007)** see http://thelancet.com/series/child-development-in-developing-countries

For the *Lancet* Series on **Child Development in Developing Countries (2011)** see http://thelancet.com/series/child-development-in-developing-countries-2

For the third time in a decade, after Series in 2007 and 2011, *The Lancet* has published a Series on the global status of early childhood development.[1–3] Building on the explicit attention to the early years of life included in the Sustainable Development Goals, the time is ripe to take stock of how much has been accomplished in the past 10 years and identify priorities for accelerated progress in the decades to come.

This new *Lancet* Series, Advancing Early Childhood Development Series: from Science to Scale,[1–3] reflects the power and future possibilities of a growing knowledge base. The science of early childhood development and its underlying neurobiology are increasingly invoked in the global discourse on education, health, social and child protection, and human capital formation.[4] This science provides a powerful framework for understanding how development happens, how it can be derailed, and how to get it back on track when it is disrupted.

Advances in the biology of adversity have also helped make a strong case for directing more resources towards the early years. But opportunities for using science to catalyse new strategies or produce larger population effects remain largely untapped.[5]

Meeting this challenge begins by bringing together the many sources of knowledge and expertise that are needed to push forward. These include not only statistics from controlled intervention trials, but also causal understanding from developmental biology, the technical craft of implementation science, practical lessons from experiences with service delivery systems across sectors, and on-the-ground insights from community leaders and families. All that said, the early childhood development agenda would benefit greatly from an expanded definition of evidence that includes but goes beyond cataloguing data from rigorous programme evaluations.

Gains in reducing child mortality provide a vivid example of what can be achieved when research is targeted towards clearly defined outcomes, specific applications, community-level engagement, and effective implementation at scale. Although the basic biology of many infectious diseases is clear, the ability to translate this knowledge into improved health outcomes and reduced mortality in different parts of the world has been variable. In some circumstances, the challenge lies in differential susceptibility to the causal agent or varied response to treatment. In others, the barriers lie in the service delivery system as a result of resource constraints or limited capacity to partner effectively with marginalised populations.

The complexity of the early childhood development agenda means that substantial progress from surviving to thriving will require an equally disciplined process driven by strong science, sound implementation, sustained community engagement, rigorous evaluation, and an uncompromising commitment to breakthrough impacts.[6,7] Scaling up an early childhood intervention that produced significant effects in one place with the expectation that it will achieve comparable impacts for a diversity of children in a wide variety of environments is a far more complex challenge than moving from a randomised controlled trial (RCT) of an effective vaccine to a successful, population-level immunisation programme. In a field where intervention variability is high, the number of intended outcomes is large, the timeline for ultimate impacts limits rapid-cycle iterative learning, and the list of potential moderating variables is long and context specific, well executed RCTs are a vital part of the knowledge base but they alone are insufficient to produce effective strategies for population effects.

Andrew Aitchison/Contributor/Getty

Leveraging the evidence presented in this new *Lancet* Series to achieve breakthrough outcomes for millions of young children will require a transformation of the early childhood development field. This change needs to be grounded in two concepts: an expanded definition of evidence beyond RCT data alone and enhanced capacity to generate and use that broader knowledge base effectively.

Research in neuroscience, for example, is generating insights about plasticity and sensitive periods in brain development that could inform more effective timing of specific interventions.[8] Advances in epigenetics are producing a deeper understanding of differences in vulnerability and resilience in the face of stress, as well as variability in response to interventions that could inform more efficient resource allocation.[9] Equally important is the role of practical, community-level knowledge embedded in cultural beliefs and child-rearing practices that influence nurturing care,[10] and the insights it provides about what works for whom and why in different contexts.[11]

Over the past decade the early childhood community has been building a welcome consensus around the need to invest in rigorous evaluations and standards-based repositories for sharing findings. To carry such findings across highly diverse settings and achieve broader impact at scale, however, a capacity for active, cross-disciplinary, and adaptive learning is equally essential. This requires a dynamic learning community that is able to integrate intervention statistics with developmental biology, technical and practical expertise in programme implementation, and context-specific knowledge and priorities.[12]

Breakthrough outcomes will not be achieved by universally applicable solutions identified in single studies. They will require an iterative process of discovery fuelled by vigorous on-the-ground adaptation, continuous dialogue at the community, national, and global levels, and broadly accessible platforms for shared learning across diverse domains of thinking and doing.

The strategic integration of multiple sources of knowledge, an innovation mindset, and the adaptive capacity within existing programmes and systems to use all available evidence productively are essential for transforming the lives of millions of children who face the burdens of poverty, violence, maltreatment, exploitation, and oppression—and for securing a brighter future for their societies. The costs of inaction are monumental. The price for too narrow a definition of evidence will be prohibitive.

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1 Black MM, Walker SP, Fernald LCH, et al, for the *Lancet* Early Childhood Development Series Steering Committee. Early childhood development coming of age: science through the life course. *Lancet* 2016; published online Oct 4. http://dx.doi.org/10.1016/S0140-6736(16)31389-7.
2 Britto PR, Lye SJ, Proulx K, et al, and the Early Childhood Development Interventions Review Group, for the *Lancet* Early Childhood Development Series Steering Committee. Nurturing care: promoting early childhood development. *Lancet* 2016; published online Oct 4. http://dx.doi.org/10.1016/S0140-6736(16)31390-3.
3 Richter LM, Daelmans B, Lombardi J, et al, with the Paper 3 Working Group and the *Lancet* Early Childhood Development Series Steering Committee. Investing in the foundation of sustainable development: pathways to scale up for early childhood development. *Lancet* 2016; published online Oct 4. http://dx.doi.org/10.1016/S0140-6736(16)31698-1.
4 Lake A, Chan M. Putting science into practice for early child development. *Lancet* 2015; **385:** 1816–17.
5 Shonkoff J. Leveraging the biology of adversity to address the roots of disparities in health and development. *Proc Natl Acad Sci USA* 2012; **109:** 17302–07.
6 Shonkoff JP, Richter L, Van der Gaag J, Bhutta Z. An integrated scientific framework for child survival and early childhood development. *Pediatrics* 2012; **129:** e460–72.
7 Shonkoff J. Capitalizing on advances in science to reduce the health consequences of early adversity. *JAMA Pediatr* 2016; published online Aug 22. DOI:10.1001/jamapediatrics.2016.1559.
8 Takesian AE, Hensch TK. Balancing plasticity/stability across brain development. *Prog Brain Res* 2013; **207:** 3–34.
9 Meaney MJ. Epigenetics and the biological definition of gene × environment interaction. *Child Dev* 2010; **81:** 41–79.
10 Radner J, Silver K, Foote N. From lab to village: reimagining how science can serve children. In: UNICEF. State of the world's children report 2015. http://sowc2015.unicef.org/stories/lab-and-village-reimagining-how-science-can-serve-children/ (accessed Sept 19, 2016).
11 Radner J, Shonkoff J. Mobilizing science to reduce intergenerational poverty. In: Andrews N, Erickson D, eds. Investing in what works for America's communities. San Francisco: Federal Reserve Bank of San Francisco and Low Income Investment Fund, 2012.
12 Center on the Developing Child at Harvard University. From best practices to breakthrough impacts: a science-based approach to building a more promising future for young children and families. Cambridge, MA: Center on the Developing Child at Harvard University, 2016.

Advancing Early Childhood Development: from Science to Scale 1

Early childhood development coming of age: science through the life course

Maureen M Black, Susan P Walker, Lia C H Fernald, Christopher T Andersen, Ann M DiGirolamo, Chunling Lu, Dana C McCoy, Günther Fink, Yusra R Shawar, Jeremy Shiffman, Amanda E Devercelli, Quentin T Wodon, Emily Vargas-Barón, Sally Grantham-McGregor, for the* Lancet *Early Childhood Development Series Steering Committee†*

Early childhood development programmes vary in coordination and quality, with inadequate and inequitable access, especially for children younger than 3 years. New estimates, based on proxy measures of stunting and poverty, indicate that 250 million children (43%) younger than 5 years in low-income and middle-income countries are at risk of not reaching their developmental potential. There is therefore an urgent need to increase multisectoral coverage of quality programming that incorporates health, nutrition, security and safety, responsive caregiving, and early learning. Equitable early childhood policies and programmes are crucial for meeting Sustainable Development Goals, and for children to develop the intellectual skills, creativity, and wellbeing required to become healthy and productive adults. In this paper, the first in a three part Series on early childhood development, we examine recent scientific progress and global commitments to early childhood development. Research, programmes, and policies have advanced substantially since 2000, with new neuroscientific evidence linking early adversity and nurturing care with brain development and function throughout the life course.

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This is the first in a **Series** of three papers about early childhood development

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Introduction

Two *Lancet* Series on Child Development in Developing Countries (2007 and 2011) spearheaded the review of evidence linking early childhood development with adult health and wellbeing. The finding that 219 million (39%) children younger than 5 years (under-5s) in low-income and middle-income countries (LMICs) are at risk of not reaching their developmental potential, leading to an average deficit of 19·8% in adult annual income,[1] attracted global attention.[2] These two Series reviewed evidence related to key biological and psychosocial risks; summarised neuroscientific evidence on both adverse and positive experiences affecting early brain development; reviewed effectiveness of programmes and policies to improve early childhood development; provided the estimated costs of not investing in preschools; and concluded that inequities in development begin prior before conception, and that timely interventions reduce inequities and increase productivity (appendix pp 2).[3–6]

New evidence supports a life course perspective on childhood development and strengthens the conclusions and recommendations from the earlier *Lancet* Series, primarily through advances in neuroscience and longitudinal follow-up approaches. Poverty and adverse childhood experiences have long-term physiological and epigenetic effects on brain development and cognition.[7–9] Neural processes, influenced by genetic and epigenetic variation, underlie the attachment and early learning systems, influencing subsequent health and development.[10] Longitudinal follow-up studies among children exposed to poverty and other adverse conditions show beneficial effects of interventions on adult wage earning,[11,12] competence (eg, intelligence quotient, educational attainment, and general knowledge),[13,14] health biomarkers,[15] reductions in violence, depressive symptoms and social inhibition,[14] and growth in the subsequent generation.[16,17] These findings provide strong economic justification for investment in early childhood,[18] especially in children younger than 3 years (under-3s).[19]

In response to the loss of human potential associated with early adversities, leaders from international organisations have issued urgent calls for strategies to

Key messages

- The proportion of children younger than 5 years in low-income and middle-income countries at risk of not attaining their developmental potential because of extreme poverty and stunting remains high (43%).
- The accumulation of adversities, beginning before conception and continuing throughout prenatal and early life, can disrupt brain development, attachment, and early learning. Developmental delays are evident in the first year, worsen during early childhood, and continue throughout life.
- Despite substantial progress in early childhood development research, programmes, and national policies since 2000, services are of varying quality with uncoordinated and inequitable access, especially for children younger than 3 years.
- Children's early development requires nurturing care—defined as health, nutrition, security and safety, responsive caregiving, and early learning—provided by parent and family interactions, and supported by an environment that enables these interactions.
- Coordination, monitoring, and evaluation are needed across sectors to ensure that high quality early childhood development services are available throughout early childhood and primary school, up to the age of 8 years.
- Action at global, national, and local levels is needed to increase political commitment to and investment in early childhood development.

	Under-5 population		Number stunted		% stunted		Number living in extreme poverty		% living in extreme poverty		Number at risk of not reaching developmental potential*		% at risk of not reaching developmental potential	
	2004	2010	2004	2010	2004	2010	2004	2010	2004	2010	2004	2010	2004	2010
East Asia and Pacific	136·2	145·7	34·1	29·6	25%	20%	30·2	18·2	22%	13%	54·7	41·7	40%	29%
Europe and central Asia	25·4	27·9	4·8	4·8	19%	17%	1·1	0·8	4%	3%	5·6	5·4	22%	19%
Latin America and Caribbean	56·8	54·1	9·1	8·0	16%	15%	4·9	3·0	9%	6%	11·6	9·7	20%	18%
Middle East and north Africa	32·3	36·5	8·0	8·6	25%	24%	1·1	1·0	3%	3%	8·7	9·1	27%	25%
South Asia	171·4	168·1	80·6	67·6	47%	40%	69·5	46·5	41%	28%	110·9	88·8	65%	53%
Sub-Saharan Africa	124·9	143·3	53·9	55·1	43%	38%	67·5	72·3	54%	50%	87·6	94·8	70%	66%
Total	547·0	575·6	190·6	173·7	35%	30%	174·3	141·8	32%	25%	279·1	249·4	51%	43%

Generated using updated data and methods. *Calculations for the number of children at risk of not reaching their developmental potential take into account the number of children jointly exposed to stunting and poverty. Further information regarding the estimation of this joint set is provided by Lu and colleagues.[22]

***Table 1*: Estimated number (in millions) and prevalence of under-5 children experiencing stunting or extreme poverty in 2004 and 2010**

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For the *Lancet* Series on Child Development in Developing Countries (2007) see http://thelancet.com/series/child-development-in-developing-countries

ensure that young children reach their developmental potential.[2] This Series responds to those calls. Paper 1 proposes a life course perspective and the study of global commitments to early childhood development; Paper 2 examines evidence to implement and sustain effective early childhood development programmes at scale;[20] and Paper 3 proposes models and strategies to promote early childhood development at scale.[21] This Series focuses on the period from conception up to and including under-5s. Particular attention is given to children under the age of 3, because of the importance associated with the sensitivity and vulnerability of early brain development, the relative lack of attention to early childhood development in general during this period, and the potential for service delivery through the health, nutrition, and social protection sectors.

This first paper has five objectives: (1) to update the estimates of children at risk of not attaining their developmental potential; (2) to present a life course conceptual framework of early childhood development; (3) to assess global commitments and progress in early childhood development since 2000; (4) to examine access to centre-based and home-based early childhood development programmes; and (5) to describe cross-sectoral opportunities to implement early childhood development programmes.

Estimates of children at risk of not attaining developmental potential

Since the 2007 *Lancet* publication of the number of under-5 children in LMICs at risk for not reaching their developmental potential due to stunting and extreme poverty,[1] definitions of stunting and extreme poverty have been updated, with improvements to the source data and estimation methods. As a result, the estimated number of children in LMICs at risk of not reaching their developmental potential, calculated in 2004, was revised from 219 million to 279 million.[22] Between 2004 and 2010, the estimated number of children under 5 years in LMICs exposed to stunting or extreme poverty, and therefore at risk of not reaching their developmental potential, declined from 279·1 million (51% of children in 2004) to 249·4 million (43% of children in 2010) (table 1).[22] South Asia experienced the largest decline in both the number and prevalence of children at risk (from 110·9 million to 88·8 million, and from 65% to 53%, between 2004 and 2010). Sub-Saharan Africa had the highest prevalence of children at risk of not reaching developmental potential (70% in 2004 and 66% in 2010).

Population-level assessments measure the developmental status of populations and are used for monitoring global targets, such as UN Sustainable Development Goals. Stunting and extreme poverty serve as proxy measures because they are associated with children's development, are measured globally using uniform methods, and are responsive to environmental and economic changes. Direct population-level assessments are advantageous due to their sensitivity to variations in children's development and responsiveness to programmatic interventions. However, direct assessments are often costly and time-consuming to measure, and might require developmental and cultural adaptations. Initial analyses using UNICEF's caregiver-reported Early Childhood Development Index found that 36·8% of 3-year-olds and 4-year-olds in 35 LMICs do not attain basic cognitive and socio-emotional skills, such as following directions and inhibiting aggression.[23] Efforts are underway to validate population-level measures that can be applied globally and used for monitoring progress in meeting targets from the Sustainable Development Goals for under-3s.[24]

Life course conceptual framework of early childhood development

Childhood development is a maturational and interactive process, resulting in an ordered progression of perceptual, motor, cognitive, language, socio-emotional, and self-regulation skills.[25] Although the developmental process is similar across cultures, progression rates can vary as

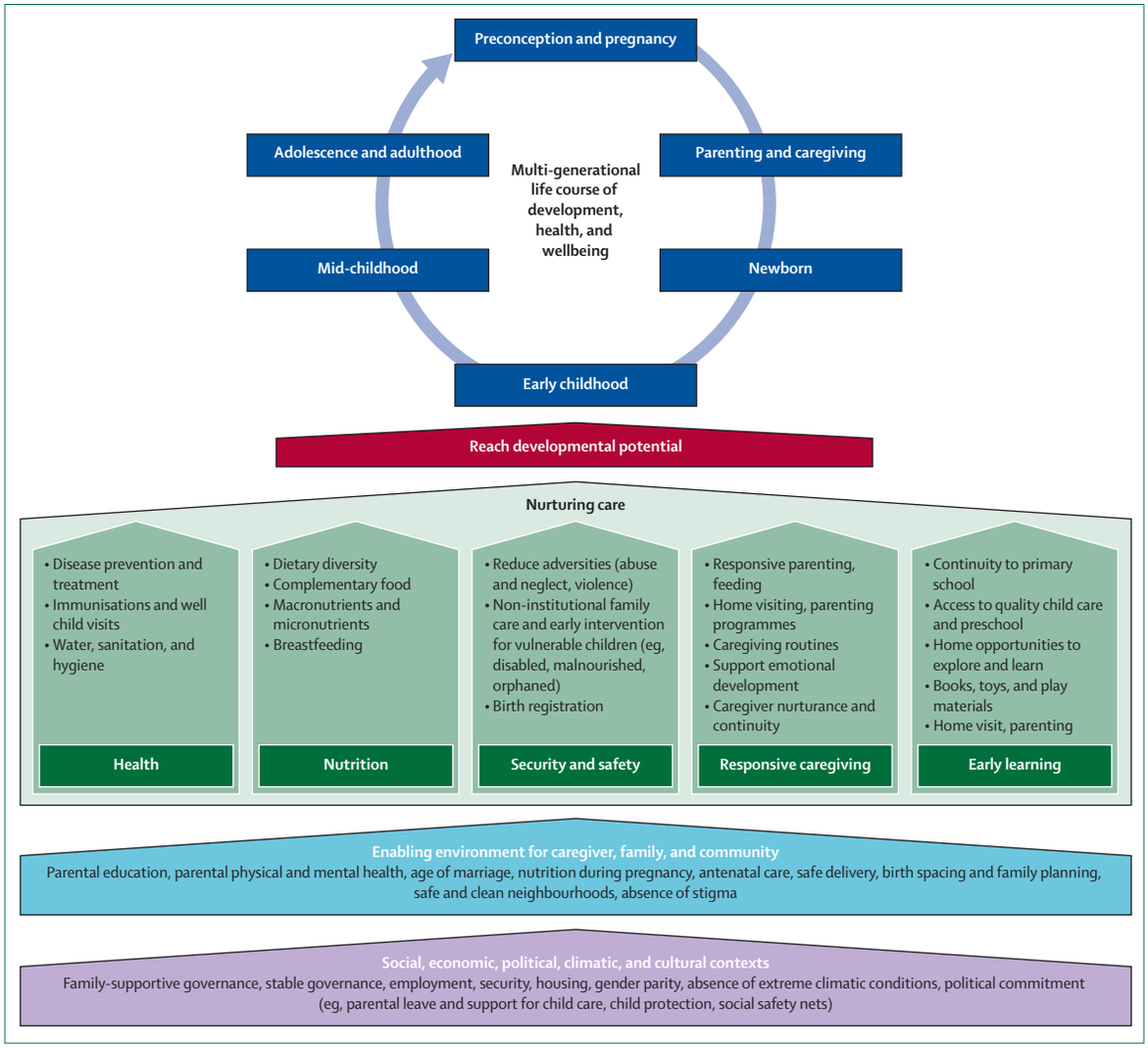

Figure 1: **The effects of contexts, environments, and nurturing care through the multigenerational life course**

For the ***Lancet*** **Series on Child Development in Developing Countries (2011)** see http://thelancet.com/series/child-development-in-developing-countries-2

See Online for appendix

children acquire culture-specific skills.[24] The acquisition of skills and learning in middle childhood, throughout adolescence, and into adulthood builds on foundational capacities established between preconception and early childhood, with multigenerational effects (figure 1).

Children reach developmental potential when they acquire developmental competencies for academic, behavioural, socio-emotional, and economic accom plishments. Multiple factors influence the acquisition of competencies, including health, nutrition, security and safety, responsive caregiving, and early learning; these domains interact with each other and can be mutually reinforcing through the process of development. All are necessary for nurturing care and occur through bi-directional interactions, initiated by both children and caregivers, and sustained by their environments.

Nurturing care is characterised by a home environment that is sensitive to children's health and nutritional needs, responsive, emotionally supportive, and developmentally stimulating and appropriate, with opportunities for play and exploration and protection from adversities.[27] Positive associations between nurturing care and children's health, growth, and development have been demonstrated worldwide,[28,29] supported by neuroscientific evidence that nurturing care during early childhood attenuates the detrimental effects of low socioeconomic status on brain development.[9,30,31]

Informed by social ecology,[15,26] nurturing care extends beyond families to include community caregivers and support for families.[32] The systems model that forms the basis for our life course conceptual framework includes both an enabling environment for caregiver, family, and community, and an enabling social, economic, political, climatic, and cultural context (figure 1). The former represents personal resources, including maternal

Panel 1: **Sensitive periods for the association of adversities with early childhood development**

Stunting

- Evidence from low-income and middle-income countries suggests that the prenatal period[39] and the first 24 months after birth[40-42] are the most sensitive times for stunting to be associated with later cognition, executive function, and school attainment; after 24 months the association is not as strong.[38,41]
- Some catch up is possible in height-for-age after 24 months, with uncertain cognitive gains.[43,44]
- Macronutrient supplementation studies generally confirm the importance of the first 24 months for intellectual development.[45] Early supplementation has long-term benefits to wages, but no benefit occurred with supplementation after 36 months.[12]

Poverty

- Poverty is associated with deficits in language and cognition at 3 years that are larger at 5 years of age.[46-48]
- Deficits are evident from the first year of life, with deficits in executive function observed in Argentinian infants aged 6 to 14 months,[49] and developmental deficits observed in infants between 3 and 23 months of age in India, Indonesia, Peru, and Senegal.[50] Deficits in language and cognition were found at 10 to 12 months of age in Colombian children, with deficits increasing up to 42 months.[47]
- A longitudinal Bangladeshi study found a 0·2 SD deficit in cognition between the top and bottom wealth quintile at age 7 months that increased to 1·2 SD of intelligence quotient (IQ) by 63 months. The effect of poverty was mostly mediated (86%) by parental education, the quality of the home environment, and prenatal and postnatal linear growth up to 2 years. After 24 months, growth had only a small effect on IQ, whereas the home environment had a substantial positive effect up to 63 months.[41]
- Changes in poverty level after age 36 months affect cognitive development and executive function.[51]

Severe psychosocial deprivation

- Being in a residential institution is an example of profound deprivation. A randomised trial of placing Romanian children (aged 5–31 months) from institutions in quality foster care, or keeping them in the institution, presents a unique opportunity to examine sensitive periods in childhood development.
- Children in quality foster care improved in IQ (at 8 years),[52] attachment (at 42 months),[53] and electroencephalogram power and coherence (at 8 years),[54] compared with children remaining in institutions. Children placed before 24–26 months showed a more improved stress response (at 12 years),[55] language (at 42 months),[56] and mental health (at 54 months),[57] than children placed later.
- Children who remained in the institutions had a blunted stress response. Children fostered before 24 months improved in their cortisol response and children fostered before 18 months improved in their parasympathetic response.[55]
- Children fostered before age 15 months caught up with their environmental peers in language development; children placed after 24 months had less improvement.[56]
- Internalising problems improved but time of placement had no effect, and there was no improvement in externalising disorders.[57]
- Children in institutions had changes in brain microstructure white matter; foster care was associated with some improvement in the microstructure, regardless of placement time.[58]

education and maternal physical and mental health, and community resources including safety, sanitation, and absence of stigma. The latter represents structural aspects, including policies, laws, supportive organisational systems and structures, and financial wellbeing, as well as wars, conflicts, droughts, and cultural variations. These multilevel components are mediated through nurturing care to influence children's development.

Adversity, brain development, and protective influences

Early life adversities affect life course development, especially when multiple adversities such as poverty, nutritional deficiencies, high-crime communities, and low quality resources coincide.[31] Neuroscientific evidence has documented associations between low socioeconomic status in early childhood and smaller hippocampal grey matter volume,[9,30] which together with low frontal and temporal lobe volume, might mediate associations between poverty and low cognitive, academic, and behavioural performance.[33] Effects of being raised in poverty can extend to adulthood, resulting in low task-related activation of brain regions supporting language, cognitive control, and memory skills, and high activation of regions associated with emotional reactivity.[31] Maternal nurturing care during early childhood can attenuate the detrimental effects of low socioeconomic status by protecting early brain development.[8]

Early brain development

Several environmental factors help explain socioeconomic status-based differences in brain development. Nutrients promote healthy brain development, with effects varying based on the timing, dose, and duration of access and deficiencies.[34] Nutritional deficiencies before conception and during pregnancy can result in neural tube disorders, low birthweight and low birth-length, and lifelong developmental delays or disabilities.[35] Although prenatal multiple micronutrient supplements benefit fetal growth, their effect on pregnancy outcomes and children's subsequent development is inconsistent.[36,37]

Stunting before age 2 years is related to poor child development[38] (panel 1). Improvements in height-for-age might occur after 2 years, but associations with cognitive gains remain uncertain.[43,44,59]

Nurturing care influences child development, and could attenuate the effects of adversity.[51,60] For instance, a randomised trial of foster care versus continued institutional placement among Romanian children in institutions found that the timing of foster placement relates to childhood stress hormone levels, a potential mediator between adversity and cognition (panel 1). The Romanian trial suggests that the negative effect of adversities can dysregulate the hypothalamic-pituitary-adrenocortical axis early in life, but might be partially ameliorated by nurturing care.[55]

Timing of interventions

Children's early development is characterised by sensitive periods for skill development related to maturation and genetic–environmental interactions.[61] The effect of interventions varies on the basis of sensitive periods related to specific experiences or environmental conditions (panel 1).[59,61] For example, in Nepal, prenatal iron and folic acid supplementation was effective in producing positive downstream effects on school-age children's cognitive and executive functioning performance,[63] but iron and folic acid supplementation in children aged 12–35 months had no effect.[64] Adoption studies suggest that after age 2 years, profoundly disadvantaged children are less sensitive to contextual improvements than younger children.[59]

In summary, the period between conception and age 2 years (1000 days) is sensitive to nutrient effects on child growth, cognition, and subsequent school attainment.[65] Poverty is associated with developmental delays before 12 months, with increasing deficits to 5 years,[41] illustrating that sensitive periods for economic adversity extend through at least age 5 years. Additional neuroscience and child development research is needed to understand optimal intervention timing.

Accumulation of adversities

Extreme poverty increases children's likelihood of exposure to multiple adversities, including family stress, child abuse or neglect, food insecurity, and exposure to violence, which are often compounded by living in communities with limited resources. Accumulated adversities are often more detrimental to children's development than single adversities, possibly because accumulated adversities could undermine children's physiological response systems and inhibit self-regulation and stress management.[66,67] Nurturing care depends on thriving families; adversities affecting families and the broader socioeconomic context could undermine the capacity of families to provide nurturing care.

Globally, large numbers of children experience multiple adversities or disabilities[68] and live in fragile settings, such as refugees and displaced or migrant families. Many children have poor access to health care and education,[69] parents living with HIV, depressed mothers and fathers,[70] or are in institutions.[71] Coordinated multisectoral, multilevel programmes might be necessary to reduce multiple adversities while enhancing protective factors and are discussed in Paper 2 of this Series.[20]

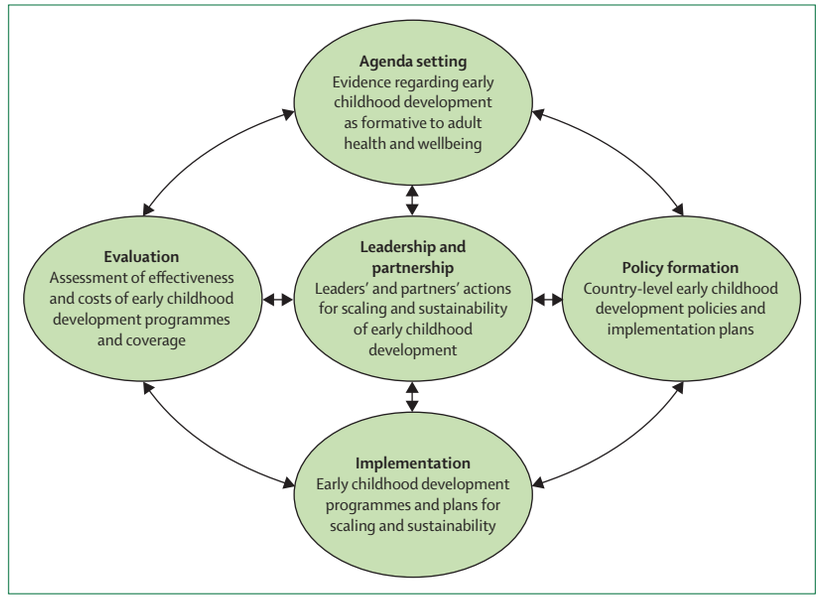

Figure 2: **Policy heuristic: relations among key processes in early childhood development policies**

Global commitments to early childhood development

We examined changes since 2000 in global commitments to early childhood development using a policy process heuristic[72] (figure 2). This heuristic assesses progress in five categories: agenda setting, evaluation, implementation, policy formation, and leadership and partnership.

We used five approaches to collect data related to the heuristic. First, we conducted a 2000–14 literature review on early childhood development risk and protective factors[6] to examine changes in the knowledge base (appendix pp 3–11). Second, we conducted a policy analysis regarding global political commitment to early childhood development that included 19 semi-structured interviews with early childhood development leaders, and analysis of key documents. This analysis is further described in a Health Policy related to this Series.[73] Third, we conducted a programme analysis with leaders of governmental and non-governmental early childhood development implementation and donor agencies, including searches of their annual reports to gather information on commitment to early childhood development (appendix pp 12–13). Fourth, we reviewed policies and investments in early childhood development

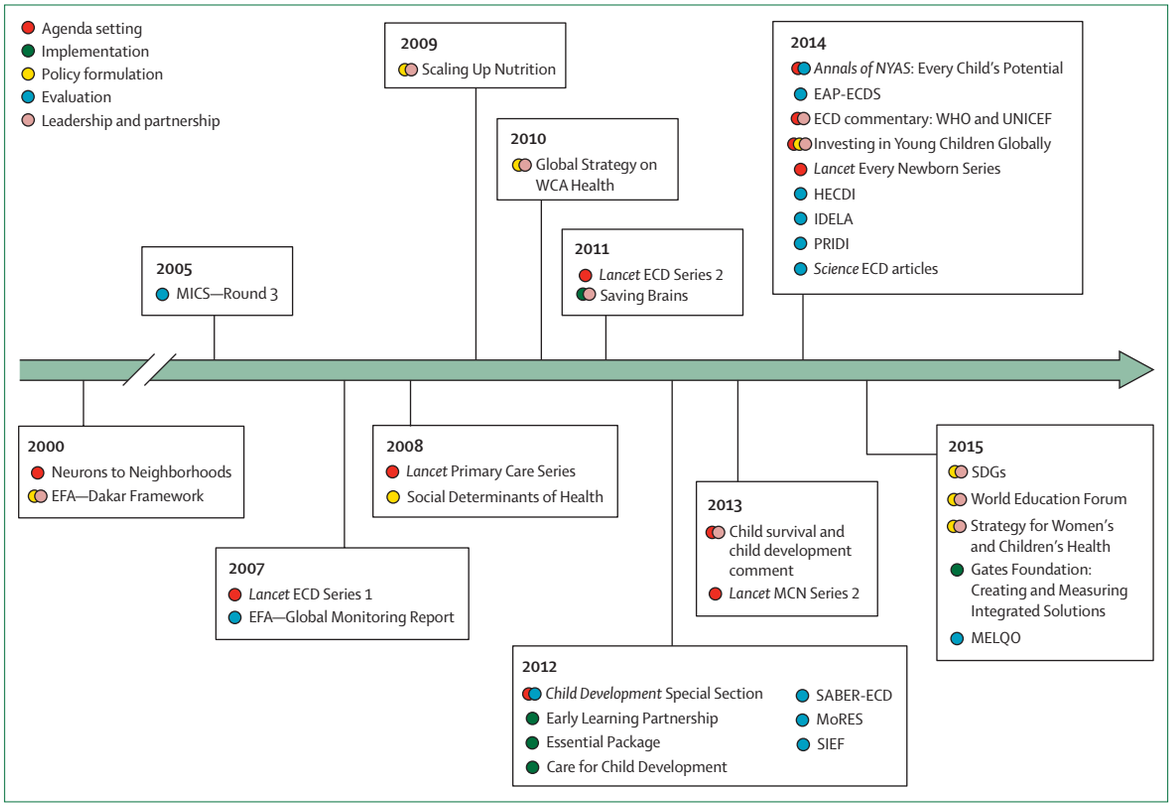

Figure 3: **Timeline of events influencing early child development policy or practice, 2000–15**
EAP-ECDS=East Asia-Pacific Early Child Development Scales. ECD=Early Childhood Development. EFA=Education for All. HECDI=Holistic Early Childhood Development Index. IDELA=International Developmental Early Learning Assessment. MCN=Maternal and Child Nutrition. MELQO=Measuring Early Learning Quality and Outcomes. MICS=Multiple Indicator Cluster Surveys. MoRES=Monitoring Results for Equity System. NYAS=New York Academy of Sciences. PRIDI=Regional Project on Child Development Indicators. SABER-ECD=Systems Approach for Better Education Results–Early Childhood Development. SDGs=Sustainable Development Goals. SIEF=Strategic Impact Evaluation Fund. UNICEF=United Nations Children's Fund. WCA=Women's, Children's, and Adolescents'.

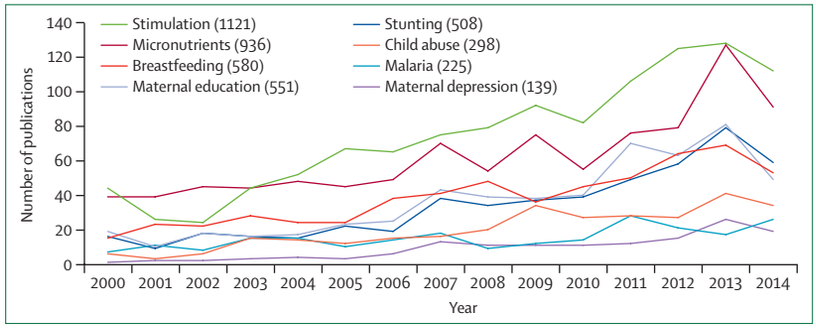

Figure 4: **Change in number of publications related to early childhood development 2000–14**

in LMICs. Finally, we summarised our findings by assembling a timeline of major 2000–15 events related to early childhood development (figure 3).

Research in early childhood development

Since 2000, publication numbers increased for all topics reviewed, with stimulation (n=1121) and nutrition-related topics (stunting, n=508, and micronutrients, n=936) having greater publication numbers than malaria (n=255), maternal depression (n=139), or child abuse and neglect (n=298; figure 4). Comparing the 5 year period from 2010–14 with the 2000–04 period, publications increased by factors of 2·0 for micronutrients, 2·9 for stimulation, 3·8 for stunting, and 6·9 for maternal depression. The doubling time for general health sciences publications is estimated at 8 years (2·4 over 10 years).[74] The increase in publications concerning early childhood development and stimulation, stunting, or maternal depression was greater than the general trend. Despite recommendations for intervention research,[3–6] only a few of the publications identified in the literature review reported on interventions (n=9, 6·3% for maternal depression and n=181, 19·3% for micronutrients).

Policy and programme analysis

The policy analysis with early childhood development leaders (detailed in the related Health Policy[73]) found that framing and governance were primary challenges for advancing global priority for early childhood development. Framing refers to how early childhood development is understood and conceptualised, including the definition

	Perspective on trends	Recommendations
Agenda setting	Subtle impacts of early childhood development (ECD) interventions inhibit advocacy There is a lack of understanding about what ECD programmes entail beyond preschool Limitations include insufficient: funding, evaluation, implementation science, political commitment, and staff time and training	Improve data availability, quality, frequency, and dissemination relating to ECD, particularly for children 0–3 years Improve integration and multisectoral coordination of ECD with other sectors Receive guidelines from the ECD community on programming, coordination, and integration strategies
Implementation	ECD programmes promote equity; there has been increased emphasis on vulnerable populations, including children with disabilities, and children affected by HIV and AIDS ECD programmes target children aged 4 to 5 years and older, with a recent focus on children 0–3 years	Leverage universal population-based interventions for children younger than age 5 years (especially younger than age 3 years), in areas where prevalence of disadvantaged children is high Increase access for evidence-based programmes and policies Improve strategies to reach disadvantaged children and geographically remote or underserved areas Design programmes to be scalable and sustainable
Policy formation	ECD programmes are integrated with other programmes (eg, nutrition, maternal and child health) Coordinating among ministries and sectors requires ECD to resonate with ministry priorities	Estimate costs of ECD interventions, assess cost-effectiveness, and conduct projections to maximise investment in children and families
Evaluation	Donors are demanding rigorous and results-driven approaches Growing neuroscience knowledge, and evidence of increases in economic productivity and reductions in poverty as a result of ECD justify increased investments in ECD programmes ECD programmes have increased in scale over the past 10–15 years	Implement rigorous and systematic data collection and systems of accountability Define a core set of ECD indicators that, with adaptation, can be used globally, regionally, and nationally for monitoring, planning, and assessment Increase support for national ECD policies and implementation plans
Leadership and partnership	There is a growing cadre of stakeholders and staff who advocate for ECD programmes Partnerships among donors are important for agenda setting and increasing programme effectivenes Sustainability and cost-effectiveness promote investment	Identify sustainable funding mechanisms at multiple levels (eg, international, national, or municipal) Establish strong and effective coordinating mechanisms for sectors that contribute to ECD outcomes Promote political commitment by linking science to practice in ECD by improving understanding of the most recent evidence-based practices

Opinions of early childhood development programme implementers, funders, and policy makers on the early childhood development landscape, 2000–15.

Table 2: **Perspectives and recommendations on the early childhood development landscape**

of early childhood development, reliable and valid measures, and effective intervention strategies. The absence of clear framing impedes planning and progress as interested parties struggle to agree on basic issues. Governance refers to the actions established to implement and support early childhood development. The multisectoral nature of early childhood development is a challenge because governance is often spread across multiple sectors with limited accountability and ownership.

The programme analysis conducted with leaders of governmental and non-governmental implementation and donor agencies yielded similar findings, and were organised into a childhood development landscape representing the perspectives and recommendations of the interviewees, using the organisation of the policy heuristic (table 2). Two seemingly contradictory themes emerged under the category of agenda setting. In spite of grassroots and emerging political commitment to early childhood development programmes, interviewees expressed concern that early childhood development was neither well understood nor appreciated.[75] Many recommended greater advocacy and clarity from the early childhood development community. Implementation concerns included equity and reaching the most vulnerable children and families, incorporating local contextual factors, monitoring, and attention to capacity and costing. Constraints noted among sectors that provide services to enhance children's development were related to policy formation, including the necessity and challenges of multilevel intervention and coordination across sectors. Common themes in the category of evaluation were the need for rigorous evaluations and accountability, better evaluation tools, and funding for evaluation research. For leadership and partnership, partnerships were valued because they lead to networks, knowledge sharing, and gains for driving agenda and programme effectiveness.

Recommendations for strategies to enhance early childhood development programmes focused on defining early childhood development programmes and achieving individual and population equity. Common themes were stakeholder representation and urgent needs for a systems perspective on equity and rights, along with multisectoral policy planning, implementation, regulation, quality assurance, accountability, governance, attention to scale, and advocacy (table 2).[76]

Policies and investments related to early childhood development

Globally, many stakeholders have supported growth of early childhood development policy through financial

For more on the **Multiple Indicator Cluster Survey** see http://mics.unicef.org/

and technical support for multisectoral policies, including strategic plans, guiding principles, and regulations.[75] However, advances in early childhood development have often been stymied by fragmentation in existing policies, laws, and programmes.[75]

In 2000, seven LMICs had national multisectoral early childhood development policies. By July, 2014, 68 of 215 countries worldwide (constituting 45% of LMICs) had such policies (appendix pp 14).[75] These statistics do not include early childhood development programmes without a unifying national policy. For example, Cuba does not have a unified national plan, but has substantial national multisectoral legislation that has achieved nearly full programme coverage for pregnant women, parents, and children (further discussed in Paper 3 of this Series).[21]

The World Bank initiative, Systems Approach for Better Education Results–Early Childhood Development (SABER–ECD), collects, analyses, and disseminates national and regional data on early childhood policies and programmes, serving as an important source of data on equity (appendix pp 15–16).[77] Despite a multisectoral early childhood development policy in 63% of participating countries (22 of 35), 31% (11 of 35) lack an institutional anchor and 59% (17 of 29) have no multisectoral operational manuals or integrated service delivery guidelines, indicating important gaps between policies and integrated implementation capacity.[78]

There has been substantial investment related to early childhood development since 2000. The Inter-American Development Bank has approved more than 150 projects for over US$1·7 billion.[77] From 2000 to 2013, the World Bank invested $3·3 billion in 273 projects, primarily through health, nutrition, and population programmes.[80] Although these investments provide support for childhood development, they do not provide the responsive caregiving and opportunities for learning that children need. Investments were relatively stable from 2000 to 2011, with large increases after 2012, attributable to increased demand from countries and shifts in World Bank policy and internal capacity.[80] These trends are promising, but additional investments tied to early childhood development are needed.

Timeline of events related to early childhood development

Our timeline includes events from 2000–15 that informed regional or global early childhood development policy or practice (figure 3; appendix pp 17–23). Advances related to agenda setting and evaluation outnumbered implementation advances, with more advances in recent years (2012–15) than in the previous decade.

Global economic growth beginning in the 1990s lifted millions of people out of extreme poverty, resulting in reductions in nutritional deficiencies (as indicated by reductions in stunting) among children younger than 5 years. Based on World Bank figures, 896 million people worldwide lived on less than $1·90 per day in 2012, compared with 1·95 billion in 1990. Implementation of global surveys, including the USAID Demographic and Health Surveys and the UNICEF Multiple Indicator Cluster Survey, charted trends in child health indicators, enabling international agencies and countries to set targets and evaluate progress. As valid and reliable population-based indicators of early childhood development become available and are incorporated into global surveys, countries will be able to track progress in their children's early development.

Access to activities and programmes promoting early childhood development

Home activities

Low-cost activities, such as storytelling, singing, and playing with household objects, expose young children to experiences that promote early development.[81] According to Multiple Indicator Cluster Survey data from 2005–15, 48·4% of the nearly 230 000 3 year-olds and 4 year-olds sampled had an adult read to them, and 67·7% had an adult either name or count objects within 3 days before the survey. These figures vary by wealth quintile within countries worldwide, with reading ranging from 62·4% in the top quintile to 36·4% in the bottom quintile. Home-based activities are likely to be even lower for children under 3 years. Of 320 000 children under the age of 5 sampled, 41·8% had home access to children's books, with availability ranging from 56·6% in the top wealth quintile to 29·0% in bottom quintile families. Disparities in the number of home-based activities by country and wealth quintile (appendix pp 24) show the urgent need for global action to enhance family support for early learning. Subsequent surveys should expand information on home-based activities to children under 3 years.

Television and other media can increase home access to early childhood development programming aimed at either children or parents. Local versions of the educational television programme Sesame Street reach children in over 150 countries.[82] In Bangladesh, almost 50% of 3–5 year-old children watched television daily,[83] and among television watchers, 83% of urban and 58% of rural preschoolers watched Sesame Street. A meta-analysis representing more than 10 000 children from 15 countries found significant benefits from watching Sesame Street in literacy and numeracy, health and safety, and social reasoning and attitudes toward others.[84]

For children with developmental delays, disabilities, and atypical behaviours such as autism and attention deficit and hyperactivity disorders, 81 countries provide national early childhood intervention. 47 (58%) of the countries providing national interventions are LMICs.[68] Beneficial effects of early intervention up to and including 36 months have been shown in children in LMICs.[85]

Centre-based child care and preschool

Since 2000, child care enrolment for children under 3 years has increased substantially, especially in Latin

America, where estimates of enrolled children exceed over 3·1 million.[79] In Brazil, Chile, Colombia, and Ecuador, between 21% and 35% of children under 3 years are in child care.[79] A review of child care programmes for children under 5 years in LMICs found that overall, programmes yielded positive but modest effects on children's development, with no clear evidence for benefits to children's health and nutrition.[86]

The effects of child care quality on children's development vary, with stronger benefits among high quality programmes and potential for harm from poor quality programmes.[87] Quality is often divided into structural dimensions including infrastructure, caregiver training, and caregiver–child ratios; and process dimensions including caregiver–child interactions and opportunities for play and exploration. Process dimensions are critical for ensuring advances in child development. Through monitoring and planning, continuous quality assurance programmes are emerging.[79]

Access to preschool education was a central objective of Education for All.[88] Attending preschool benefits children's primary school performance,[89] especially when preschool programmes include both education and nutrition.[90] Preschool enrolment rates increased globally from 33% in 1999 to 54% in 2012, with particularly high rates in Latin America and the Caribbean.[88] Although preschools are incorporated into the educational sector in many LMICs, almost one-third of children who attend preschool are enrolled in private institutions, often operating outside the regulatory system.[79]

Despite an impressive increase in preschool enrolment, according to UNESCO's Global Monitoring Report, coverage ranges from 19% for low-income countries to 86% for high-income countries, with highest enrolment among children from the highest wealth quintiles.[88] These trends are consistent with caregiver reports from the Multiple Indicator Cluster Survey. According to data from 164 900 children across 58 LMICs, 31·4% of all 36–59-month-old children sampled had access to early education programmes, with preschool enrolment rates more than twice as high among children from the top wealth quintile (47·3%) compared with children from the lowest quintile (19·7%; figure 5).

Opportunities to coordinate early childhood development across sectors

The implementation of early childhood development programmes is often fragmented, particularly for children under 3 years, with confusion between multisector and integrated approaches. Multisector approaches include coordinated services across sectors, ideally with unifying

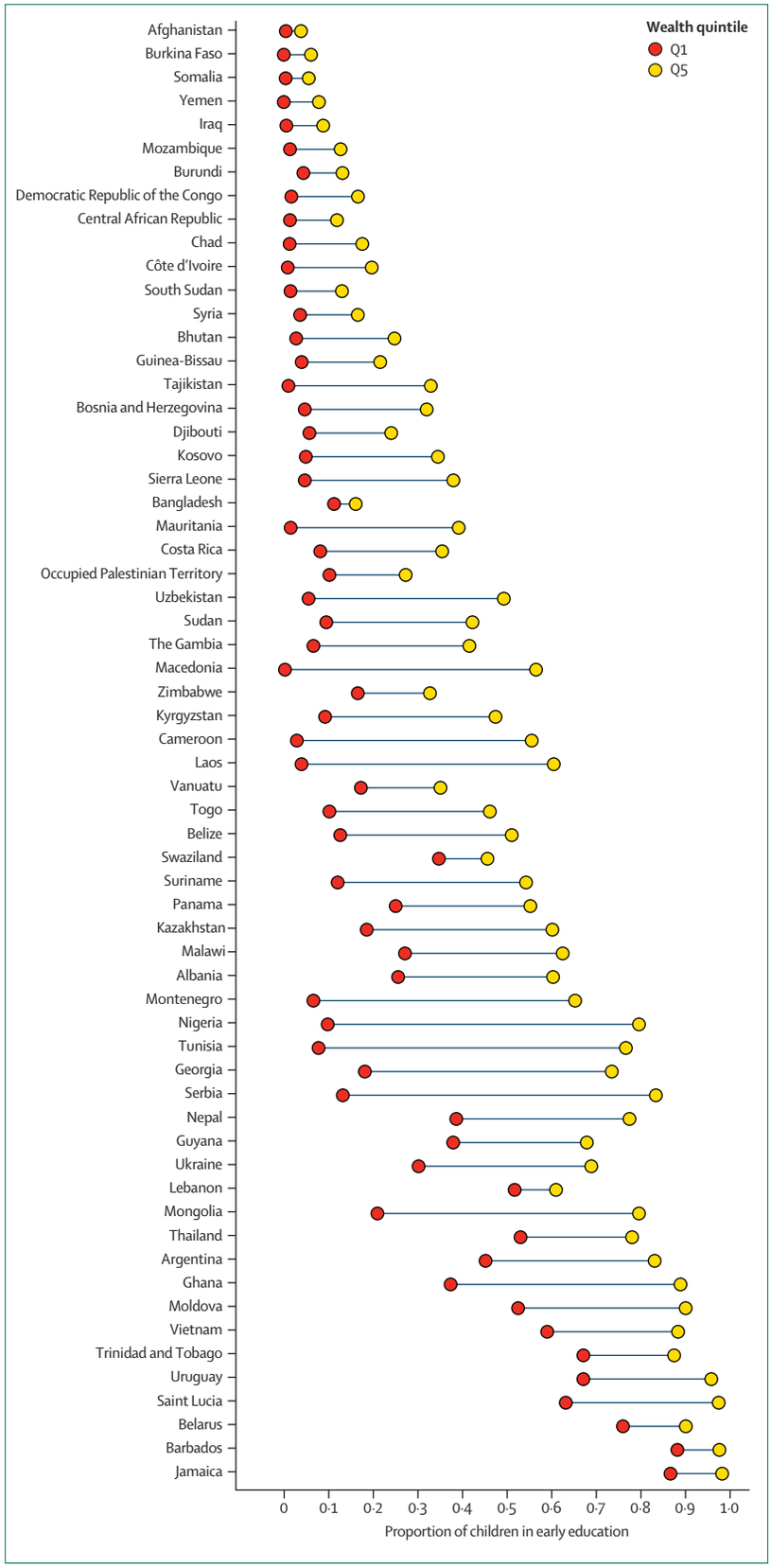

Figure 5: **Proportion of children aged 3–4 years in early education, by country and wealth quintile**
Data obtained from UNICEF Multiple Indicator Cluster Survey.

policies.[91] Integrated approaches refer to integration across services with shared messages and opportunities for synergy.[92] Although there have been multiple calls for integrated services,[92] logistical issues remain.[59] We outline here and in the appendix (pp 25) potential components of a multisector approach to early child development.

Health and nutrition

The health and nutrition sectors provide opportunities for coordinated early childhood development services in early life, as the main government services in regular contact with children from birth.[3,4] Children who are undernourished or frequently ill are at high risk for developmental problems, emphasising the urgency of developing coordinated early childhood development programmes in collaboration with the health and nutrition sectors. Since 2000, there has been an expansion of knowledge synthesis, products, and evidence-based interventions to address maternal, newborn, and child survival.[93] Although health and nutrition interventions are necessary to promote child development, children need responsive caregiving and learning opportunities.[59] Extending the emphasis on survival to include components of nurturing care and a life course perspective would ensure that children who survive also thrive.[2]

Home-based early childhood development activities are often implemented by community health workers and sponsored by health, nutrition, or social protection sectors, or through non-governmental organisations. There is a broad evidence base supporting home-based interventions to build parenting capacity, which links to child cognitive and socio-emotional development,[5,6] with effects that extend to adulthood.[14] Community health workers have made major contributions to health promotion globally.[94] Although there are clear advantages to integrating child development with health and nutrition sectors, areas to consider include: feasible and scalable implementation strategies; personnel training and supervision on early childhood development; workload; logistics; compensation; and synchronised work schedules.[95] Finally, the limited routine health and nutrition contacts beyond infancy might result in a 2–3 year service gap before preschool. Although several integrated programmes have shown beneficial effects on children's development,[96,97] additional models are needed at scale.

Security and safety

The WHO 2014 Global Status Report on Violence Prevention includes data from 133 countries on violence prevalence and prevention, including child abuse and neglect.[98] Despite global acceptance of child rights, recognition of the harmful effects of violence exposure and maltreatment on children, and endorsement of home visiting and parent education as effective in reducing risk factors for child maltreatment,[99] there have been few evaluated programmes to protect children from violence and maltreatment in LMICs.[98]

UNICEF recommends a global prevention strategy with the following actions: (1) support caregivers; (2) help children manage risks; (3) change attitudes and norms that encourage violence; (4) provide support services for children; (5) implement child protection laws; and (6) conduct data collection and research.[100] These recommendations are consistent with early childhood development programming. Ensuring that teachers in preschool and early primary school have appropriate training in classroom management can reduce aggression and violence towards and among children, illustrating that preschools can provide a platform for preventive interventions.[101]

Increasing numbers of children are refugees from conflict, climate change, and natural disasters.[102] More than 50% of the 59·5 million displaced people documented in 2014 are children, many under age 5 years.[102] The feasibility and potential benefits of integrating early childhood development activities into services for this vulnerable group have been demonstrated,[103] and strategies are needed to ensure that services include such activities.

Responsive caregiving

Effective parenting programmes have been implemented in LMICs,[3,4] providing evidence that methodologically rigorous parenting programmes can support the capacity of caregivers to provide the early learning environments that young children need. The evaluation of delivery models provides options for linking parenting programmes across sectors, and is discussed further in Paper 2 of this Series.[20] Examples include delivery of home visits by community workers linked to health or social sectors,[97] community-based group sessions,[29] and health centre-based programmes.[96] Parenting programmes to improve early learning might also strengthen parents' ability to manage child behaviour, support social-emotional development, and reduce child abuse and neglect.

Early learning and education

Early childhood development programmes and opportunities for early learning improve child outcomes during subsequent schooling.[89] Coordination across preschools and primary schools promotes smooth transitions, enables children to build on their preschool skills, and facilitates a coordinated, sequential strategy for promoting early learning, which provides support for children across the life course.[79]

For the post-2015 agenda, the Sustainable Development Goals call for all children to have access to high quality pre-primary education. Achievement of this goal requires coordination of early childhood development programming within the education infrastructure,[104] with attention to equity in both access and quality of services.

The education sector has had limited focus on programmes for under-3s.[42] Greater engagement of parents and caregivers in early childhood development programmes, coordination across sectors, and inclusive policies for children with disabilities are examples of strategies to maximise returns from early learning programmes and present young children and their families with better coordinated services.

Enabling environment for caregiver, family, and community

An enabling environment supports the family and caregivers as proximal providers of nurturing care. Support for caregivers' nutrition and mental and physical health benefits children's growth and development, and enhances caregivers' receptiveness to parenting programmes.[29] Attention to female education and gender equity builds capacity to promote child development and elicit necessary family support. Mothers and children benefit from shared caregiving that includes fathers and other family members.[29] At a community level, clean and safe neighbourhoods, access to health and education services, and interpersonal community support strengthen the ability of families to provide nurturing care.

Social, economic, political, climatic, and cultural context

The social, economic, political, climatic, and cultural context can provide broad support and guidance for the implementation of family-friendly systems that enable nurturing care. Social protection programmes are designed to reduce poverty and provide opportunities to improve child development. Protection begins with birth registry, and continues through sustained investment in poverty alleviation, with the goal to reduce the intergenerational transmission of poverty (figure 1). A meta-analysis of the effects of multiple types of financial incentives on the coverage of child health interventions, targeting children under 5 years in LMICs, found that the most promising programmes were those that removed barriers and increased access to services.[105]

Delivery strategies

Delivery strategies for early childhood development programmes are indicated (available to children identified by screening), selective (available to sub-populations at risk), or universal (available to all).[106] The high prevalence of young children at risk for not reaching their developmental potential in some countries and regions (>40%) supports a selective approach to early childhood development intervention that reaches vulnerable groups of children, rather than devoting limited resources to individual screening. Universal, high quality programming that reaches all children living in communities characterised by extreme poverty or malnutrition might improve equity, and is discussed in Paper 3 of this Series.[21]

In many countries, early childhood development services are delivered through a disjointed set of primarily non-governmental organisations, often with few regulatory guidelines, limited attention to quality, and little coordination with other services or sectors.[79] As the emphasis on early childhood has increased over the past decade and governments look to increase access to early childhood development programmes, finding effective ways to leverage the non-governmental sector to increase access and ensure quality is critically important. Platforms for early childhood development services range from home visits, clinical contacts, and community-based group sessions to new approaches, such as media. These platforms are discussed in more detail in Papers 2 and 3 of this Series.[20,21] Implementation research can aid in the scaling of evidence-based programmes by engaging stakeholders and opinion leaders, identifying core elements of evidence-based intervention, and focusing on quality assurance and cost-effectiveness, as discussed in Paper 3.[21] However, caution is warranted as the transition from science to practice often involves compromises.

Conclusions

Despite remarkable progress in early childhood development research, programmes, and policies, services for young children are inadequate and inequitably distributed. The burden of children not reaching their developmental potential remains high. The lack of attention to nurturing care as a comprehensive concept is a major concern, especially during the period of rapid brain development and learning, and the formation of caregiver–child attachments that characterises children under 3 years.

The conceptual basis of early childhood development has been well established (figure 1). The underlying science of early childhood development and the life course framework illustrate the crucial part that early childhood development plays, enabling children to become healthy and productive citizens with the intellectual skills, creativity, and wellbeing to reduce global inequities and ensure sustainable global development. However, the application of policy heuristics to existing evidence has shown that implementation of early childhood development programmes is fragmented and lacks coordination, especially for children under 3 years (panel 2).

Investment in early childhood development is increasing through advances in the health, nutrition, and social protection sectors, through programmes that promote survival, nutritional adequacy, and poverty reduction, respectively. Although these interventions provide benefits for early childhood development, they do not ensure that children reach their developmental potential. The advances in personal and societal equity that have been attributed to early childhood development require that interventions also include opportunities to promote all components of nurturing care through the family, with support from communities and social, economic, political, climatic, and cultural contexts. Nurturing care in early

childhood is the essential foundation for human capital development and should be followed by high quality schooling, support for at-risk youth, and programmes to facilitate the school-to-work transition.[79]

Early childhood development services are necessary to address the enormous global burden of children in LMICs who are not reaching their developmental potential and who will experience lifelong disparities in health, academic achievement, and earning potential. There is an urgent need for population-level indicators of child development, especially for the youngest children, to enable ongoing monitoring and improvement in quality.[24] Achieving the Sustainable Development Goals depends on ensuring adequate health, nutrition, security and safety, responsive caregiving, and early learning opportunities for the youngest children.

Contributors

MMB, SPW, LCHF, CTA, and SG-M (senior author) planned and wrote the paper. Co-authors contributed specific sections: AMD (programme and policy analysis); CL (recalculation of the burden based on extreme poverty and stunting); DCM and GF (analysis of data from UNICEF's Multiple Indicator Cluster Survey); YRS and JS (policy analysis); AED and QTW (economic and policy analysis); and EV-B (policy analysis). All authors reviewed the drafts, made critical comments, and approved the final submission.

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Declaration of interests

We declare no competing interests.

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References

1 Grantham-McGregor S, Cheung YB, Cueto S, et al. Developmental potential in the first 5 years for children in developing countries. *Lancet* 2007; **369:** 60–70.

2 Lake A, Chan M. Putting science into practice for early child development. *Lancet* 2015; **385:** 1816–17.

3 Engle PL, Black MM, Behrman JR, et al. Strategies to avoid the loss of developmental potential among over 200 million children in the developing world. *Lancet* 2007; **369:** 229–42.

4 Engle PL, Fernald LC, Alderman H, et al. Strategies for reducing inequalities and improving developmental outcomes for young children in low-income and middle-income countries. *Lancet* 2011; **378:** 1339–53.

5 Walker SP, Wachs TD, Gardner JM, et al. Child development: risk factors for adverse outcomes in developing countries. *Lancet* 2007; **369:** 145–57.

6 Walker SP, Wachs TD, Grantham-McGregor S, et al. Inequality in early childhood: risk and protective factors for early child development. *Lancet* 2011; **378:** 1325–38.

7 Shonkoff JP, Garner AS. The lifelong effects of early childhood adversity and toxic stress. *Pediatrics* 2012; **129:** e232–46.

8 Luby JL. Poverty's most insidious damage: the developing brain. *JAMA Pediatr* 2015; **169:** 810–11.

9 Noble KG, Houston SM, Brito NH, et al. Family income, parental education and brain structure in children and adolescents. *Nat Neurosci* 2015; **18:** 773–78.

10 Weaver IC. Integrating early life experience, gene expression, brain development, and emergent phenotypes: unraveling the thread of nature via nurture. *Adv Genet* 2014; **86:** 277–307.

11 Gertler P, Heckman J, Pinto R, et al. Labor market returns to an early childhood stimulation intervention in Jamaica. *Science* 2014; **344:** 998–1001.

12 Hoddinott J, Maluccio JA, Behrman JR, Flores R, Martorell R. Effect of a nutrition intervention during early childhood on economic productivity in Guatemalan adults. *Lancet* 2008; **371:** 411–16.

13 Maluccio JA, Hoddinott J, Behrman JR, Martorell R, Quisumbing AR, Stein AD. The impact of improving nutrition during early childhood on education among Guatemalan adults. *Econ J* 2009; **119:** 734–63.

14 Walker SP, Chang SM, Vera-Hernandez M, Grantham-McGregor S. Early childhood stimulation benefits adult competence and reduces violent behavior. *Pediatrics* 2011; **127:** 849–57.

15 Campbell F, Conti G, Heckman JJ, et al. Early childhood investments substantially boost adult health. *Science* 2014; **343:** 1478–85.

16 Behrman JR, Calderon MC, Preston SH, Hoddinott J, Martorell R, Stein AD. Nutritional supplementation in girls influences the growth of their children: prospective study in Guatemala. *Am J Clin Nutr* 2009; **90:** 1372–79.

17 Walker SP, Chang SM, Wright A, Osmond C, Grantham-McGregor SM. Early childhood stunting is associated with lower developmental levels in the subsequent generation of children. *J Nutr* 2015; **145:** 823–28.

18 Hoddinott J, Alderman H, Behrman JR, Haddad L, Horton S. The economic rationale for investing in stunting reduction. *Matern Child Nutr* 2013; **9** (suppl 2)**:** 69–82.

19 Doyle O, Harmon CP, Heckman JJ, Tremblay RE. Investing in early human development: timing and economic efficiency. *Econ Hum Biol* 2009; **7:** 1–6.

20 Britto PR, Lyes S, Proulx K, et al, with the Early Childhood Development Interventions Review Group, for the *Lancet* Early Childhood Development Series Steering Committee. Nurturing care: promoting early childhood development. *Lancet* 2016; published online Oct 4. http://dx.doi.org/10.1016/S0140-6736(16)31390-3.

21 Richter LM, Daelmans B, Lombardi J, et al, with the Paper 3 Working Group, for the *Lancet* Early Childhood Development Series Steering Committee. Investing in the foundation of sustainable development: pathways to scale up for early childhood development. *Lancet* 2016; published online Oct 4. http://dx.doi.org/10.1016/S0140-6736(16)31698-1.

22 Lu C, Black MM, Richter LM. Risk of poor development in young children in low-income and middle-income countries: an estimation and analysis at the global, regional, and country level. *Lancet Glob Health*, 2016; published online Oct 4. http://dx.doi.org/10.1016/S2214-109X(16)30266-2.

23 McCoy DC, Peet ED, Ezzati M, et al. Early childhood developmental status in low-and middle-income countries: national, regional, and global prevalence estimates using predictive modeling. *PLoS Med* 2016; **13:** e1002034.

24 McCoy DC, Black MM, Daelmans B, Dua T. Measuring development in children from birth to age 3 at population level. Early Childhood Matters. The Hague: Bernard van Leer Foundation, 2016. https://www.odi.org/sites/odi.org.uk/files/resource-documents/10680.pdf (accessed Sept 21, 2016).

25 Sameroff A, ed. The transactional model of development: how children and contexts shape each other. New York, NY: Wiley, 2009.

26 Bornstein MH, Hendricks C. Basic language comprehension and production in >100 000 young children from sixteen developing nations. *J Child Lang* 2012; **39:** 899–918.

27 Black M, Aboud F. Theoretical basis of responsive feeding among infants and young children in high and low income countries. *J Nutr* 2011; **141:** 490–94.

28 Bradley RH, Putnick DL. Housing quality and access to material and learning resources within the home environment in developing countries. *Child Dev* 2012; **83:** 76–91.

29 Singla DR, Kumbakumba E, Aboud FE. Effects of a parenting intervention to address both maternal psychological wellbeing and child development and growth in rural Uganda: a community-based, cluster randomised trial. *Lancet Glob Health* 2015; **3:** e458–69.

30 Hanson JL, Nacewicz BM, Sutterer MJ, et al. Behavioral problems after early life stress: contributions of the hippocampus and amygdala. *Biol Psychiatry* 2015; **77:** 314–23.

31 Pavlakis AE, Noble K, Pavlakis SG, Ali N, Frank Y. Brain imaging and electrophysiology biomarkers: is there a role in poverty and education outcome research? *Pediatr Neurol* 2015; **52:** 383–88.

32 Farnsworth SK, Böse K, Fajobi O, et al. Community engagement to enhance child survival and early development in low-and middle-income countries: an evidence review. *J Health Commun* 2014; **19** (suppl 1)**:** 67–88.

33 Hair NL, Hanson JL, Wolfe BL, Pollak SD. Association of child poverty, brain development, and academic achievement. *JAMA Pediatr* 2015; **169:** 822–29.

34 Georgieff MK. Nutrition and the developing brain: nutrient priorities and measurement. *Am J Clin Nutr* 2007; **85:** 614S–20S.

35 Bhutta ZA, Das JK, Bahl R, et al. Can available interventions end preventable deaths in mothers, newborn babies, and stillbirths, and at what cost? *Lancet* 2014; **384:** 347–70.

36 Fall CH, Fisher DJ, Osmond C, Margetts BM. Multiple micronutrient supplementation during pregnancy in low-income countries: a meta-analysis of effects on birth size and length of gestation. *Food Nutr Bull* 2009; **30** (suppl 4)**:** S533–46.

37 Ramakrishnan U, Grant FK, Goldenberg T, Bui V, Imdad A, Bhutta ZA. Effect of multiple micronutrient supplementation on pregnancy and infant outcomes: a systematic review. *Paediatr Perinat Epidemiol* 2012; **26** (suppl 1)**:** 153–67.

38 Sudfeld CR, Charles McCoy D, Danaei G, et al. Linear growth and child development in low- and middle-income countries: a meta-analysis. *Pediatrics* 2015; **135:** e1266–75.

39 Christian P, Murray-Kolb LE, Tielsch JM, Katz J, LeClerq SC, Khatry SK. Associations between preterm birth, small-for-gestational age, and neonatal morbidity and cognitive function among school-age children in Nepal. *BMC Pediatr* 2014; **14:** 58.

40 Black RE, Victora CG, Walker SP, et al. Maternal and child undernutrition and overweight in low-income and middle-income countries. *Lancet* 2013; **382:** 427–51.

41 Hamadani JD, Tofail F, Huda SN, et al. Cognitive deficit and poverty in the first 5 years of childhood in Bangladesh. *Pediatrics* 2014; **134:** e1001–08.

42 Manji S, Arnold C, Gowani S, et al. How are we doing and how do we get it right for children? Evolution of the roles of the public and private sector in early childhood care and education in efforts to achieve EFA goal 1. Paris: United Nations Educational, Scientific and Cultural Organization, 2015.

43 Casale D, Desmond C. Recovery from stunting and cognitive outcomes in young children: evidence from the South African Birth to Twenty Cohort Study. *J Dev Orig Health Dis* 2016; **7:** 163–71.

44 Crookston BT, Schott W, Cueto S, Dearden KA, Engle P, Georgiadis A, et al. Postinfancy growth, schooling, and cognitive achievement: Young Lives. *Am J Clin Nutr* 2013; **98:** 1555–63.

45 Stein AD, Wang M, DiGirolamo A, et al. Nutritional supplementation in early childhood, schooling, and intellectual functioning in adulthood: a prospective study in Guatemala. *Arch Pediatr Adolesc Med* 2008; **162:** 612–18.

46 Fernald LC, Weber A, Galasso E, Ratsifandrihamanana L. Socioeconomic gradients and child development in a very low income population: evidence from Madagascar. *Dev Sci* 2011; **14:** 832–47.

47 Rubio-Codina M, Attanasio O, Meghir C, Varela N, Grantham-McGregor S. The socioeconomic gradient of child development: cross-sectional evidence from children 6–42 panel in Bogota. *J Hum Resour* 2015; **50:** 464–83.

48 Schady N, Behrman J, Araujo MC, et al. Wealth gradients in early childhood cognitive development in five Latin American countries. *J Hum Resour* 2015; **50:** 446–63.

49 Lipina SJ, Martelli MI, Colombo J. Performance on the A-not-B task of Argentinean infants from unsatisfied and satisfied basic needs homes. *Interam J Psychol* 2005; **39:** 49–60.

50 Fernald LC, Kariger P, Hidrobo M, Gertler PJ. Socioeconomic gradients in child development in very young children: evidence from India, Indonesia, Peru, and Senegal. *Proc Natl Acad Sci USA* 2012; **109** (suppl 2)**:** 17273–80.

51 Hackman DA, Gallop R, Evans GW, Farah MJ. Socioeconomic status and executive function: developmental trajectories and mediation. *Dev Sci* 2015; **18:** 686–702.

52 Fox NA, Almas AN, Degnan KA, Nelson CA, Zeanah CH. The effects of severe psychosocial deprivation and foster care intervention on cognitive development at 8 years of age: findings from the Bucharest Early Intervention Project. *J Child Psychol Psychiatry* 2011; **52:** 919–28.

53 Smyke AT, Zeanah CH, Fox NA, Nelson CA, Guthrie D. Placement in foster care enhances quality of attachment among young institutionalized children. *Child Dev* 2010; **81:** 212–23.

54 Vanderwert RE, Marshall PJ, Nelson CA, Zeanah CH, Fox NA. Timing of intervention affects brain electrical activity in children exposed to severe psychosocial neglect. *PLoS One* 2010; **5:** e11415.

55 McLaughlin KA, Sheridan MA, Tibu F, Fox NA, Zeanah CH, Nelson CA. Causal effects of the early caregiving environment on development of stress response systems in children. *Proc Natl Acad Sci USA* 2015; **112:** 5637–42.

56 Windsor J, Benigno JP, Wing CA, et al. Effect of foster care on young children's language learning. *Child Dev* 2011; **82:** 1040–46.

57 Zeanah CH, Gunnar MR, McCall RB, Kreppner JM, Fox NA. Sensitive periods. *Monogr Soc Res Child Dev* 2011; **76:** 147–62.

58 Bick J, Zhu T, Stamoulis C, Fox NA, Zeanah C, Nelson CA. Effect of early institutionalization and foster care on long-term white matter development: a randomized clinical trial. *JAMA Pediatr* 2015; **169:** 211–19.

59 Black MM, Perez-Escamilla R, Fernandez Rao S. Integrating nutrition and child development interventions: Scientific Basis, evidence of impact, and implementation considerations. *Adv Nutr* 2015; **6:** 852–59.

60 Luby J, Belden A, Botteron K, et al. The effects of poverty on childhood brain development: the mediating effect of caregiving and stressful life events. *JAMA Pediatr* 2013; **167:** 1135–42.

61 Wachs TD, Georgieff M, Cusick S, McEwen BS. Issues in the timing of integrated early interventions: contributions from nutrition, neuroscience, and psychological research. *Ann N Y Acad Sci* 2014; **1308:** 89–106.

62 WHO, UNICEF. Care for child development: improving the care of young children. Geneva: World Health Organization, 2012.

63 Christian P, Murray-Kolb LE, Khatry SK, et al. Prenatal micronutrient supplementation and intellectual and motor function in early school-aged children in Nepal. *JAMA* 2010; **304:** 2716–23.

64 Murray-Kolb LE, Khatry SK, Katz J, et al. Preschool micronutrient supplementation effects on intellectual and motor function in school-aged Nepalese children. *Arch Pediatr Adolesc Med* 2012; **166:** 404–10.

65 Adair LS. Long-term consequences of nutrition and growth in early childhood and possible preventive interventions. *Nestle Nutr Inst Workshop Ser* 2014; **78:** 111–20.

66 Evans GW, Kim P. Childhood poverty, chronic stress, self-regulation, and coping. *Child Dev Perspect* 2013; **7:** 43–48.

67 McCoy DC, Raver CC. Household instability and self-regulation among poor children. *J Child Poverty* 2014; **20:** 131–52.

68 Mitra S, Posarac A, Vick BC. Disability and poverty in developing countries: a snapshot from the world health survey. Washington, DC: World Bank Group, 2011.

69 Peters DH, Garg A, Bloom G, Walker DG, Brieger WR, Hafizur Rahman M. Poverty and access to health care in developing countries. *Ann N Y Acad Sci* 2008; **1136:** 161–71.

70 Parsons CE, Young KS, Rochat TJ, Kringelbach ML, Stein A. Postnatal depression and its effects on child development: a review of evidence from low- and middle-income countries. *Br Med Bull* 2012; **101:** 57–79.

71 Berens AE, Nelson CA. The science of early adversity: is there a role for large institutions in the care of vulnerable children? *Lancet* 2015; **386:** 388–98

72 Howlett M, Ramesh M, Perl A. Studying public policy: policy cycles and policy subsystems, 3rd edn. Toronto: Oxford University Press, 2009.

73 Shawar YR, Shiffman J. Generation of global political priority for early childhood development: the challenges of framing and governance. *Lancet* 2016; published online Oct 4. http://dx.doi.org/10.1016/S0140-6736(16)31574-4.

74 Bornmann L, Mutz R. Growth rates of modern science: a bibliometric analysis based on the number of publications and cited references. *J Assoc Inf Sci Technol* 2015; **66**: 2215–22.

75 Vargas-Barón E. Policies on early childhood care and education: their evolution and some impacts. United Nations Educational, Scientific and Cultural Organization, 2015.

76 Vargas-Barón E. Building and strengthening national systems for early childhood development. In: Britto PR, Engle PL, and Super CM, eds. Handbook of early childhood development research and its impact on global policy. New York: Oxford University Press, 2013: 443–66.

77 Neuman MJ, Devercelli AE. What matters most for early childhood development: a framework paper. Washington, DC: World Bank Group, 2013. http://documents.worldbank.org/curated/en/252561473963612937/What-do-we-know-about-early-childhood-development-policies-in-low-and-middle-income-countries (accessed Sept 21, 2016).

78 Devercelli A, Sayre R, Denboba A. What do we know about early childhood development policies in low and middle income countries? Washington, DC: World Bank Group, 2016. http://documents.worldbank.org/curated/en/252561473963612937/What-do-we-know-about-early-childhood-development-policies-in-low-and-middle-income-countries (accessed Sept 27, 2016).

79 Berlinski S, Schady N. The early years: child well-being and the role of public policy. New York: MacMillan, 2015.

80 Sayre R, Devercelli AE, Neuman MJ, Wodon Q. Investing in early childhood development: review of the World Bank's recent experience. Washington, DC: World Bank Group, 2015.

81 Barros AJ, Matijasevich A, Santos IS, Halpern R. Child development in a birth cohort: effect of child stimulation is stronger in less educated mothers. *Int J Epidemiol* 2010; **39:** 285–94.

82 Cole CF, Richman BA, MCCann Brown SA. "G" is for growing: Thirty years of research on children and Sesame Street. In: Fisch SM, Truglio RT, eds. The World of Sesame Street Research. Mahwah, NJ: Lawrence Erlbaum, 2001: 147–79.

83 Khan M, Chakraborty N, Rahman A, Nasrin T. 2007 follow-up (wave II) evaluation of the reach and impact of Sisimpur: a technical report. Bangladesh: Associates for Community and Population Research (ACPR), 2007.

84 Mares M-L, Pan Z. Effects of Sesame Street: a meta-analysis of children's learning in 15 countries. *J Appl Dev Psychol* 2013; **34:** 140–51.

85 Rahman A, Malik A, Sikander S, Roberts C, Creed F. Cognitive behaviour therapy-based intervention by community health workers for mothers with depression and their infants in rural Pakistan: a cluster-randomised controlled trial. *Lancet* 2008; **372**: 902–09.

86 Leroy JL, Gadsden P, Guijarro M. The impact of daycare programmes on child health, nutrition and development in developing countries: a systematic review. *J Dev Effect* 2012; **4:** 472–96.

87 Grantham-McGregor SM, Fernald LC, Kagawa RM, Walker S. Effects of integrated child development and nutrition interventions on child development and nutritional status. *Ann N Y Acad Sci* 2014; **1308:** 11–32.

88 EFA Global Monitoring Report Team. Education for All 2000-2015: Achievements and Challenges. Paris United Nations Educational, Scientific and Cultural Organization, 2015.

89 Berlinski S, Galiani S, Gertler P. The effect of pre-primary education on primary school performance. *J Public Econ* 2009; **93:** 219–34.

90 Nores M, Barnett WS. Benefits of early childhood interventions across the world:(under) investing in the very young. *Econ Educ Rev* 2010; **29:** 271–82.

91 Vargas-Barón E. Planning policies for early childhood development: guidelines for action. United Nations Educational, Scientific and Cultural Organization, 2005.

92 Black MM, Dewey KG. Promoting equity through integrated early child development and nutrition interventions. *Ann N Y Acad Sci* 2014; **1308:** 1–10.

93 Bhutta ZA, Hafeez A, Rizvi A, et al. Reproductive, maternal, newborn, and child health in Pakistan: challenges and opportunities. *Lancet* 2013; **381:** 2207–18.

94 Perry HB, Zulliger R, Rogers MM. Community health workers in low-, middle-, and high-income countries: an overview of their history, recent evolution, and current effectiveness. *Annu Rev Public Health* 2014; **35:** 399–421.

95 Phuka J, Maleta K, Thomas M, Gladstone M. A job analysis of community health workers in the context of integrated nutrition and early child development. *Ann N Y Acad Sci* 2014; **1308:** 183–91.

96 Chang SM, Grantham-McGregor SM, Powell CA, et al. Integrating a parenting intervention with routine primary health care: a cluster randomized trial. *Pediatrics* 2015; **136:** 272–80.

97 Yousafzai AK, Rasheed MA, Rizvi A, Armstrong R, Bhutta ZA. Effect of integrated responsive stimulation and nutrition interventions in the Lady Health Worker programme in Pakistan on child development, growth, and health outcomes: a cluster-randomised factorial effectiveness trial. *Lancet* 2014; **384:** 1282–93.

98 WHO. Global status report on violence prevention. Geneva: World Health Organization, 2014.

99 Mikton C, Butchart A. Child maltreatment prevention: a systematic review of reviews. *Bull World Health Organ* 2009; **87:** 353–61.

100 UNICEF. Hidden in plain sight: a statistical analysis of violence against children. New York, NY: United Nations Children's Emergency Fund, 2014.

101 Baker-Henningham H, Scott S, Jones K, Walker S. Reducing child conduct problems and promoting social skills in a middle-income country: cluster randomised controlled trial. *Br J Psychiatry* 2012; **201:** 101–08.

102 UNHCR. Worldwide displacement hits all-time high as war and persecution increase. June 18, 2015. http://www.unhcr.org/558193896.html (accessed Aug 15, 2016).

103 Morris J, Jones L, Berrino A, Jordans MJ, Okema L, Crow C. Does combining infant stimulation with emergency feeding improve psychosocial outcomes for displaced mothers and babies? A controlled evaluation from northern Uganda. *Am J Orthopsychiatry* 2012; **82:** 349–57.

104 UN. Open working group proposal for sustainable development goals. 2014. https://sustainabledevelopment.un.org/content/documents/1579SDGs%20Proposal.pdf (accessed Sept 9, 2016).

105 Bassani DG, Arora P, Wazny K, Gaffey MF, Lenters L, Bhutta ZA. Financial incentives and coverage of child health interventions: a systematic review and meta-analysis. *BMC Public Health* 2013; **13** (suppl 3): S30.

106 Gordon RS. An operational classification of disease prevention. *Public Health Rep* 1983; **98:** 107–09.

Advancing Early Childhood Development: from Science to Scale 2

Nurturing care: promoting early childhood development

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The UN Sustainable Development Goals provide a historic opportunity to implement interventions, at scale, to promote early childhood development. Although the evidence base for the importance of early childhood development has grown, the research is distributed across sectors, populations, and settings, with diversity noted in both scope and focus. We provide a comprehensive updated analysis of early childhood development interventions across the five sectors of health, nutrition, education, child protection, and social protection. Our review concludes that to make interventions successful, smart, and sustainable, they need to be implemented as multi-sectoral intervention packages anchored in nurturing care. The recommendations emphasise that intervention packages should be applied at developmentally appropriate times during the life course, target multiple risks, and build on existing delivery platforms for feasibility of scale-up. While interventions will continue to improve with the growth of developmental science, the evidence now strongly suggests that parents, caregivers, and families need to be supported in providing nurturing care and protection in order for young children to achieve their developmental potential.

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Introduction

Although global attention to early childhood development has been established through its inclusion in the UN Sustainable Development Goals, 250 million children (43%) younger than 5 years in low-income and middle-income countries are at risk of not achieving their developmental potential, as discussed in Paper 1 of this Series.[1] We suggest that this gap in human potential is partly due to two reasons: the failure to apply emerging scientific knowledge on nurturing care to shape young children's development; and the failure to take action at scale, using a multi-sector approach across key stages in the early life course.

We define nurturing care as a stable environment that is sensitive to children's health and nutritional needs, with protection from threats, opportunities for early learning, and interactions that are responsive, emotionally supportive, and developmentally stimulating. As an overarching concept, nurturing care is supported by a large array of social contexts—from home to parental work, child care, schooling, the wider community, and policy influences.[2] Nurturing care consists of a core set of inter-related components, including: behaviours, attitudes, and knowledge regarding caregiving (eg, health, hygiene care, and feeding care); stimulation (eg, talking, singing, and playing); responsiveness (eg, early bonding, secure attachment, trust, and sensitive communication); and safety (eg, routines and protection from harm).[3,4] The single most powerful context for nurturing care is the immediate home and care settings of young children often provided by mothers, but also by fathers and other family members, as well as by child-care services.

The brain has evolved to adapt in response to a wide range of early experiences, which supports the rapid acquisition of language, cognitive skills, and socio-emotional competencies. Nurturing care mediates the

Key messages

- Advances in basic and intervention science indicate that early childhood is a period of special sensitivity to experiences that promote development, and that critical time windows exist when the benefits of early childhood development interventions are amplified.
- The most fundamental promotive experiences in the early years of life come from nurturing care and protection received from parents, family, and community, which have lifelong benefits including improved health and wellbeing, and increased ability to learn and earn.
- Nurturing care and protection are supported by a range of interventions delivered pre-pregnancy and throughout birth and the newborn period, infancy, and early childhood. Many of these interventions have shown benefits for child development, nutrition, and growth, and reductions in morbidity, mortality, disability, and injury.
- Interventions that integrate nurturing care and protection can target multiple risks to developmental potential at appropriate times, and can be integrated within existing preventive and promotive packages.
- Preventive and promotive packages can build on existing platforms, such as community-based strategies and social safety nets, for delivering parental and child services at scale to vulnerable and difficult-to-reach populations, enhancing their effectiveness and sustainability.

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See Online for appendix

development of key brain regions and promotes developmental adaptations. These developments have lifelong benefits for children, including an increased ability to learn, greater achievement in school and later life, citizenship, involvement in community activities, and overall quality of life.[5,6] The period of early development is one of enormous change and is characterised by a high degree of plasticity in brain organisation.[7,8] Advances in developmental science have also provided an understanding of the multiple and overlapping critical windows of time when development of specific capacities and abilities is most powerfully enhanced.[9,10] Nurturing, caring, enriching, and protective interactions provide the early environments needed for developmental progression to occur, and protect infants and children from the negative effect of stress and adversity (panel 1). Studies from across the globe, including from Jamaica,[17–19] Pakistan,[20] and Turkey,[21,22] have demonstrated that including elements of nurturing care in interventions significantly improves childhood development and even later adult outcomes (appendix pp 22–25). The interplay between the elements of nurturing care, the timing of experiences, and complexity of risks requires action beyond single sector interventions.

Selection of interventions for review

This paper provides a comprehensive update of early childhood development interventions across key sectors. Although progress has been made with early childhood development-related interventions, existing research is at different levels of maturity across sectors and distributed across numerous populations and settings. Experts from research communities in reproductive, maternal, newborn, and child health (RMNCH), nutrition, parenting, early childhood education, maltreatment prevention, and social protection worked in teams using standard methods to critically appraise the available evidence that addressed child outcomes, including: mortality; malformations, disability, and injury; nutrition and growth; and severe morbidity (panel 2). The primary focus, however, was direct measures of child development outcomes (eg, language, cognition, motor, social and emotional development, and psychosocial wellbeing). Most papers in each sector were published after the last *Lancet* Series on early childhood development—ie, from October, 2011, to April, 2015. Search strategies in each group were tailored to the existing evidence in each sector. The RMNCH and nutrition group relied on the most recent overviews of systematic reviews featuring good quality methods for all interventions, and updated the evidence by incorporating newer studies, when available. The parenting and early childhood education, child protection, and social protection groups relied on the most recent systematic reviews, and incorporated newer studies, when available. From preconception to birth, the focus of the interventions is primarily on the maternal caregiver. From birth throughout infancy, interventions typically include both adult and child, and in the age period transitioning into primary school (between the ages of 6 and 8, depending on the country), we note a predominantly child-focused set of interventions with increasing emphasis on the importance of a nurturing environment provided by teachers. Details of the search methods used for selecting and screening reviews are described in panel 2.

Interventions encompassing the period before conception to birth

We did a comprehensive review of 40 interventions related to early childhood development across diverse sectors, and found 15 types of interventions that show benefit on multiple outcomes including child development, based on high-quality systematic reviews (table). Many of those with effects on childhood development encompass aspects of nurturing care including parenting support and social protection, care for the caregiver, and early learning opportunities provided in or out of the home environment.

Maternal health

While nurturing care interventions usually begin at birth, established RMNCH interventions can reduce adverse growth and health outcomes—including stunting, low birthweight, and iron deficiency anaemia—that are strongly related to early childhood development. In our review of low-income and middle-income countries (LMICs), we identified five such RMNCH interventions during the period from preconception to birth and labour that have significant effects on child development, in addition to growth, mortality, morbidity, or disability (appendix pp 2–9). These interventions include: iodine supplementation before or during pregnancy,[56] antenatal corticosteroids for women at risk of preterm birth,[57] magnesium sulphate for women at risk of preterm birth,[58] antiplatelet drugs for women at risk of pre-eclampsia,[59] and therapeutic hypothermia[60] for hypoxic ischaemic encephalopathy. One review[61] found mixed effects of delayed cord clamping on measures of neurodevelopment at 4 months, based on the results of one study.[62] Tobacco and alcohol use are viewed as serious threats to the health of pregnant women and their children. A review of 86 randomised controlled trials showed that psychosocial programmes have been successful during pregnancy for smoking cessation, reducing low birthweight and preterm births, but evidence is limited on such interventions in LMICs.[63]

Maternal nutrition, micronutrients, and iodine supplementation

The ability of a mother to support the health and development of her children is critically dependent on her own health and wellbeing before, during, and after pregnancy. Intrauterine growth restriction influences

Panel 1: **Co-occurrences among bio-ecological or contextual risk factors in low-income and middle-income countries**

Although there are parallels in the types of risk and promotive factors encountered by children in high-income, middle-income, and low-income countries, the limited evidence indicates that children from low-income and middle-income countries (LMICs) are more likely to encounter a greater number and range of risk factors and fewer promotive influences for development than poor children in high-income countries (HICs).[11,12] Toxins, chronic severe malnutrition, direct exposures to armed conflict and displacement, and refugee status are risk factors that occur in LMICs, but are rarely seen in HICs. Exposure to environmental factors that reduce blood–brain barrier integrity will decrease protection of the developing brain. Poor sanitation, severe childhood diarrhoea, iron deficiency anaemia, orphan status, substandard housing, domestic violence, harsh physical punishment, and maternal depression are risk factors that occur at a higher rate in LMICs than in HICs and can be frequently amplified by exposure to conflict and population displacement. Some evidence indicates that there might be a reduced availability of promotive factors in LMICs, such as routine neonatal screening for iodine deficiency,[13] childbirth attended by skilled health personnel,[14] and fewer learning resources in the home.[15] In addition to a greater range and prevalence, there are higher levels of co-occurrence among risk factors in LMICs compared with HICs.[16] Based on analysis of UNICEF Multiple Indicator Cluster Survey data, multiple risk factors co-occur. For example, 85% of children aged 3–4 years in west and central Africa and 56% in east Asia and Pacific experience multiple risks. Data estimating risks for children living in conflict, crises, and insecure conditions are scant; however, we estimate increased levels of co-occurrence of risk factors in such situations. The findings support the application of coordination or combining of interventions, within packages, to reduce exposure to multiple risk factors. The following are specific examples of co-occurrence.

Nutritional deficiencies in infancy and early childhood are likely to occur with:

- Being born small for gestational age, or preterm, or both
- Parents who are less involved, sensitive, or responsive to the needs of the child
- Extreme poverty and food insecurity
- Suboptimal infant and young child feeding practices
- High exposure to pathogens and corresponding burden of infectious disease in infancy and childhood
- Home environments characterised as less stimulating than others
- Exposure to domestic violence

Maternal depression and anxiety are likely to coexist with:

- Preterm birth
- Low birthweight
- Poor infant growth and reduced cognitive development
- Less adequate prenatal care
- Less adequate caregiving including:
- Suboptimal infant and child feeding practices (including not exclusive breastfeeding)
- Insufficient communication and play to stimulate learning
- Delayed and inappropriate care-seeking
- Increased child morbidity
- Increased use of harsh discipline
- Increased family stress

Exposure to societal violence is likely to occur with:

- Child abuse and neglectful parenting
- Disruption of family or community support systems
- Disrupted and dysfunctional health systems

multiple aspects of child development and has been linked to poorer neurodevelopmental outcomes, risks of prematurity, reduced school performance, and heightened behavioural problems in children.[64] Evidence suggests that linear growth is correlated across generations and short maternal stature is associated with low birthweight, stunting, childbirth complications, and increased child mortality.[65] The provision of a balanced energy and protein diet,[66] as well as multiple micronutrients,[67] for women of childbearing age and expectant mothers at risk of deficiencies shows potential benefits in reducing the risk of intrauterine growth restriction, small-for-gestational-age births, and stillbirths (appendix pp 2–9). Iron and iron-folate supplementation during pregnancy reduces the risk of small-for-gestational-age and premature births,[68] while folic acid fortification is associated with prevention of neural tube defects and risk of adverse birth outcomes.[69] Iodine supplementation in moderate-to-severely iodine deficient areas is the only nutrition-related intervention during pregnancy with evidence of a significant effect on children's cognitive development scores, increasing them by 10–20%.[56]

Maternal stress, depression, and mental disorders

The onset of caregiving in humans is triggered by hormonal signals beginning in pregnancy (eg, oxytocin and lactogens).[70] Mental disorders and the timing of stress during pregnancy can disrupt maternal programming, which prepares women to respond to their infants, and can have negative effects on the fetus.[71] Disruption to maternal programming might account for associations between maternal mental disorders, insecure mother–infant attachment, and exposure to maltreatment. Mental disorders in women, including depression and anxiety, are among the most common conditions to coexist with pregnancy and are associated with a range of negative child outcomes, including poor infant growth, children's emotional and behavioural difficulties, and insecure attachment with caregivers.[71] Recent evidence is emerging that paternal mental health during pregnancy can also influence the socioemotional

Panel 2: Criteria for identifying relevant research

We identified peer-reviewed overviews, systematic reviews, and individual studies that focused primarily on child development outcomes, published between January, 2009, and April, 2015. We used established guidelines to search, evaluate, and synthesise the results of relevant research.[23] The reproductive maternal, newborn, and child health and nutrition reviews relied primarily on six recent overviews of reviews, including: the *Lancet* Breastfeeding Series (2016);[24] the *Lancet* Every Newborn Series (2014);[25] the *Lancet* Maternal and Child Nutrition Series (2013);[26] the *Lancet* Childhood Pneumonia and Diarrhoea Series (2013);[27] the *Reproductive Health* 2014 supplement on essential maternal, newborn, and child health interventions;[28] and the Essential Interventions for Reproductive, Maternal, Newborn, and Child Health report by the Partnership for Maternal, Newborn and Child Health (2011).[29] The education review was based on four recent reviews, including: the *Lancet* Child Development in Developing Countries Series (2011);[30] a systematic review of parenting interventions published by the *Annual Review of Psychology* (2015);[31] a literature review of parenting and early childhood programmes (2014);[32] and a Cochrane review of centre-based day care for children under 5 (2014).[33] A meta-analysis of education programmes was conducted to determine non-cognitive developmental benefits of parenting and early childhood education programmes, as this information was not available in existing systematic reviews. The review of maltreatment prevention publications updated the *Lancet* article on prevention of child maltreatment (2009)[34] and a systematic review of child maltreatment prevention reviews,[35] by including recent reviews of maltreatment prevention interventions,[32,34–45] such as home visiting,[37–39] parenting training programmes,[40,41] sexual abuse prevention programmes,[42,43] universal campaigns to prevent physical abuse,[44] behavioural and counselling interventions,[45] detection of child maltreatment,[46] and three narrative reviews on prevention of child maltreatment.[47–49] The social protection literature review examined five systematic reviews that focused on the effects of social programmes, including conditional and unconditional cash transfers and microcredit schemes.[50,51,53,54] After examining the systematic reviews, the literature was searched for papers that had been published since the systematic reviews. 24 new studies were included that investigated the effects of conditional cash transfers or unconditional cash transfers on measures of health, nutrition, or developmental outcomes. The search focused on research conducted in low-income and middle-income countries (LMICs), but systematic reviews based on evidence from high-income countries were included for maltreatment prevention where evidence from LMICs was either unavailable or limited. Data were double-extracted using a standardised form. Methodological quality of systematic reviews was assessed using the AMSTAR criteria, where appropriate.[55] More detailed information on the search strategies for each review topic can be found in the supplementary appendix.

and behavioural development of children.[72] A systematic review of 13 trials of psychological interventions, delivered by local community health workers, for women with antenatal depression in LMICs showed positive effects on reducing maternal depression.[73] Benefits to children included improved mother–infant interaction, improved cognitive development and growth, reduced frequency of diarrhoea episodes, and increased immunisation rates. Antidepressants for treatment of antenatal depression have been associated with small but significant increases in preterm birth and reductions in birthweight.[74,75] Persistence of depression into the postnatal period and beyond seems to be of particular importance in relation to poorer cognitive development in children, including achievement of developmental milestones, and language development.[71] Recent trials from Uganda[76] and Bangladesh[77] suggest that group-based parenting programmes can improve maternal mental health in community settings as well as young children's cognitive and receptive language scores. However, more analysis is needed to determine which characteristics of maternal health interventions are associated with improved maternal wellbeing and issues of scalability.

Living in poverty is associated with a high degree of stress. Conditional cash transfer programmes have increased the proportion of people receiving prenatal care, probability of in-facility birth and of having a skilled birth attendant,[52] conditions often associated with improved birth outcomes (ie, decreased neonatal mortality) and later developmental outcomes. During labour and childbirth, mothers who have continuous social support (eg, emotional support, comfort measures, information, and advocacy) show significantly more positive clinical benefits for themselves and for their infants compared with mothers who don't.[78]

Interventions from birth to 5 years of age

Parenting support

Opportunities for stimulation, responsive parent–child interactions, child-directed and focused enrichment, early learning, and positive parenting are crucial for children's development.[30] Parenting programmes are operationally defined as interventions or services aimed at improving parenting interactions, behaviours, knowledge, beliefs, attitudes, and practices. Three recent reviews[31,32,36] of parenting programmes in LMICs found positive effects on direct measures of children's cognitive and language development across diverse policy, service delivery, and social contexts. We updated and expanded on the previous reviews by conducting a meta-analysis of non-cognitive outcomes and concluded that parenting programmes increased scores on measures of psychosocial development (standardised mean difference [SMD] 0·35, 95% CI 0·14–0·56, 13 studies) and motor development (0·13, 0·07–0·19, nine studies), in addition to child cognitive development (0·36, 0·22–0·49, 19 studies) (appendix pp 10–15). The effect of parenting programmes on child growth was not significant.

Parenting programme implementation varied in relation to dose of intervention, setting, and curriculum. The total amount of contact with parents, which ranged from less than 10 h to 120 h, did not have a clear association with the size of effect.[32] Some programme models have used only home visits—eg, Roving Caregivers in Jamaica[79]—and others, such as Pastoral del Niño in Paraguay, have used group sessions.[80] Combined group sessions and home visits in Bangladesh[81] and Brazil[82] produced better outcomes than did home visits alone. The most effective parenting programmes used several behaviour-change techniques, including media such as posters and cards that illustrate

For more on the **Care for Child Development Package** see http://www.unicef.org/earlychildhood/index_68195.html

For more on **Reach Up and Learn** see http://www.reachupandlearn.com

enrichment practices, opportunities for parental practice of play and responsive talk with their child, guidance and support for changing practices, and problem-solving strategies.[31] Examples include the Care for Child Development package developed by UNICEF and WHO, and Reach Up and Learn, which provide opportunities to use multiple strategies to strengthen nurturing care by parents.[17] A notable gap in published reviews is the role of fathers in promoting nurturing care and protection.[83] Parenting programmes that combine nutrition and stimulation have been effective in improving child cognitive and language development outcomes.[31] Taken together, the results suggest that parenting support programmes that promote nurturing care and protection can substantially augment the positive effects of basic health and nutrition, education, and protection interventions on early child development outcomes.

Attachment and bonding

Different brain systems enhance nurturing by supporting infant–mother attachment, as well as emotional wellbeing, learning and memory, attention, and executive functions.[84] Secure attachment forms with a caregiver who provides security, safety, affection, and comfort. Aspects of nurturing care during birth and labour include early initiation of breastfeeding and interventions such as Kangaroo Mother Care, which promotes thermal sufficiency in preterm infants, and early bonding. Kangaroo Mother Care has been associated with an increase in bonding indicators such as infant-mother attachment at 3 months (mean difference [MD]=6·24, 95% CI 5·57–6·91), infant growth, and rates of early exclusive breastfeeding (at 1–3 months) (risk ratio [RR]=1·20, 95% CI 1·01–1·43).[85] Most of these evaluations were undertaken in health facilities; there is a need for research focusing on effectiveness of Kangaroo Mother Care or variants thereof when delivered at scale in community settings.

Breastfeeding

Breastfeeding has clear short-term benefits for child health, reducing mortality and morbidity from infectious diseases, encouraging healthy food preferences, and promoting the establishment of a healthy gut microbiome.[86] A recent review of 17 observational studies of breastfeeding presents evidence that optimal breastfeeding supports improved performance in intelligence tests in childhood and adolescence, demonstrating an intelligence quotient (IQ) increase of 3·44 points (95% CI 2·30–4·58).[87] Findings from a 2015 analysis[88] of the Pelotas birth cohort in Brazil also showed a dose-response association between breastfeeding duration and increased child intelligence, educational attainment, and income at the age of 30 years. The positive effect of breastfeeding was observed in one randomised trial[89] in Belarus, in which

	Childhood development	Nutrition and growth	Mortality	Disability, injury, and malformations	Severe morbidity
Iodine supplementation before or during pregnancy	✓	✓	✓	✓	..
Antenatal corticosteroids for women at risk of preterm birth	✓	..	✓	..	✓
Magnesium sulphate for women at risk of preterm birth	✓	..	..	✓	..
Antiplatelet agents for women at risk of pre-eclampsia	✓	✓	✓	..	..
Therapeutic hypothermia for hypoxic ischaemic encephalopathy	✓	..	✓	✓	✓
Psychological interventions for common perinatal mental disorders	✓	✓	..	..	✓
Iron supplementation in children	✓	✓	..	..	..
Multiple micronutrient supplementation in children	✓	✓	..	..	..
Supplementary feeding for disadvantaged children	✓	✓	..	..	..
Parenting programmes	✓	..	..	..	..
Integrated parenting and nutrition programmes	✓	✓	..	..	..
Out-of-home interventions (pre-primary education)	✓	..	..	..	..
Conditional cash transfer	✓	✓	✓	..	✓
Delayed cord clamping (ie, more placental transfusion)	✓	✓	✓	..	✓
Breastfeeding promotion, education, or support	✓	✓	..	..	..
Unconditional cash transfers	..	✓	..	..	✓
Periconceptional folic acid fortification or supplementation	..	..	..	✓	..
Birth interval at least 36–60 months	..	✓	✓	..	..
Preconceptional diabetes care	..	..	✓	✓	..
Iron and iron-folate supplementation during pregnancy	..	✓	..	..	..
Multiple micronutrient supplementation during pregnancy	..	✓	✓	..	..
Balanced protein-energy supplementation during pregnancy	..	✓	✓	..	..
Intermittent preventive therapy and use of bednets for malaria prevention in mothers and children	..	✓	✓	..	✓
Antibiotics for premature rupture of membranes	..	✓	..	✓	✓
Lower genital tract infection screening and treatment in pregnant mothers	..	✓	..	..	..
Antibiotics for asymptomatic bacteriuria in children	..	✓	..	..	..

(Table continues on next page)

	Childhood development	Nutrition and growth	Mortality	Disability, injury, and malformations	Severe morbidity
(Continued from previous page)					
Detection and treatment of syphilis in pregnant mothers	..	✓	✓	..	✓
Smoking cessation interventions in parents	..	✓	..	..	..
Continuous support during childbirth	..	..	..	..	✓
Kangaroo Mother Care, skin-to-skin, cap and wrap (thermal care)	..	✓	✓	..	✓
Topical emollient therapy for preterm neonates	..	✓	✓	..	✓
Intramuscular vitamin K for neonates	..	..	..	..	✓
Handwashing behaviour and water quality improvement eg, water, sanitation, and hygiene (WASH)	..	✓	✓	..	✓
Rotavirus, HiB, and pneumococcal vaccinations in children	..	..	✓	..	✓
Vitamin A supplementation in children	..	✓	✓	✓	✓
Zinc supplementation and treatment for acute diarrhoea in children	..	✓	✓	..	✓
Deworming drug treatment in children	..	✓	..	..	..
Complementary feeding education and provision	..	✓	..	..	✓
Treatment of moderate and severe acute malnutrition in children	..	✓	..	..	✓
Interventions to prevent child maltreatment (eg, specific home-visiting and parenting programmes)*	..	..	..	..	..

Interventions were for improving child development, nutrition and growth, mortality, disability, and morbidity in low-income and middle-income countries (LMICs), based on high-quality systematic review evidence discussed in text. Checkmarks pertain to significant pooled effect sizes. HiB=*Haemophilus influenza* type B. *Most rigorous trials of interventions to prevent child maltreatment have been conducted in high-income countries, with far fewer in LMICs, and are not uniformly effective in reducing injuries, physical abuse, and neglect.

***Table*: Summary of effective interventions related to early childhood development**

duration of total and exclusive breastfeeding was higher in the intervention group that received the Baby-Friendly Hospital Initiative than in a control group that was not exposed to the breastfeeding counselling intervention; performance in intelligence tests at 6·5 years was also higher in the intervention group. A cohort analysis from South Africa found that exclusive breastfeeding was associated with fewer than average conduct disorders.[90]

Micronutrients and child feeding

Malnutrition remains a serious challenge in developing countries, undermining the survival, growth, and development of young children. Stunting and severe acute malnutrition (wasting) are often associated with concomitant micronutrient deficiencies—among these, vitamin A, iron, zinc, and iodine deficiencies are the most prevalent in childhood. Given the wide prevalence of multiple micronutrient deficiencies in malnourished children, there is a need to implement interventions that combine micronutrient interventions with appropriate infant and young child feeding.

One review, limited to four trials, found that multiple micronutrient supplementation in children at risk of deficiencies has also been shown to improve academic performance among children 5–16 years of age (SMD 0·30, 95% CI 0·01 to 0·58).[91] A review of iron supplementation in children found improvement in psychomotor development at 12 months (MD 6·90, 95% CI 1·35 to 12·45) and a decrease in IQ in school grades 1–6 (children of average age 10 years; MD –3·00, –5·96 to –0·04);[92] a second review on iron supplementation found an improvement in mental development (SMD 0·30, 0·15 to 0·46) and IQ (SMD 0·41, 0·20 to 0·62).[93] One other review, which focused on the effect of supplementary food given to socioeconomically disadvantaged children aged from 3 months to 5 years, found that food supplements improved psychomotor development (SMD 0·41, 0·10 to 0·72), but found mixed effects on measures of cognitive development in different trials (SMD –0·40, –0·79 to 0 for Bayley II: Mental Development; and SMD 0·58, 0·17 to 0·98 for cognitive development test battery).[94] Results from individual studies in Bangladesh[95] and India[96] suggest that responsive feeding can be effective in promoting child growth and developmental outcomes.

Prevention of child maltreatment

Family violence is increasingly recognised as a key public health problem in LMICs. Maltreatment during childhood is associated with reduced volume of both the midsaggital area and hippocampus, which are brain regions involved in learning and memory.[97] Children who receive inadequate care, especially in the first 24 months of life, are more sensitive to the effects of stress and display more behavioural problems than do children who receive nurturing care.[98] There is increasing evidence that one of the most powerful predictors of caregiving behaviour is how caregivers, especially mothers, were cared for themselves.[99] Children who grow up neglected or abused by their parents, or under conditions of extreme distress within their families, are at risk of developing a host of unhealthy behaviours that affect their own lives. When these children grow up, they tend to be less equipped to take on a parenting role and are more likely to perpetuate a cycle of adverse caregiving across generations. The maltreatment prevention interventions with the best evidence that shows positive results following the intervention are selective

programmes (eg, Nurse Family Partnership) characterised by intensive visits by professional home visitors and beginning prenatally, but these programmes have not been evaluated in LMICs (appendix pp 16–18). The extent to which these findings are generalised beyond the specific HICs where they have been evaluated is unknown. A systematic review of 12 parenting interventions for reducing harsh or abusive parenting in LMICs found potentially positive results on a range of parenting measures, but the quality of included trials was generally low.[40] Early intervention that occurs before the onset of abusive and neglectful parenting is crucial to preventing maltreatment. One specific parenting programme, Triple P, has shown some promise in one HIC randomised trial.[100] There is an urgent need for more rigorously evaluated maltreatment prevention interventions in LMICs, focusing on parenting and child outcomes, and adapted for low resource contexts. More recent reviews of early childhood development interventions in LMICs are suggesting associations with violence reduction and peace promotion (appendix pp 26–28).

Out-of-home interventions

Effects of early learning programmes, including high-quality child care, and formal and informal preschools, are well established in LMICs.[30] On the basis of an update of an earlier published review,[32] we found that formal and non-formal or community-based preschools in LMICs improved scores on direct measures of children's cognitive development (SMD=0·67, 95% CI 0·43–0·91, 26 studies) and psychosocial development (0·23, 0·06–0·4, five studies; appendix pp 10–15). The effects of early learning programmes on child growth were not significant and one study measuring motor development showed non-significant effects. The earlier review[32] found that the effects of non-formal preschools on child outcomes were typically weaker than those of formal preschools; yet some low-cost and innovative programmes, such as home-based preschool[101] and a child-to-child approach,[102] improve developmental outcomes in participants compared with non-participants. Regardless of type, programme quality is a key predictor of effectiveness; important factors of preschool quality include greater number, variety and challenging play materials, interactive or dialogic reading, classroom organisation, and instructional support. Nurturing environments, in the form of care and positive interactions and individualised attention, appear to be important in early learning programmes. A positive emotional climate at child-care centres in Chile[103] and Ecuador,[104] including individualised attention, positive affect or positive moods, and reinforcement of children's behaviours, has shown positive associations with children's early childhood cognitive and socioemotional skills.

Social safety net interventions

Our analysis of the systematic reviews[50–54] and the new literature (appendix pp 19–21) on social safety net interventions suggests positive effects of conditional cash transfer programmes on some child outcomes, including birthweight, illness, or morbidity. Outcomes with mixed-group or subgroup effects included height-for-age or stunting, weight-for-age or underweight, and cognitive and language development. Conditional cash transfer programme participation consistently had no effects on haemoglobin concentration or prevalence of anaemia in children. In terms of indirect effects of these programmes, results were significant for effects of participation on prenatal care, growth monitoring, micronutrient supplementation, and household food consumption. It is difficult, however, to compare results across countries and contexts because programmes differ greatly. The effect of cash transfers on child development might be improved by combining social protection and early childhood development interventions. Cash transfer programmes try to address many issues at multiple levels that influence child development, such as parental and community levels, but these programmes do not directly change the factors that are linked with improving development outcomes. For example, programmes providing parental support for child development within the context of larger social protection efforts in Latin America have shown substantial benefits for child development, over and above the benefits of conditional cash transfer programmes.[105,106] Bringing these two interventions together can address both economic and nurturing care factors that impact developmental outcomes.

Intervention packages that integrate nurturing care with sector-specific programmes

Building on the earlier *Lancet* child development Series, the subsequent literature on early childhood interventions has expanded to include new longitudinal data and cohort data from LMICs. Most interventions during the period from preconception to birth focus on the physical and mental health of the mother to support a healthy pregnancy and improve birth outcomes. Interventions focusing on nurturing care and protection are usually introduced at birth; however, maternal programming for nurturing care begins during pregnancy and even earlier, with the caregiver's own childhood experiences. Evidence-based interventions during infancy that combine basic sectoral elements in health, nutrition, child and social protection, and child care and learning, with nurturing care and protection can synergistically improve child developmental outcomes. For example, including stimulation in nutrition programmes can improve developmental outcomes, which cannot be fully promoted through nutrition interventions alone.[31] Breastfeeding is an example of an intervention that combines elements of nutrition with bonding.

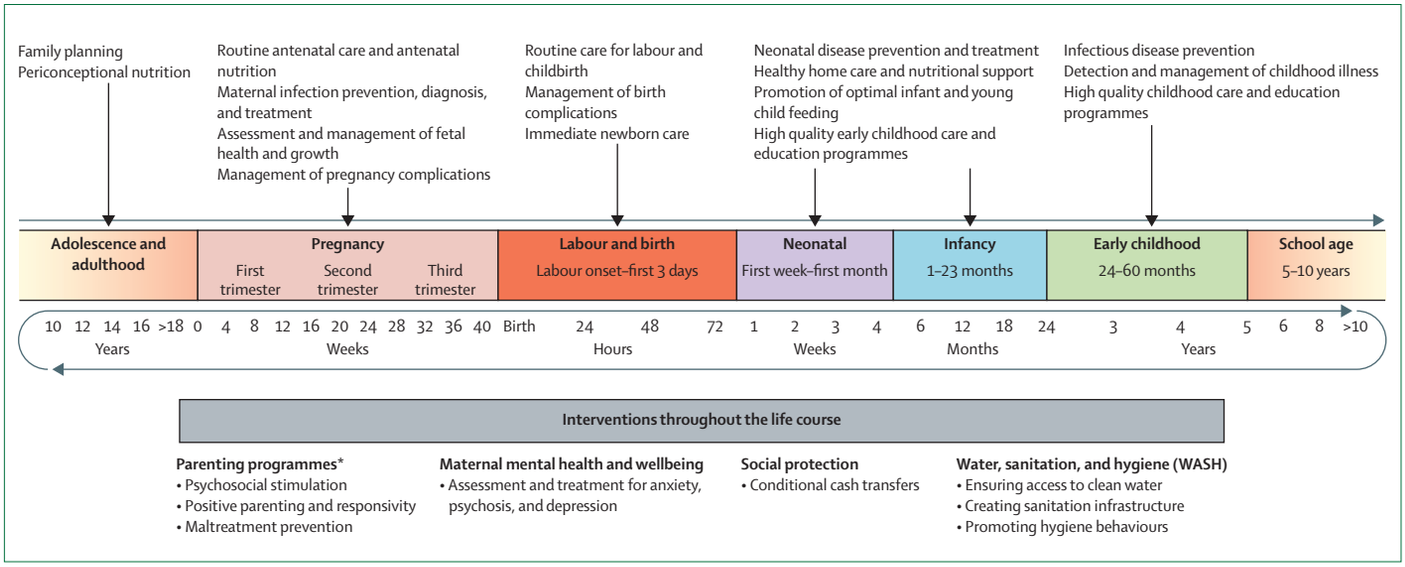

Figure: **Evidence-based interventions that affect aspects of nurturing care**

Building on sectoral services

Multi-sector approaches include coordinated services across sectors, for example water and sanitation, ideally with unifying policies. Integrated approaches refer to integration across services with shared messages and opportunities for synergy, as discussed in Paper 1 of this Series.[1] Many sectoral interventions could serve as the basis for delivery of services that link policy level strategies of cash transfer, social policies, and income generation with programmatic interventions, such as parenting support, that could benefit childhood development (appendix pp 19–21). Sectors were not included in this review, as further research is needed to examine their effects on developmental outcomes. However, associations have been noted between these sectoral interventions and such outcomes as child nutritional status, growth, and health.[80–82]

Delivering multi-sectoral intervention packages to improve childhood development

The effect of interventions on early childhood development could be improved by taking into consideration the major insights we have gained over the past decade about how human development is affected by complex and multi-faceted experiences, starting with previous generations. Based on the science of early human development, we need to conceptualise meaningful integration of interventions through a coordinated approach. In instances in which sectoral interventions were combined with elements of nurturing care and protection—eg, the Care for Child Development Programme delivered by Lady Health Workers in Pakistan—the effect of the intervention on child outcomes increased significantly.[20] This approach allows us to intervene with the family as a unit rather than the child alone. Furthermore, there are increasing opportunities to improve interventions by combining them with nurturing care and protection, through parenting support and skills programmes.

Previous attempts at creating packages of effective interventions have focused either on the temporal relevance of the interventions (ie, packaging interventions that co-occur during the same age period of the child)[107] or on the delivery of the programmes through the same system (eg, maternal, newborn, and child health). Although it is important to consider these factors, we also need to incorporate nurturing care and protection into the packages and tailor them to unique sets of risks and adversities facing the young child population particular to the setting.

Based on our review, we propose three illustrative packages that build on these principles and the findings. These interventions affect different aspects of nurturing care and cover numerous domains and stages in the life course (figure).

Family support and strengthening package

There are three elements of family strengthening: (access to quality services (eg, antenatal care, immunisation, and nutrition); skills building (eg, positive and responsive parenting to reduce harsh discipline and promote stimulation); and support (eg, social protection, safety networks, and family support policies). These elements increase the likelihood that families are better able to provide nurturing care for their children. Each of these elements—services, skills, and support—have independent predictive effects, however significant positive effects are seen when they

are combined with programmatic interventions (eg, social protection interventions). By creating a package of the three elements of services, support, and skill building, based on the age of the child and nature of bio-ecological and contextual risk factors, developmental outcomes could be substantially improved.

Multi-generational nurturing care package

This two generation package emphasises care and protection of the mother's and father's physical and mental health and wellbeing, while enhancing their capacity to provide nurturing care to their child. This package combines the essential interventions of health and nutrition for mother and child—primarily delivered by the health-care system from pre-conception up until the first 1000 days of a child's life—and the elements of care, responsivity, stimulation, and protection. This package can be further strengthened with parental leave policies as discussed in Paper 3 of this Series.[108] While the reviews did not specifically cover situations of conflict and violence, this package is also relevant for humanitarian contexts (panel 3). Conflict, violence, and insecurity present a complex array of adversities. In these settings families, parents, and caregivers require a package of services that addresses their needs as well as the immediate and long-term needs of their children.

Early learning and protection package

This set of interventions integrates the support for young children with parental support and the facilitation of teachers' and caregivers' ability to create a nurturing environment in early childhood centres, classrooms, and community settings for learning. This package of interventions should include nurturing care and protection by enhancing teachers' capacities to proving a nurturing, safe, and positive emotional climate, and should include greater attention to parental support. Long-term gains have been noted when early learning packages have included parenting support and protection for young children.[21] This package needs to emphasise quality and family support through parental empowerment, guidance on nutrition and care, and child protection.

There are advantages of such integrated packages in terms of delivery; for example, one location can be used for the provision of key services for young children. Identification of platforms at community, clinic, and school levels can be used to coordinate the delivery of the packages targeting population segments and families in greatest need. For example, community platforms that mobilise antenatal and postnatal home visits by community health workers complement facility-based care and promote family contact with the health-care system at crucial times. Social protection platforms provide the opportunity for identification of families in need and delivery of packages of services that link these policies with programmatic interventions.

Panel 3: **Early childhood development interventions for violence prevention and peace promotion**

Early parent–child programmes aimed at enhancing responsive parenting can reduce adverse childhood experiences—eg, poor nutrition, neglect, abuse, and exposure to violence in the home—and can positively affect the child's cognitive and socioemotional development, their brain structure and function, and their physical health. Although the published medical literature on implementing early childhood development interventions in contexts of conflict and fragility is limited, the theoretical and empirical underpinnings are strong.

The biobehavioural systems that underlie the development of parent-child relationships are ancient and deeply rooted in mammalian evolution, and are also highly adaptable to changes in the environment. For example, exposure to violence in the home environment and other adverse childhood experiences are associated with changes in brain structure and function in children.[109,110] Unfortunately, these children are also at an increased risk of becoming perpetrators of violence as they grow older, so that violence can become self-perpetuating from generation to generation. The biological underpinnings of these phenomena are likely to involve epigenetic mechanisms. Despite an ever-growing body of research, there is still a long way to go before the role of the epigenome in shaping human behaviour across generations is fully understood. If consistent findings emerge, they will provide a solid foundation for the hypothesis that interventions to strengthen families, promote nurturing care and protection, and to improve the cognitive and socioemotional wellbeing of children have trans-generational consequences (appendix).

Factors that affect the selection of intervention include the age group being targeted, the expertise of the sector, coverage, or an analysis of the most efficient and effective use of resources within a service for a particular context. More evaluation is needed to codify the interventions to consolidate them into essential packages and assess effectiveness, implementation quality, and cost-benefits of integrated, inter-sectoral, and multi-sectoral approaches for early childhood development packages. Delivery of multi-sectoral services involves challenges, including limited workforce capacity, demonstration of value added for including programmatic interventions of nurturing care, and political will. Some of these challenges are discussed in Paper 3 of this Series.[108]

Future research areas

Although there has been progress in the understanding of what interventions work, there are major gaps in knowledge. The particular set of risks faced by children in conflict is not well understood. There is also a lack of knowledge about the effectiveness of early childhood development interventions in conflict-affected and fragile countries. We need to improve our understanding of how to: better combine interventions through robust assessment of intervention outcomes and evaluations of integrated parenting, responsive care, stimulation, mental health, education and protection interventions that could be delivered through community platforms; use technology-based platforms to deliver effective interventions (appendix pp 29–31); and how to scale up using evidence-based approaches.

Conclusion

In this paper we call for meaningful integration across sectoral interventions, through programmatic packages that promote nurturing care and protection to improve developmental outcomes. We also call for better integration of evidence-based interventions within health-care and nutrition sectors. The results of our literature review suggest that successful, smart, and sustainable interventions to improve developmental outcomes need to: promote nurturing care and protection; be implemented as packages that target multiple risks; be applied at developmentally appropriate times during the life course; be of high quality; and build on existing delivery platforms to enhance feasibility of scaling up and sustainability. We have proposed illustrative packages that meet these requirements. The nature of these interventions will continue to progress as new understanding of early human development emerges. Although questions remain about scaling up interventions at a population level, as discussed by Richter and colleagues in Paper 3 of this Series,[108] we are now at a historic juncture; the evidence is clear about what needs to be done to improve the wellbeing of future generations, and the political commitment to this is strong, as expressed by the adoption of the Sustainable Development Goals. The science is clear and the evidence convincing that our earliest experiences matter; the Sustainable Development Goals provide a crucial opportunity for implementation. We must draw on this knowledge to take action to support parents, caregivers, and families in providing the nurturing care and protection that young children deserve.

Contributors

PRB and SJL conceptualised the review in consultation with the Early Childhood Development Series Steering Committee and wrote the first draft of the Series paper with substantial inputs from KP. ZAB, RP-E, MFG, and TV led the review of MCNH and nutrition interventions. NR, PI, and AKY led the review of early childhood education and parenting interventions. HM led the review of child maltreatment prevention interventions. LCHF led the review of social protection interventions. SGM, AC, AF, and VGM contributed to the scientific literature review of nurturing care and human development. TDW and HYa reviewed the literature on cumulative and protective risk factors. All authors and members of the review groups saw successive drafts of the paper and provided input. PRB, SJL, and KP prepared the final version of the Series paper, which all authors approved. PRB had final responsibility for the decision to submit for publication.

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Declaration of interests

PRB is employed by UNICEF. JFL has received several contracts, gifts, and grants focused on the impact of early child development programmes from UNICEF, the Anne Çocuk Eğitim Vakfi (AÇEV, Mother-Child Education Foundation), the UBS Optimus Foundation, and the Open Road Alliance. The other authors declare that they have no conflicts of interest. The views expressed are those of the authors and not necessarily those of UNICEF, Bill & Melinda Gates Foundation, and Conrad N Hilton Foundation. As corresponding author, PRB states that she had full access to all data and final responsibility to submit for publication.

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References

1 Black MM, Walker SP, Fernald LC, et al, for the *Lancet* Early Childhood Development Series Steering Commitee. Early childhood development coming of age: science through the life course. *Lancet* 2016; published online Oct 4. http://dx.doi.org/10.1016/S0140-6736(16)31389-7.

2 Shonkoff JP, Phillips DA, eds. From neurons to neighborhoods: the science of early childhood development. Washington, DC: National Academies Press (US), 2000.

3 Bornstein MH, ed. Handbook of Parenting. New York, NY: Psychology Press, 2012.

4 Britto PR, Engle P. Parenting education and support: maximizing the most critical enabling environment. In: Marope PTM, Kaga Y, eds. Investing against evidence: the global state of early childhood care and education. Paris: United Nations Educational, Scientific and Cultural Organization, 2015: 157–76.

5 Boivin M, Bierman KL, eds. Promoting school readiness and early learning: implications of developmental research for practice. New York, NY: Guilford Publications, 2013.

6 Ermisch J, Jantti M, Smeeding TM, eds. From parents to children: the intergenerational transmission of advantage. New York, NY: Russell Sage Foundation, 2012.

7 Marshall PJ, Kenney JW. Biological perspectives on the effects of early psychosocial experience. *Dev Rev* 2009; **29:** 96–119.

8 Kolb B, Whishaw IQ. Fundamentals of human neuropsychology, 5th edn. New York, NY: Worth Publishers, 2003.

9 Britto PR, Perez-Escamilla R. No second chances? Early critical periods in human development. Introduction. *Soc Sci Med* 2013; **97:** 238–40.

10 Huttenlocher P. Neural plasticity: the effects of the environment on the development of the cerebral cortex. Cambridge, MA: Harvard University Press, 2002.

11 Ferguson KT, Cassells RC, MacAllister JW, Evans GW. The physical environment and child development: an international review. *Int J Psychol* 2013; **48:** 437–68.

12 Walker SP, Wachs TD, Grantham-McGregor S, et al. Inequality in early childhood: risk and protective factors for early child development. *Lancet* 2011; **378:** 1325–38.

13 LaFranchi SH. Approach to the diagnosis and treatment of neonatal hypothyroidism. *J Clin Endocrinol Metab* 2011; **96:** 2959–67.

14 WHO. Proportion of births attended by a skilled health worker: 2008 updates. Geneva: World Health Organization, 2008.

15 Bradley RH, Putnick DL. Housing quality and access to material and learning resources within the home environment in developing countries. *Child Dev* 2012; **83:** 76–91.

16 Wachs TD, Rahman A. The nature and impact of risk and protective influences on children's development in low-income countries. In: Britto PR, Engle PL, Super CM, eds. Handbook of early childhood development research and its impact on global policy. New York, NY: Oxford University Press, 2013: 85–122.

17 Gertler P, Heckman J, Pinto R, et al. Labor market returns to an early childhood stimulation intervention in Jamaica. *Science* 2014; **344:** 998–1001.

18 Walker SP, Chang SM, Powell CA, Grantham-McGregor SM. Effects of early childhood psychosocial stimulation and nutritional supplementation on cognition and education in growth-stunted Jamaican children: prospective cohort study. *Lancet* 2005; **366:** 1804–07.

19 Grantham-McGregor SM, Walker SP, Chang SM, Powell CA. Effects of early childhood supplementation with and without stimulation on later development in stunted Jamaican children. *Am J Clin Nutr* 1997; **66:** 247–53.

20 Yousafzai AK, Rasheed MA, Rizvi A, Armstrong R, Bhutta ZA. Effect of integrated responsive stimulation and nutrition interventions in the Lady Health Worker programme in Pakistan on child development, growth, and health outcomes: a cluster-randomised factorial effectiveness trial. *Lancet* 2014; **384:** 1282–93.

21 Kagitcibasi C, Sunar D, Bekman S, Baydar N, Cemalcilar Z. Continuing effects of early enrichment in adult life: the Turkish Early Enrichment Project 22 years later. *J Appl Dev Psychol* 2009; **30:** 764–79.

22 Kagitcibasi C, Sunar D, Bekman S. Long-term effects of early intervention: Turkish low-income mothers and children. *J Appl Dev Psychol* 2001; **22:** 333–61.

23 Higgins JP, Green S, eds. Cochrane handbook for systematic reviews of interventions, version 5.1.0 (updated March, 2011). The Cochrane Collaboration, 2011.

24 Victora CG, Bahl R, Barros AJ, et al. Breastfeeding in the 21st century: epidemiology, mechanisms, and lifelong effect. *Lancet* 2016; **387:** 475–90.

25 Bhutta ZA, Das JK, Bahl R, et al. Can available interventions end preventable deaths in mothers, newborn babies, and stillbirths, and at what cost? *Lancet* 2014; **384:** 347–70.

26 Bhutta ZA, Das JK, Rizvi A, et al. Evidence-based interventions for improvement of maternal and child nutrition: what can be done and at what cost? *Lancet* 2013; **382:** 452–77.

27 Bhutta ZA, Das JK, Walker N, et al. Interventions to address deaths from childhood pneumonia and diarrhoea equitably: what works and at what cost? *Lancet* 2013; **381:** 1417–29.

28 Lassi ZS, Kumar R, Mansoor T, Salam RA, Das JK, Bhutta ZA. Essential interventions: implementation strategies and proposed packages of care. *Reprod Health* 2014; **11** (suppl 1)**:** S5.

29 The Partnership for Maternal, Newborn and Child Health. A global review of the key interventions related to reproductive, maternal, newborn and child health (RMNCH). Geneva: The Partnership for Maternal Health, Newborn and Child Health and the Aga Khan University, 2011.

30 Engle PL, Fernald LC, Alderman H, et al. Strategies for reducing inequalities and improving developmental outcomes for young children in low-income and middle-income countries. *Lancet* 2011; **378:** 1339–53.

31 Aboud FE, Yousafzai AK. Global health and development in early childhood. *Annu Rev Psychol* 2015; **66:** 433–57.

32 Rao N, Sun J, Wong JMS, et al. Early childhood development and cognitive development in developing countries: a rigorous literature review. London: Department for International Development, 2014.

33 Brown TW, van Urk FC, Waller R, Mayo-Wilson E. Centre-based day care for children younger than five years of age in low- and middle-income countries. *Cochrane Database Syst Rev* 2014; **4:** CD010543.

34 Macmillan HL, Wathen CN, Barlow J, Fergusson DM, Leventhal JM, Taussig HN. Interventions to prevent child maltreatment and associated impairment. *Lancet* 2009; **373:** 250–66.

35 Mikton C, Butchart A. Child maltreatment prevention: a systematic review of reviews. *Bull World Health Organ* 2009; **87:** 353–61.

36 Britto PR, Ponguta LA, Reyes C, Karnati R. A systematic review of parenting programs for young children. New York, NY: United Nations Children's Emergency Fund, 2015.

37 Peacock S, Konrad S, Watson E, Nickel D, Muhajarine N. Effectiveness of home visiting programs on child outcomes: a systematic review. *BMC Public Health* 2013; **13:** 17.

38 Segal L, Sara Opie R, Dalziel K. Theory! The missing link in understanding the performance of neonate/infant home-visiting programs to prevent child maltreatment: a systematic review. *Milbank Q* 2012; **90:** 47–106.

39 Avellar SA, Supplee LH. Effectiveness of home visiting in improving child health and reducing child maltreatment. *Pediatrics* 2013; **132** (suppl 2)**:** S90–99.

40 Knerr W, Gardner F, Cluver L. Improving positive parenting skills and reducing harsh and abusive parenting in low- and middle-income countries: a systematic review. *Prev Sci* 2013; **14:** 352–63.

41 Chen M, Chan KL. Effects of parenting programs on child maltreatment prevention: a meta-analysis. *Trauma Violence Abuse* 2016; **17:** 88–104.

42 Topping KJ, Barron IG. School-based child sexual abuse prevention programs: a review of effectiveness. *Rev Educ Res* 2009; **79:** 431–63.

43 Walsh K, Zwi K, Woolfenden S, Shlonsky A. School-based education programmes for the prevention of child sexual abuse. *Cochrane Database SystRev* 2015; **4:** CD004380.

44 Poole MK, Seal DW, Taylor CA. A systematic review of universal campaigns targeting child physical abuse prevention. *Health Educ Res* 2014; **29:** 388–432.

45 Selph SS, Bougatsos C, Blazina I, Nelson HD. Behavioral interventions and counseling to prevent child abuse and neglect: a systematic review to update the US Preventive services task force recommendation. *Ann Intern Med* 2013; **158:** 179–90.

46 Bailhache M, Leroy V, Pillet P, Salmi LR. Is early detection of abused children possible? A systematic review of the diagnostic accuracy of the identification of abused children. *BMC Pediatr* 2013; **13:** 202.

47 Cummings M, Berkowitz SJ. Evaluation and treatment of childhood physical abuse and neglect: a review. *Curr Psychiatry Rep* 2014; **16:** 429.

48 Schwartz KA, Preer G, McKeag H, Newton AW. Child maltreatment: a review of key literature in 2013. *Curr Opin Pediatr* 2014; **26:** 396–404.

49 Lane WG. Prevention of child maltreatment. *Pediatr Clin North Am* 2014; **61:** 873–88.

50 Manley J, Gitter S, Slavchevska V. How effective are cash transfers at improving nutritional status? *World Dev* 2013; **48:** 133–55.

51 Bassani DG, Arora P, Wazny K, Gaffey MF, Lenters L, Bhutta ZA. Financial incentives and coverage of child health interventions: a systematic review and meta-analysis. *BMC Public Health* 2013; **13** (suppl 3)**:** S30.

52 Fernald LCH, Gertler PJ, Hidrobo M. Conditional cash transfer programs: effects on growth, health and development in young children. In: King RB, Maholmes V, eds. The Oxford handbook of poverty and child development. Oxford: Oxford University Press, 2012.

53 Glassman A, Duran D, Koblinsky M. Impact of conditional cash transfers on maternal and newborn health. Washington, DC: Center for Global Development, 2013. http://www.cgdev.org/publication/impact-conditional-cash (accessed June 1, 2015).

54 Ruel MT, Alderman H, Group MaCNS. Nutrition-sensitive interventions and programmes: how can they help to accelerate progress in improving maternal and child nutrition? *Lancet* 2013; **382:** 536–51.

55 Shea BJ, Hamel C, Wells GA, et al. AMSTAR is a reliable and valid measurement tool to assess the methodological quality of systematic reviews. *J Clin Epidemiol* 2009; **62:** 1013–20.

56 Zimmermann MB. The effects of iodine deficiency in pregnancy and infancy. *Paediatr Perinat Epidemiol* 2012; **26** (suppl 1)**:** 108–17.

57 Roberts D, Dalziel Stuart R. Antenatal corticosteroids for accelerating fetal lung maturation for women at risk of preterm birth. *Cochrane Database Syst Rev* 2006; **3:** CD004454.

58 Doyle LW, Crowther CA, Middleton P, Marret S, Rouse D. Magnesium sulphate for women at risk of preterm birth for neuroprotection of the fetus. *Cochrane Database Syst Rev* 2009; **1:** CD004661.

59 Duley L, Henderson-Smart D, Meher S, King J. Antiplatelet agents for preventing pre-eclampsia and its complications. *Cochrane Database Syst Rev* 2007; **2:** CD004659.

60 Jacobs SE, Berg M, Hunt R, Tarnow-Mordi WO, Inder TE, Davis PG. Cooling for newborns with hypoxic ischaemic encephalopathy. *Cochrane Database Syst Rev* 2013; **1:** CD003311.

61 McDonald SJ, Middleton P, Dowswell T, Morris PS. Effect of timing of umbilical cord clamping of term infants on maternal and neonatal outcomes. *Cochrane Database Syst Rev* 2013; **7:** CD004074.

62 Andersson O, Domellöf M, Andersson D, Hellström-Westas L. Effect of delayed cord clamping on neurodevelopment and infection at four months of age: a randomised trial. *Acta Paediatr* 2013; **102:** 525–31.

63 Chamberlain C, O'Mara-Eves A, Oliver S, et al. Psychosocial interventions for supporting women to stop smoking in pregnancy. *Cochrane Database Syst Rev* 2013; **10:** CD001055.

64 Wang Y, Fu W, Liu J. Neurodevelopment in children with intrauterine growth restriction: adverse effects and interventions. *J Matern Fetal Neonatal Med* 2016; **29:** 1–9.

65 Walker SP, Chang SM, Wright A, Osmond C, Grantham-McGregor SM. Early childhood stunting is associated with lower developmental levels in the subsequent generation of children. *J Nutr* 2015; **145:** 823–28.

66 Imdad A, Bhutta ZA. Maternal nutrition and birth outcomes: effect of balanced protein-energy supplementation. *Paediatr Perinat Epidemiol* 2012; **26** (suppl 1)**:** 178–90.

67 Haider B, Bhutta Z. Multiple-micronutrient supplementation for women during pregnancy. *Cochrane Database Syst Rev* 2015; **11:** CD004905.

68 Peña-Rosas JP, De-Regil Luz M, Garcia-Casal Maria N, Dowswell T. Daily oral iron supplementation during pregnancy. *Cochrane Database Syst Rev* 2015; **7:** CD004736

69 Imdad A, Yakoob MY, Bhutta ZA. The effect of folic acid, protein energy and multiple micronutrient supplements in pregnancy on stillbirths. *BMC Public Health* 2011; **11** (suppl 3)**:** S4.

70 Barrett J, Fleming AS. Annual Research Review: all mothers are not created equal: neural and psychobiological perspectives on mothering and the importance of individual differences. *J Child Psychol Psychiatry* 2011; **52:** 368–97.

71 Stein A, Pearson RM, Goodman SH, et al. Effects of perinatal mental disorders on the fetus and child. *Lancet* 2014; **384:** 1800–19.

72 Kvalevaag AL, Ramchandani PG, Hove O, Assmus J, Eberhard-Gran M, Biringer E. Paternal mental health and socioemotional and behavioral development in their children. *Pediatrics* 2013; **131:** e463–69.

73 Rahman A, Fisher J, Bower P, et al. Interventions for common perinatal mental disorders in women in low-and middle-income countries: a systematic review and meta-analysis. *Bull World Health Organ* 2013; **91:** 593–601I.

74 Ross LE, Grigoriadis S, Mamisashvili L, et al. Selected pregnancy and delivery outcomes after exposure to antidepressant medication: a systematic review and meta-analysis. *JAMA Psychiatry* 2013; **70:** 436–43.

75 Huang H, Coleman S, Bridge JA, Yonkers K, Katon W. A meta-analysis of the relationship between antidepressant use in pregnancy and the risk of preterm birth and low birth weight. *Gen Hosp Psychiatry* 2014; **36:** 13–18.

76 Singla DR, Kumbakumba E, Aboud FE. Effects of a parenting intervention to address both maternal psychological wellbeing and child development and growth in rural Uganda: a community-based, cluster-randomised trial. *Lancet Glob Health* 2015; **3:** e458–69.

77 Aboud FE, Singla DR, Nahil MI, Borisova I. Effectiveness of a parenting program in Bangladesh to address early childhood health, growth and development. *Soc Sci Med* 2013; **97:** 250–58.

78 Hodnett ED, Gates S, Hofmeyr GJ, Sakala C. Continuous support for women during childbirth. *Cochrane Database Syst Rev* 2013; **7:** CD003766.

79 Powell C. An evaluation of the Roving Caregivers Programme of the Rural Family Support Organization, May Pen, Clarendon, Jamaica. Kingston, Jamaica: United Nations Population Fund, 2004.

80 Peairson S, Berghout Austin AM, de Aquino CN, de Burro EU. Cognitive development and home environment of rural Paraguayan infants and toddlers participation in Pastoral del Niño, an early child development program. *J Res Child Educ* 2008; **22:** 343–62.

81 Hamadani JD, Huda SN, Khatun F, Grantham-McGregor SM. Psychosocial stimulation improves the development of undernourished children in rural Bangladesh. *J Nutr* 2006; **136:** 2645–52.

82 Eickmann SH, Lima AC, Guerra MQ, et al. Improved cognitive and motor development in a community-based intervention of psychosocial stimulation in northeast Brazil. *Dev Med Child Neurol* 2003; **45:** 536–41.

83 Panter-Brick C, Burgess A, Eggerman M, McAllister F, Pruett K, Leckman JF. Practitioner review: engaging fathers—recommendations for a game change in parenting interventions based on a systematic review of the global evidence. *J Child Psychol Psychiatry* 2014; **55:** 1187–212.

84 Joseph S, Lonstein J, Levy F, Fleming AS. Common and divergent psychobiological mechanisms underlying maternal behaviors in non-human and human mammals. *Horm Behav* 2015; **73:** 156–85.

85 Conde-Agudelo A, Díaz-Rossello JL. Kangaroo mother care to reduce morbidity and mortality in low birthweight infants. *Cochrane Database Syst Rev* 2014; **4:** CD002771.

86 Goldsmith F, O'Sullivan A, Smilowitz JT, Freeman SL. Lactation and intestinal microbiota: how early diet shapes the infant gut. *J Mammary Gland Biol Neoplasia* 2015; **20:** 149–58.

87 Horta BL, de Mola CL, Victora CG. Breastfeeding and intelligence: a systematic review and meta-analysis. *Acta Paediatr* 2015; **104:** 14–19.

88 Victora CG, Horta BL, de Mola CL, et al. Association between breastfeeding and intelligence, educational attainment, and income at 30 years of age: a prospective birth cohort study from Brazil. *Lancet Glob Health* 2015; **3:** e199–205.

89 Kramer MS, Aboud F, Mironova E, et al. Breastfeeding and child cognitive development: new evidence from a large randomized trial. *Arch Gen Psychiatry* 2008; **65:** 578–84.

90 Rochat TJ, Houle B, Stein A, et al. Exclusive breastfeeding and cognition, executive function and behavioural disorders in primary school-aged children in rural South Africa: a cohort analysis. *PLoS Med* 2016; **13:** 1–51.

91 Eilander A, Gera T, Sachdev HS, et al. Multiple micronutrient supplementation for improving cognitive performance in children: systematic review of randomized controlled trials. *Am J Clin Nutr* 2009; **91:** 115–30.

92 De-Regil LM, Jefferds MED, Sylvetsky AC, Dowswell T. Intermittent iron supplementation for improving nutrition and development in children under 12 years of age. *Cochrane Database Syst Rev* 2011; **12:** CD009085.

93 Sachdev H, Gera T, Nestel P. Effect of iron supplementation on mental and motor development in children: systematic review of randomised controlled trials. *Public Health Nutr* 2005; **8:** 117–32.

94 Kristjansson E, Francis DK, Liberato S, et al. Food supplementation for improving the physical and psychosocial health of socio-economically disadvantaged children aged three months to five years. *Cochrane Database Syst Rev* 2015; **3:** CD009924.

95 Aboud FE, Moore AC, Akhter S. Effectiveness of a community-based responsive feeding programme in rural Bangladesh: a cluster randomized field trial. *Matern Child Nutr* 2008; **4:** 275–86.

96 Vazir S, Engle P, Balakrishna N, et al. Cluster-randomized trial on complementary and responsive feeding education to caregivers found improved dietary intake, growth and development among rural Indian toddlers. *Matern Child Nutr* 2013; **9:** 99–117.

97 Teicher MH, Samson JA. Childhood maltreatment and psychopathology: A case for ecophenotypic variants as clinically and neurobiologically distinct subtypes. *Am J Psychiatry* 2013; **170:** 1114–33.

98 Bick J, Zhu T, Stamoulis C, Fox NA, Zeanah C, Nelson CA. Effect of early institutionalization and foster care on long-term white matter development: a randomized clinical trial. *JAMA Pediatr* 2015; **169:** 211–19.

99 Lomanowska AM, Boivin M, Hertzman C, Fleming AS. Parenting begets parenting: A neurobiological perspective on early adversity and the transmission of parenting styles across generations. *Neuroscience* 2015; published online Sept 16. DOI:10.1016/j.neuroscience.2015.09.029.

100 Prinz RJ, Sanders MR, Shapiro CJ, Whitaker DJ, Lutzker JR. Population-based prevention of child maltreatment: the US Triple P system population trial. *Prev Sci* 2009; **10:** 1–12.

101 Rao N, Sun J, Pearson V, et al. Is something better than nothing? An evaluation of early childhood programs in Cambodia. *Child Dev* 2012; **83:** 864–76.

102 Mundy K, Proulx K, Janigan K, Geva E, Fraser C. Evaluation of the Child-to-Child school readiness programme in Ethiopia. Addis Ababa: United Nations Educational, Scientific and Cultural Organization, 2014.

103 Leyva D, Weiland C, Barata M, et al. Teacher-child interactions in Chile and their associations with prekindergarten outcomes. *Child Dev* 2015; **86:** 781–99.

104 Araujo M, Carneiro P, Cruz-Aguayo Y, Schady N. A helping hand? Teacher quality and learning outcomes in kindergarten. Washington, DC: Inter-American Development Bank, 2014.

105 Attanasio OP, Fernandez C, Fitzsimons EO, Grantham-McGregor SM, Meghir C, Rubio-Codina M. Using the infrastructure of a conditional cash transfer program to deliver a scalable integrated early child development program in Colombia: cluster randomized controlled trial. *BMJ* 2014; **349:** g5785.

106 Fernald LCH, Kagawa RMC, Knauer HA, Garcia Guerra A, Schnaas L, Neufeld LM. Promoting child development through group-based parent support within a cash transfer program: experimental effects on children's outcomes. *Dev Psychol* (in press).

107 Denboba A, Sayre R, Wodon Q, Elder L, Rawlings L, Lombardi J. Investing in young children: key interventions and principles to ensure all young children reach their full potential. Washington, DC: World Bank Group, 2014.

108 Richter LM, Daelmans B, Lombardi J, et al, with the Paper 3 Working Group, for the *Lancet* Early Childhood Development Series Steering Committee. Investing in the foundation of sustainable development: pathways to scale up for early childhood development. *Lancet* 2016; published online Oct 4. http://dx.doi.org/10.1016/S0140-6736(16)31698-1.

109 Birn RM, Patriat R, Phillips ML, Germain A, Herringa RJ. Childhood maltreatment and combat posttraumatic stress differentially predict fear-related fronto-subcortical connectivity. *Depress Anxiety* 2014 Oct; **31:** 880–92.

110 Campbell JA, Walker RJ, Egede LE. Associations between adverse childhood experiences, high-risk behaviors, and morbidity in adulthood. *Am J Prev Med* 2015; **50:** 344–52.

Advancing Early Childhood Development: from Science to Scale 3

Investing in the foundation of sustainable development: pathways to scale up for early childhood development

Linda M Richter, Bernadette Daelmans, Joan Lombardi, Jody Heymann, Florencia Lopez Boo, Jere R Behrman, Chunling Lu, Jane E Lucas, Rafael Perez-Escamilla, Tarun Dua, Zulfiqar A Bhutta, Karin Stenberg, Paul Gertler, Gary L Darmstadt, with the Paper 3 Working Group and the Lancet *Early Childhood Development Series Steering Committee**

Building on long-term benefits of early intervention (Paper 2 of this Series) and increasing commitment to early childhood development (Paper 1 of this Series), scaled up support for the youngest children is essential to improving health, human capital, and wellbeing across the life course. In this third paper, new analyses show that the burden of poor development is higher than estimated, taking into account additional risk factors. National programmes are needed. Greater political prioritisation is core to scale-up, as are policies that afford families time and financial resources to provide nurturing care for young children. Effective and feasible programmes to support early child development are now available. All sectors, particularly education, and social and child protection, must play a role to meet the holistic needs of young children. However, health provides a critical starting point for scaling up, given its reach to pregnant women, families, and young children. Starting at conception, interventions to promote nurturing care can feasibly build on existing health and nutrition services at limited additional cost. Failure to scale up has severe personal and social consequences. Children at elevated risk for compromised development due to stunting and poverty are likely to forgo about a quarter of average adult income per year, and the cost of inaction to gross domestic product can be double what some countries currently spend on health. Services and interventions to support early childhood development are essential to realising the vision of the Sustainable Development Goals.

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This is the third in a **Series** of three papers about early childhood development

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Introduction

The first Sustainable Development Goal (SDG) is to "ensure that all human beings can fulfil their potential in dignity and equality".[1] Protecting, promoting, and supporting early childhood development is essential to enable everyone to reach their full human potential.

In 2007, a *Lancet* Series estimated that 200 million children younger than 5 years in low-income and middle-income countries (LMICs) were at elevated risk of not reaching their human potential.[2] A second *Lancet* Series in 2011 identified risks and protective factors, and growing evidence of the effectiveness of interventions to prevent loss of human potential.[3,4]

In this Series on early childhood development, Paper 1 takes stock of what has been achieved in the era of the Millennium Development Goals (MDGs).[5] Paper 2 reviews effective interventions and new findings in neuroscience and genetics.[6] Scientific evidence confirms conception to age 3 years as the time during which adverse exposures exert the greatest harm, and effective interventions the greatest benefit. The development of young children has been neglected to date in favour of emphasis on survival and preparation for school. For this reason, the focus in this paper is on optimisation of development at scale during early childhood.[6]

We argue that the burden of poor development is larger than currently estimated because we lack global data to include additional risk factors. This burden makes it imperative to scale up effective interventions to protect, promote, and support early childhood development. We identify crucial elements of the pathways to successful scale-up, including political prioritisation, creation of supportive policy environments, the use of existing

Key messages

- The burden of poor child development is currently underestimated because risks to health and wellbeing go beyond stunting and extreme poverty.
- Effective interventions for early childhood development are now available and can feasibly be integrated into existing systems in health, education, and social and child protection.
- The scale-up of early child development programmes rests on political prioritisation of efforts to address deep social problems such as poverty, inequality, and social exclusion through interventions starting early in the life course.
- Policies that alleviate poverty and buttress family resources create a supportive environment to promote, protect, and support early childhood development at scale.
- Health and nutrition services are ideal starting points to scale up interventions for early childhood development. Efforts to promote nurturing care of young children built onto existing services for maternal and child health and nutrition are affordable.
- Societies around the world pay a high price, now and into the future, for not acting to protect children and promote early child development. The 43% of children younger than 5 years of age in low-income and middle-income countries, who are at elevated risk of poor development because of stunting or extreme poverty, are likely to forego about a quarter of average adult income per year. The benefits forfeited at a country level can be up to two times the gross domestic product spent on health.
- Services and interventions to support early childhood development are essential to ensuring that everyone reaches their potential over the life course and into the next generation, the vision that is core to the Sustainable Development Goals.

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See Online for appendix

delivery systems to build further efforts, and affordability. Action in all sectors is important to promote early childhood development, particularly in education and in social and child protection.

In this paper, we highlight the role of the health and nutrition sector as an entry point to scaling up of programmes for early childhood development. It has extensive reach to women and children during the crucial period from conception throughout early childhood, and is thus well placed to deliver early childhood development services to women, families, and the youngest children, together with education, and social and child protection. Further, there is good evidence of effectiveness, feasibility, and affordability of inclusion of interventions for early childhood development in reproductive, maternal, newborn, and child health (RMNCH) services. UNESCO,[7–9] UNICEF,[10] the World Bank,[11] and other agencies[12] are committed to promotion of early childhood development, and WHO's commitment is expressed in leadership of the Global Strategy for Women's, Children's and Adolescents' Health 2016–2030. Finally, the Strategy, supported under the UN Secretary General's Every Women Every Child initiative, offers new opportunities for linking child health, nutrition, and development.[13]

We address affordability by estimating the additional costs of including two scalable, evidence-based interventions for child development in the existing maternal and child health package, and the probable costs of inaction to both individuals and societies. We conclude with a call for actions that are essential for enabling all children to begin life with improved prospects for health, prosperity, and equality, essential to achieve the SDGs in "strengthened global solidarity".

Millions of young children are at risk of falling behind

> "There can be no equality of opportunity without… appropriate stimulation, nurturing, and nutrition for infants and young children. Conditions of poverty, toxic stress and conflict will have produced such damage that they may never be able to make the best of any future opportunities. If your brain won't let you learn and adapt in a fast changing world, you won't prosper and, neither will society."
>
> *World Bank Group President Jim Yong Kim, Oct 1, 2015*

250 million children (43%) younger than 5 years in LMICs are estimated to be at elevated risk of not achieving their human potential because of stunting or exposure to extreme poverty.[5] Increasing numbers of children, including in high-income countries (HICs), are surviving but begin life at a disadvantage because they do not receive the nurturing care necessary for their physical and psychological development. Little is yet being done during the essential first years of life when the effects of risk, and also plasticity, are greatest—a crucial gap in interventions to accelerate improvements in children's early development at scale.

To test potential underestimation of this burden, we explored the implications of additional risks to children's development beyond poverty and stunting by conducting an illustrative analysis from 15 countries with available Multiple Indicator Cluster Surveys in 2010 or 2011 to examine risks posed by adding low maternal schooling (completed primary school only) and child maltreatment (severe punishment of children aged 2–5 years, such as hitting a child as hard as possible, or with a belt or stick). The estimated proportion of children at risk of stunting or extreme poverty in these 15 countries increases substantially from 62·7% (95% CI 62·0–63·4) to 75% (75·0–76·0) when low maternal schooling and child maltreatment are added, with large disparities among subnational social and economic groups (appendix pp 1–6).

In addition to these risks, millions of children globally are exposed to armed conflict and community unrest.[14] Furthermore, millions more are living with disabilities, or with displaced or immigrant families,[15] parents living with HIV, or mothers who are depressed.[16,17]

To redress these challenges to child development, countries worldwide must scale up systemic actions to promote, protect, and support early childhood development, ensuring that the most vulnerable children and families are reached.

A multi-sectoral framework to promote the development of young children across the life course

Child development is part of the life course, including preconceptual health and wellbeing of adolescents and continuing into the next generation of young people who grow up and become parents. Promotion of health and wellbeing across the life course requires interventions through services and programmes of several sectors, most notably health and nutrition, education, and child and social protection, in the context of a supportive environment of policies, cross-sectoral coordination, and financing. These multiple inputs create a framework within which actions to promote early childhood development can be initiated and expanded (figure 1).

At the heart of this framework is the nurturing care of young children, provided by parents, families, and other caregivers. Nurturing care, defined in Paper 1 of this Series, comprises caregiver sensitivity to children's physical and emotional needs, protection from harm, provision of opportunities for exploration and learning, and interactions with young children that are responsive, emotionally engaging, and cognitively stimulating.[5]

The second paper of this Series concludes that a range of interventions delivered from preconception, through pregnancy and birth, the newborn period, infancy, and early childhood can support nurturing care and have

proven benefits for child development, including for health, growth, and learning (panel 1). These interventions are delivered ideally through the coordinated services of several sectors.[6] Many of these interventions also have benefits for survival and prevention of morbidities and, in some cases, disabilities.

We focus on parenting programmes to promote nurturing care, of which among the most widely implemented in LMIC settings are the WHO–UNICEF Care for Child Development (CCD)[18] and Reach Up and Learn, a parent support programme tested in trials in Jamaica during the past 20 years, which is now expanding to other regions. CCD originated as a module of Integrated Management of Childhood Illness, and can be delivered by home visitors and community workers as well as facility-based providers through various health, education, family, and social protection services (panel 1).[19] Early field testing demonstrated the ability of health workers to implement the counselling sessions while also attending to tasks of sick child consultation, as well as mothers' recall and ability to perform the recommended activities at home. Findings from several trials[19–21] have shown improvements in home environment and children's development with CCD, suggesting that the programme can be incorporated into existing health services at relatively low cost.[22] CCD has been integrated into programmes across various sectors, including child survival and health, nutrition rehabilitation, early learning (infant day care and preschool education), social protection (families participating in a cash transfer programme, prevention of violence and abuse), mental health, and services for families with developmentally disabled children (appendix pp 7–14). The time is ripe for the scale-up of interventions like CCD.

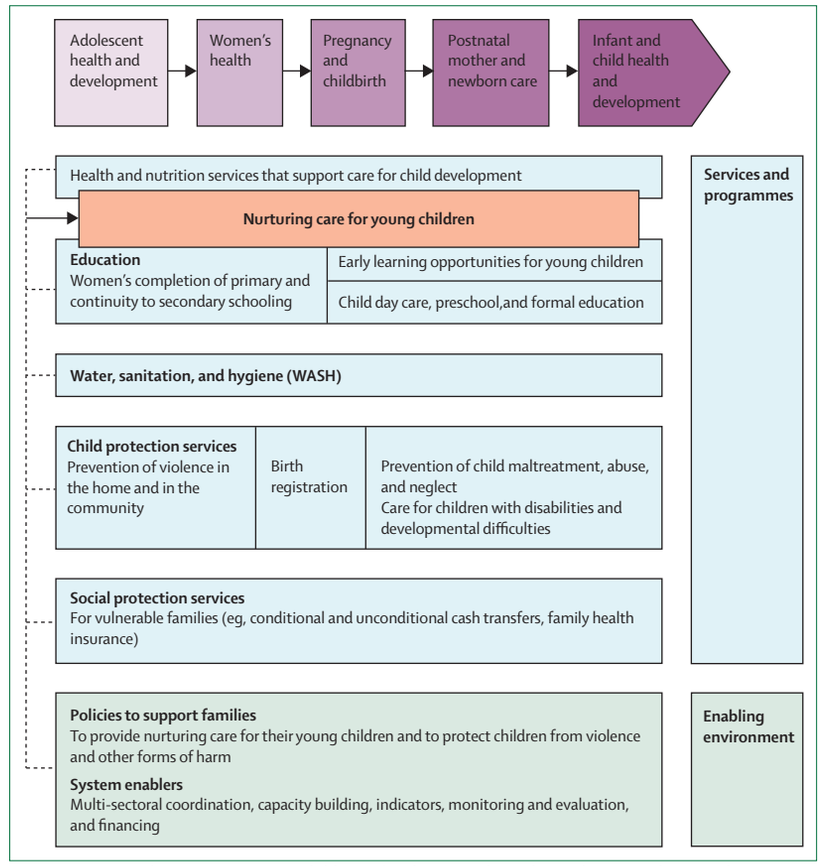

Figure 1: **Framework to promote young children's development through a multi-sectoral approach.**

Essential elements to accelerate scale-up of programmes for early childhood development

Overview

We identify several elements critical to scale up programmes,[23,24] including political prioritisation, implementation of policies that enable families to provide young children with nurturing care, delivery systems through which effective interventions can be scaled feasibly, governance structures to ensure that young children's holistic needs are addressed, and affordability.

Political prioritisation of early childhood development and financing

Many HICs have long-running, large-scale programmes for early childhood development that are led and financed by government. We reviewed ten programmes in English-speaking countries identified as successful examples of partnerships involving multiple stakeholders from different sectors working together to improve children's health and development (appendix pp 15–31).[25] These programmes include Early Head Start in the USA and Sure Start in the UK.

We also analysed scaled up programmes for early childhood development in three LMICs and one HIC. These countries were selected to exemplify variation in aims, entry points, governance, and coordination (panel 2; appendix pp 32–47). Chile, India, and South Africa demonstrate commitment by governments to scale up interventions through legislation and financing, with achievement of universal coverage in Chile and South Africa. Bangladesh demonstrates government and civil society partnership to assist families with children who have developmental difficulties.

Programmes for early childhood development everywhere are challenged by inadequate and uncertain funding, and inefficient flows of resources across sectors and from central to local levels of government. Management and monitoring, including the documentation of successes and learning from mis-steps, and numbers of trained staff are insufficient. Programmes struggle to achieve uniform quality and to demonstrate impact on child development outcomes across all implementation contexts through carefully designed evaluations, true also of programmes in HICs.[26]

For the **Reach Up and Learn programme** see http://www.reachupandlearn.com

Panel 1: **Examples of interventions known to effectively improve early childhood development**

Interventions

- Iodine supplementation before or during pregnancy
- Antenatal corticosteroids for women at risk of preterm birth
- Magnesium sulphate for women at risk of preterm birth
- Antiplatelet agents for women at risk of pre-eclampsia
- Delayed cord clamping[5]
- Therapeutic hypothermia for hypoxic ischaemic encephalopathy
- Kangaroo Mother Care for small infants (eg, birthweight <2000 g)
- Breastfeeding and complementary feeding promotion, education, and support
- Responsive caregiving with simulation and early learning opportunities
- Iron and multiple micronutrient supplementation for infants and children
- Deworming
- Treatment of moderate and severe acute malnutrition
- Interventions for common (parental) mental disorders including in the perinatal period
- Smoking cessation interventions
- Elimination of environmental toxins (eg, lead, mercury, pesticides)
- Parent support programmes
- Early childhood care and education

Examples of supportive policy environment

- Paid parental leave and paid sick leave to enable parents to provide care
- Breastfeeding breaks at work
- Paid sick leave to enable parents to provide nurturing care
- Minimum wage sufficient to lift families out of poverty
- Tuition-free pre-primary education
- Poverty alleviation strategies

The interventions are further reviewed by Britto and colleagues in Paper 2 of this Series.[6]

Involvement and mobilisation of parents, families, and communities—important drivers of demand for access and quality—has been insufficient, and although there are signs that demand for quality preschools is increasing in LMICs,[27] demand for services for young children aged 0–3 years must be encouraged.[28]

Our analysis of these country programmes illustrates the importance of political prioritisation, legislation, and policy, and the use of existing systems and financing in scale-up.[29] The typical successfully scaled up programme for early childhood development is motivated by political concerns about social inequality, poverty, and social exclusion; informed by local and global scientific and economic evidence; has a vision of comprehensive and integrated services for children and families that is informed by whole-of-government and joined-up thinking; founded by statute or formally communicated government strategy; funded by government; and led by a government department or agency working collaboratively with other departments and civil society organisations, in many cases reporting to a senior executive political body such as the Cabinet or Council of Ministers. The importance of political prioritisation has also been shown for programmes to improve nutrition, breastfeeding, and newborn health (appendix pp 15–31).[23,30–32]

Creation of a policy environment that supports nurturing care of young children

Laws and policies can improve child development by increasing access and quality of health and other services, as well as money and time for parents to provide nurturing care for their young children. We examine a subsection of policies that are core to social determinants of health: family income and time for working parents to devote to their children, as well as access to free pre-primary education. Access varies by rural and urban areas and other parameters. For illustrative purposes, we discuss five transformative policies for which there are robust global data on levels, duration, country coverage, and progress achieved in the past two decades (table 1). A breakdown of access to these policies by country income level is included in the appendix (pp 48–58). Global data for important policy areas are still lacking, for example, those regarding child day care for working parents. Discrepancies between policy adoption and implementation must also be addressed, in addition to the wide disparities in benefits between caregivers engaged in formal and informal work. Nonetheless, policies and laws have an enabling effect even at less-than-complete levels of implementation (appendix pp 48–58, figure 2).

Delivery systems for scaling up of evidence-based interventions for early childhood development

Many efforts to promote early childhood development are dependent on non-governmental services,[5] which are frequently limited in scope and inequitable in coverage.[48] Interventions are also dependent on skilled human resources and (unless built on existing service systems such as health, education, and social and child protection) face severe supply-side constraints. The case studies (panel 2) illustrate that national scale-up of programmes for early childhood development can be achieved by building on existing systems.

The importance of this approach is exemplified by the rapid scale-up between 2000 and 2009 of more than 120 cash transfer programmes in LMICs, growing from 28·3 million beneficiaries in 2001 to 129·4 million in 2010 (appendix pp 59–70). Lessons learned are that the main drivers of expansion of cash transfer programmes included political commitment and popularity, operational ease, advances in information technology and banking, rigorous evidence that they are effective, and support from international organisations. Colombia, Ecuador, and Mexico have built programmes for early childhood development onto existing cash transfer programmes.[49–51]

Given the extensive benefits of health and nutrition interventions on children's development,[6] and opportunities for the health sector to reach young children and their families during pregnancy and the first years of a child's life,[52] we propose that existing

Panel 2: **Examples of scaled-up programmes for early childhood development**

Chile Crece Contigo (ChCC): multisectoral services for early childhood development delivered through government and non-governmental programmes

Chile has a scaled-up system of early childhood development provision guaranteed by law and fully funded by government (appendix pp 33–35). Initiated in 2007, the ChCC provides universal and targeted interventions for early childhood development from gestation to age 4 years in all 345 municipalities. With strong support from political leadership, the Ministry of Social Development coordinates with the Ministries of Health and Education. ChCC's point of entry is prenatal care in public hospitals and currently reaches about 80% of the target population of pregnant women and their unborn children. The Biopsychosocial Development Support Programme includes access to maternal–child primary health care, screening, and referrals for children with developmental delays, and care for children admitted to hospital. ChCC ensures that children younger than 4 years living in a family with risk factors for poor early development also have access to age-appropriate stimulation and education from nursery school to preschool, and that their families are referred to additional social protection services including cash transfers and home visits. ChCC offers high-quality information about early childhood development to families and providers through a radio show and its website.

India's Integrated Child Development Services (ICDS): one of the earliest and the world's largest early childhood development programme

ICDS is the world's largest community-based outreach programme to promote the early development of children from economically disadvantaged backgrounds (appendix pp 36–39). The nationwide programme, launched in 1975 and funded by the government, aims to deal with high rates of child mortality, malnutrition, and poor learning outcomes. It provides a package of services (medical checks, immunisations, referral services, supplementary feeding, preschool education, and health and nutrition education for adolescent girls and mothers) through a network of 1·4 million Anganwadi (courtyard) centres and workers. In 2014, the scheme served 104·5 million beneficiaries, including 46·7 million children between birth and 3 years, 38·2 million children between 3–6 years, and 19·6 million pregnant and lactating women. Many different government departments and programmes are involved, led at the central level by the Ministry of Women and Child Development. Although the government committed to universalising ICDS for all eligible beneficiaries in 1995, the political will to truly expand and enhance the programme has only been evident in recent years and the programme continues to be under-resourced. ICDS was restructured in 2013–14 to shift focus on children younger than 3 years of age, convert Anganwadi into Early Childhood Development Centres, strengthen the early childhood stimulation and early learning components, improve infrastructure, and allow flexibility in implementation.

Grade R in South Africa: a universal school preparatory year provided through public education and non-governmental community programmes

A comprehensive early childhood development programme to address inequalities arising from racist policies was envisioned by anti-apartheid activists working to prepare for a post-democratic education system (appendix pp 40–43). Since then, commitment to address poverty and inequality from the beginning of a child's life has been reiterated by government and backed by civil society. A preschool or reception year was planned as part of the programme, and a pilot programme implemented in 1997; Grade R was introduced nationally in 2005. 10 years later, some 80% of children aged 4·5–6 years attend a free preschool class (Grade R), most attached to public primary schools but also at some accredited, government-funded, community-based crèches. The highest uptake has occurred in the poorest areas of the country as parents take advantage of low-cost and safe child day care, a school lunch programme, and the expectation that their children will be better prepared for formal schooling. Grade R is built on the education system, including teacher training, management, financing, monitoring, and quality control. School health services are provided, including disability screening. The programme as a whole is coordinated by an inter-departmental steering committee led by the Minister of Social Development, who reports to the Cabinet. Under the new South African National Early Childhood Development Policy, a pre-Grade R class (starting at age 3·5 years) is planned, as is a re-invigorated programme aimed from pregnancy to age 3·5 years to promote maternal wellbeing and early childhood development through the health sector.

Bangladesh's child development centres (Shishu Bikash Kendra [SBK]): a public–private partnership to support young children with disabilities and their families

A public–private partnership, funded through a combination of government and development resources, was established in 2008 to ensure early screening, assessment, intervention, treatment, and management of the entire range of developmental delays, disorders, impairments, and disabilities (appendix pp 44–47). The Dhaka Shishu Hospital and the government's Health, Population, and Nutrition Sector Development Programme have established child and family-friendly SBK centres within key public hospitals across the country. Core teams of multidisciplinary professionals (child health physicians, child psychologists, and developmental therapists) have been trained to provide services, including psychosocial services, to families and to empower parents and primary care providers to optimise their child's development.

(Continues on next page)

(Panel 2 continued from previous page)

Multidisciplinary SBKs provide a range of free services to poor families in 15 tertiary government hospitals, extended recently to eight semi-government and private hospitals to meet the needs of relatively high-income urban families. Services are anchored in paediatric outpatient departments to reach at-risk children from birth through adolescence, to facilitate linkages with other relevant clinical departments, and to build the competence of undergraduate and postgraduate medical students. A partner non-governmental organisation for developmentally disabled children has established early mother–child intervention programmes and inclusive schools offering school meals adjacent to several of the SBKs where children are referred for education and rehabilitation. Between 2009 and 2016 there were more than 200 000 child visits to the 15 government hospital SBKs, with up to three-quarters of children showing neurodevelopmental improvement on follow-up.

RMNCH services are important entry points for early childhood development interventions.[53]

Many existing programmes for early childhood development are built on health services, and 11 of 15 such programmes identified by Engle and colleagues[3] showed positive effects. There are several other country reports of the feasibility of building activities for early childhood development into health and nutrition services,[54] and an inventory of CCD implementation illustrates integration into health services in a range of countries (appendix pp 7–14).

We identified multiple opportunities in health and nutrition services into which interventions to promote nurturing care and improve child developmental outcomes have been feasibly and effectively incorporated (panel 3; appendix pp 71–76). These interventions can be provided by non-specialist trained providers within primary health care and community services.

Opportunities also exist in other sectors, which is important for the continuity of support from early childhood into schooling. For example, in the education sector, child development can be supported through various early learning opportunities, including early child day care,[67,68] preschools, and parent education.[59,69] Interventions can also be provided through child and social protection services, including cash transfer programmes.[70,71]

To effectively integrate interventions into existing services, a systematic approach is required to prepare the system. This approach involves learning about implementation in a scalable unit such as a district, and testing and further refining the approach in different settings before scaling up. National and local institutions must be strengthened to ensure that staff have adequate competencies to deliver the services with high quality and that there is community demand for services. The approach requires systems investments that align with the principles of universal coverage.[72,73]

Governance of multisectoral coordination and monitoring to deliver quality services equitably

Responsibility for multisectoral coordination typically lies with a senior lead government department or agency working collaboratively with other departments and civil society organisations, usually reporting to the Cabinet or other senior government executive. However, there is no established precedent for how to organise governance of programmes for early childhood development; there are multiple potential entry points and several models of coordination are in place. Sectors can serve children and families independently under a structure for sharing responsibility (eg, China, Cameroon), with so-called zones of convergence that are nationally planned, provincially guided, and flexibly adapted at a local level.[74] Coordination can also be organised under a single ministry, in collaboration with other sectors, for example through a multisectoral committee (eg, South Africa, India, Bangladesh [panel 2], Jamaica, Brazil).[75] A third approach is coordination through a high-level central council or similar body (eg, Colombia,[74] Chile [panel 2],[76] Ghana, Rwanda).[75]

Affordability

To assess the affordability of incorporating interventions to promote early childhood development into existing health and nutrition services, we estimated the additional costs of two interventions aimed at supporting nurturing care of children. The first is based on CCD and the second on support for maternal depression, based on the WHO Thinking Healthy package, because it bolsters nurturing care.[77] We selected these two interventions because they are well defined, have proved effective, and have sufficient available data about their costs for a simulation.

We modelled the effects of expanded coverage for these two interventions towards universal coverage by 2030. We used an integrated approach to estimate the use of existing services and systems, and the health worker requirements to scale up these services (appendix pp 77–86). The analysis covered 73 high-burden countries, and two scale-up scenarios (medium and high) compared with a scenario of maintained current coverage (low). The high scale-up scenario would attain 98% coverage by 2030 among all parents in these countries, whereas the medium scale-up projection would lead to, on average, 58% coverage. Resource needs were modelled by country and year (2016–30), with inputs based on WHO recommended practices and applying country-specific price data.

Table 2 shows that the additional investment for attaining the high coverage scenario over the next 15 years would total US$34 billion for both interventions. The average

	Benefits	Progress*	Gaps
Paid parental leave for new mothers and fathers	Paid maternity leave is associated with multiple health benefits for children. It can support bonding between mother and child, increase initiation and duration of breastfeeding, and improve the likelihood of infants being vaccinated and receiving preventive care.[33,34] New fathers are more involved with their young children when they take leave from work and they take on more child-care responsibilities after the leave ends[35]	Since 1995, eight countries have enacted paid maternal leave, 55 approved an increase in leave duration, and 21 increased their wage replacement rates. The proportion of countries across all income groups offering full pay or close to it grew from 66% in 1995 to 73% in 2014. Today in all but eight of 193 UN countries, paid maternal leave is guaranteed and most countries provide at least 12 weeks of leave, paying at least two-thirds of workers' wages. More than three-quarters of countries with paid maternal leave guarantee between 85% and 100% of wages for all or part of the leave period through some combination of employer, employee, and government contributions	Paid parental leave covers the informal sector in some countries but not in all. Although 49% of countries encourage men to participate in caregiving by making leave available to both mothers and fathers, only 40% of countries provide paid leave specifically designated for fathers, and only one in five of these provide it for more than 2 weeks, far shorter than for mothers
Breastfeeding breaks at work	Breastfeeding has substantial benefits for maternal and child health and development. It significantly reduces risks of infant mortality, diarrhoeal disease, respiratory illness, malnutrition, and chronic diseases, and improves neurocognitive development.[36] The guarantee of paid breastfeeding breaks is associated with increased rates of exclusive breastfeeding[37]	In the past 20 years, the global share of countries that have laws providing for breastfeeding breaks increased from 63% to 72%, which in the vast majority of cases is paid. South Asia and the Middle East and north Africa have shown the largest increases (>15%) between 1995 and 2014. 72% of countries guarantee breastfeeding breaks for at least the 6 months WHO recommends for exclusive breastfeeding. In 22% of countries both paid breastfeeding breaks and paid maternal leave are guaranteed for this period[38]	Access to breaks for breastfeeding is variable in the informal sector and many women are unable to breastfeed in formal jobs if a location for pumping and refrigeration of breastmilk is unavailable or child care is far from work
Paid leave for child health care	The ability to take leave to care for children's health is crucial to nurturing care for young children[39]	45% of countries provide paid leave for mothers or fathers that could be used to tend to children's health needs, 10% provide unpaid leave, and 3% provide paid leave but only to mothers	Large gaps remain because 42% of countries still do not guarantee leave, paid or unpaid, to address children's health needs, and parents in the informal economy have no provision
Income support—minimum wage	When parents are not able to earn adequate income, children's basic needs, including health care and education, cannot be met and early childhood development suffers. Policies that support poverty-reducing growth have a crucial part to play in reducing the number of young children raised in poverty.[40] Although the evidence is somewhat mixed, an adequate increase in minimum wages has the potential to improve the lives of millions of children whose parents work in the formal economy.[41,42] Minimum wages might also raise earnings of workers in the informal economy[43]	As a means to lift workers out of poverty, minimum wage policies are in place in 88% of countries. Unemployment insurance is a crucial safety net for families when they face individual work disruption and during national economic downturns	Although in 41% of countries a minimum wage of more than purchasing power parity-adjusted US$10 per day is mandated, many countries still do not guarantee an income that is above the international poverty level of $2 per day per person for a parent supporting a child; 12% of countries have not set an official minimum wage level, and in many countries (55%) the growth in minimum wage lags behind the growth of gross domestic product (figure 2). Although 90% of countries provide income protection during unemployment, the informal economy is mostly not covered
Tuition-free pre-primary education	Developmentally appropriate early education is crucial to child cognitive development, ensuring future successful learning experiences in diverse contexts.[44] It is important for children across all demographic groups to have access to tuition-free primary school. The estimated benefit-to-cost ratio for investments targeted at increasing preschool attendance in low-income and middle-income countries ranges from 6·4:1 to 17·6:1[3]	Primary school is prioritised globally and there is significant progress toward universalisation, but there are marked disparities in pre-primary educational preparation: only 43% of countries with available policy data provide at least 1 year of tuition-free pre-primary education. Of these, only 4% are low income (figure 2). The average gross enrolment rate is 34 points greater for countries with free pre-primary education (80%) compared with countries where it is neither tuition-free nor compulsory (46%)	Free pre-primary education is not available even in many high-income countries. In 40% of high-income countries and in 57% of middle-income countries, free pre-primary education is not available. Only 9% of countries in sub-Saharan Africa, 19% of countries in east Asia and the Pacific, and 20% of countries in the Middle East and north Africa offer at least one free pre-primary year. Only 25% of countries provide the recommended 2 years of tuition-free pre-primary education,[45] most of which are middle-income and high-income countries (92%), mostly located in Europe and central Asia or Latin America and the Caribbean

*Sample size varies based on the availability of globally comparative data. The sample size for paid leave for mothers and fathers of infants is 193 countries; for breastfeeding breaks is 192 countries; for paid leave for child health care is 185 countries; for minimum wage policies is 177 countries; for income support during unemployment is 182 countries; and for tuition-free pre-primary education policies is 163 countries. For further details and to download the original dataset, please visit www.worldpolicycenter.org.

Table 1: **Policies to support parental income and nurturing care needed to promote early childhood development**

additional investment needed for the supply side of the health system is half a dollar per capita in the year 2030, ranging from US$0·20 in low-income countries (which have lower prices than in high-income countries) to $0·70 in upper-middle-income countries per year. In the medium coverage scenario, the additional cumulative total investment needed for the intervention is estimated at $16 billion, equivalent to $0·20 per person per year. For both interventions, service delivery costs through primary care are the main cost driver at 83% of cost, followed by 15% for training and communication or media, and 2% for commodities to support maternal depression interventions.

An average half a dollar per person, per year represents an additional 10% over previously published estimates for a comprehensive set of RMNCH services.[7,8] Current empirical evidence and these modelled data suggest that interventions to promote nurturing care can be added to existing platforms for health delivery at little additional cost. Given the large number of assumptions used in our model (appendix pp 77–86), our cost

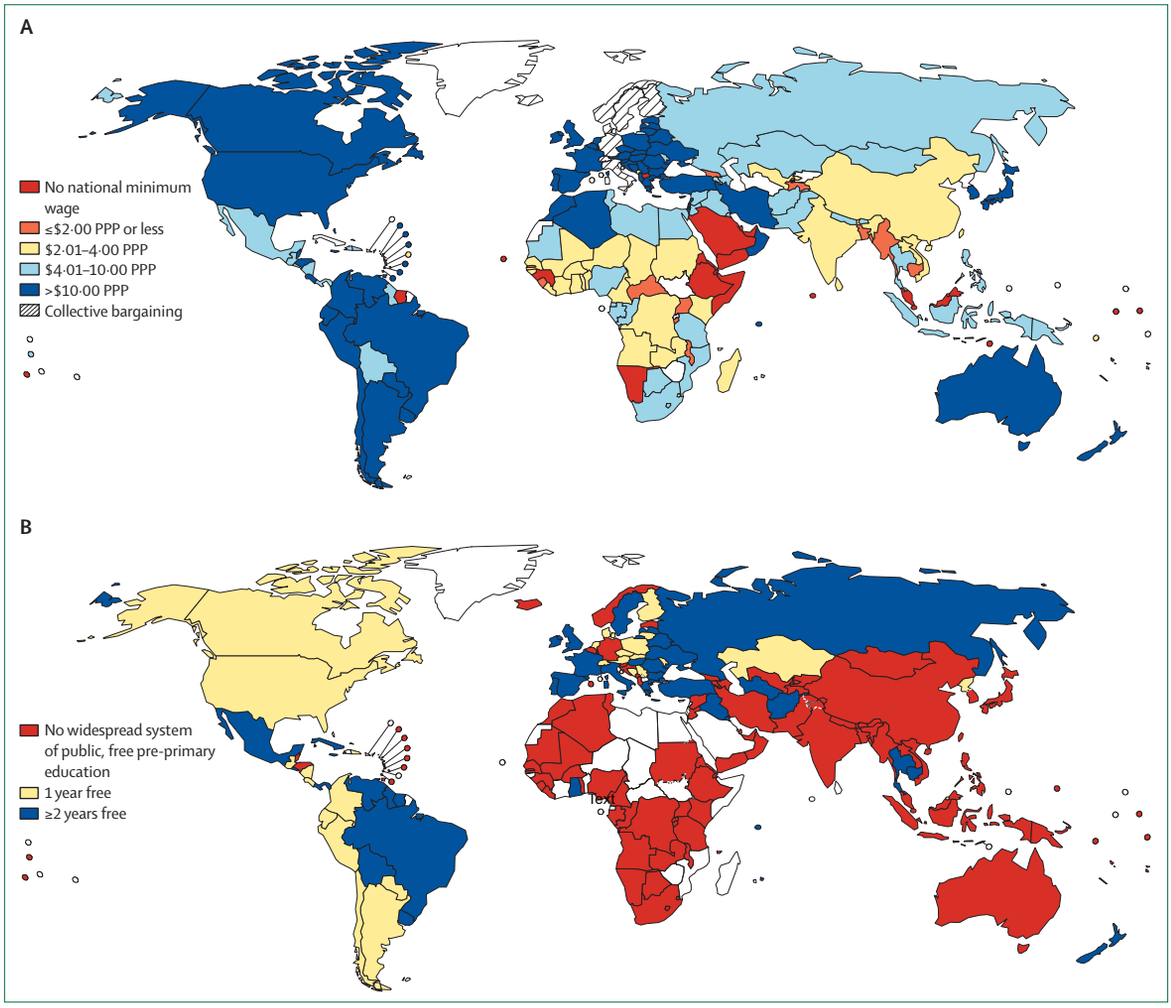

Figure 2: **Global provision of minimum wage (A) and free pre-primary education (B) in 2012**
Figures prepared using data from the WORLD Policy Analysis Center: Public Use Data on Poverty (appendix pp 48–58).[46] PPP denotes the amount of money required to purchase the same bundle of goods and services across countries. For international comparability, minimum wages established by law are converted to daily rates and adjusted using the PPP. Pre-primary education is defined as ISCED-0, educational early childhood services and programmes attended by children from the age of three up to the age of entry into primary school.[47] PPP=purchasing power parity.

estimates should be interpreted as indicative. Although data for the cost-effectiveness of nurturing care interventions are scarce,[79] available evidence suggests that implementation of these interventions represents value for money. More data are needed about the coverage and benefits of interventions to improve nurturing care using a lifetime perspective of their effects on health, wellbeing, and adult productivity and income, especially from LMICs.

The personal and societal costs of inaction

Interventions to integrate and promote child development within RMNCH services are feasible (panel 3) and affordable (table 2). In this section, we demonstrate that the costs of not acting immediately to expand services to improve early childhood development are high for individuals and their families, as well as for societies.

To estimate the lifelong disadvantage for individuals of global inaction, we updated the average percentage loss of adult income per child at risk of suboptimal development (estimated in 2007),[2] and incorporated additional data about associations between schooling and adult income.[80,81] For the 43% of children estimated to be at risk of poor development due to extreme poverty and stunting, their average percentage loss of adult income per year is likely to be 26% with uncertainty levels between 8% and 44% (appendix pp 87–89), exerting a strong downward economic pull and trapping families in poverty.

To estimate societal costs, we simulated illustrative costs of inaction (ie, the net benefits forgone that depend on both benefit–cost ratios and the extent of undercoverage) of not intervening to improve early healthy development. The costs of inaction are not a substitute for benefit–cost ratios for marginal decisions. The simulations were made

Panel 3: Evidence of effective inclusion of early childhood development interventions in health and nutrition services

Hospital inpatient care

- Kangaroo Mother Care for preterm and small-for-gestational-age (SGA) babies has been found to contribute to reduced risk of infections and improved breastfeeding and growth, maternal–infant bonding and maternal confidence, survival,[55] and cerebral motor function during adolescence.[56]

Follow-up after discharge

- Post-hospital discharge follow-up of preterm infants, including early stimulation, is associated with improved infant motor development and infant intelligence quotient, persisting into preschool age.[57]

Maternal and child primary care services, including antenatal, childbirth, and postnatal care, as well as sick and well child visits

- Maternal care, including promotion of breastfeeding antenatally and optimising maternal nutrition and care reduces SGA.[58]
- A parenting intervention integrated into primary care visits in three Caribbean countries improved parenting knowledge and child cognitive development.[59]
- Care for Child Development (CCD) as part of sick child consultations in health facilities in Turkey resulted in home environments with increased learning opportunities at 1 month follow-up.[20]
- CCD delivered as part of well child visits in health facilities in China resulted in higher cognitive, social, and linguistic scores 6 months after intervention.[21]
- A home stimulation programme for caregivers to implement with their HIV-infected children was supervised during regular 3-monthly clinic visits in South Africa, which resulted in significantly higher cognitive scores at 12 months.[60]
- Developmental monitoring of children in primary health-care services has been found to be an effective, family-centred strategy to identify children with developmental difficulties or delays, parent education and support, and timely referral to other services for further assessment and early interventions.[61]

Home visiting services, community groups, and community outreach

- A meta-analysis of perinatal interventions for maternal mental health done through home visits found maternal benefits in addition to, when measured, improved child cognitive development, growth, and immunisation.[62]
- Children who participated with their mothers in CCD play groups, led by lady health workers in Pakistan (and reinforced by home visits), showed higher developmental outcomes and had fewer episodes of illness than the controls; and their mothers showed a reduction in maternal depression, compared with children who did not participate.[19]
- Home-based early stimulation and support integrated into primary care visits in Jamaica improved parenting knowledge and child cognitive development.[59]
- Group-based, peer-mediated parent training for caregivers of children with developmental disorders in Pakistan led to improvement in children's disability and socioemotional difficulties, reduction in stigmatising experiences, and enhanced family empowerment to seek services and community resources for the child.[63]

Nutrition interventions to prevent and treat under-nutrition

- Child stimulation, delivered together with food supplementation, enabled malnourished children in Jamaica to achieve developmental scores similar to those of non-malnourished children, and enhanced their educational attainment and economic productivity compared with untreated malnourished children.[64,65]
- Several trials examining potential synergies between nutrition and early child stimulation interventions have shown mixed results.[19,54] Findings from a systematic review[66] suggested that nutritional interventions benefit nutritional and sometimes developmental status, stimulation interventions consistently benefit child development, but not nutrition, and too few studies to date have examined synergies to draw conclusions.[66]

for selected developing countries with sufficient data under strong assumptions and limitations, and we provide sensitivity analysis for alternative values of the key underlying benefit–cost ratios (appendix pp 94–119). Some costs of inaction are apparent in infancy, and others emerge in later childhood, but many effects are not fully manifested until adulthood. Median benefit–cost ratios have been estimated by others to be roughly 18:1 for stunting reduction,[82] 4:1 for preschool education, and 3:1 for home visits for children with signs of language delay,[12] making them good investments.

We computed the aggregate costs of inaction and their standard errors from available data for not reducing stunting to 15% prevalence (table 3)[83] and not improving child development through universal preschool coverage and home visits for children with scores of 2 SD or more below the mean on a language development test (table 4).[84] For both scenarios, we adopted a 3% discount rate and a 30 year time horizon in the labour market. We calculated the costs of inaction as a percentage of gross domestic product (GDP) and for comparison also provide annual country expenditure on health (for stunting) and education (for preschool and home visit coverage) as percentages of GDP.

The costs of inaction as a percentage of GDP are given with their standard errors, calculated with several assumptions (appendix pp 94–119), including that estimates of costs and impacts based on small studies, not nationwide interventions, can be scaled up without reducing benefit–cost ratios substantially. Simulations of

	Country category	Number	High prevalence scenario		Medium prevalence scenario	
			Additional costs compared with low scenario (total 2016–30), billion US$	Additional per-person costs compared to low scenario (year 2030)	Additional costs compared with low scenario (total 2016–30), billion US$	Additional per-person costs compared to low scenario (year 2030)
Nuturing care and support for maternal depression combined	Upper middle income	11	17·3	0·7	8·5	0·3
	Lower middle income	32	15·5	0·4	6·6	0·15
	Low income	30	1·6	0·2	0·9	0·1
	Total	73	34·46	0·46	16·0	0·21
Nuturing care only	Upper middle income	11	8·0	0·3	4·1	0·2
	Lower middle income	32	7·4	0·2	3·4	0·1
	Low income	30	0·7	0·1	0·4	0·0
	Total	73	16·10	0·22	8·00	0·11

Table shows estimates for scaling up of nurturing care for children and support for maternal depression in 73 countries, in 2011 US dollars (appendix pp 77–86).

Table 2: **Affordability calculated as additional estimated costs for scaling up support**

	Costs of inaction as proportion of GDP (SE)	Total governmental expenditure on health as proportion of GDP
Bangladesh	5·6% (1·82)	3·7%
Democratic Republic of the Congo	2·5% (0·86)	3·5%
Ethiopia	7·9% (2·57)	5·1%
India	8·3% (2·65)	4·0%
Kenya	5·4% (1·75)	4·5%
Madagascar	12·7% (4·17)	4·2%
Nepal	3·4% (1·12)	6·0%
Nigeria	3·0% (0·96)	3·9%
Pakistan	8·2% (2·65)	2·8%
Tanzania	11·1% (3·59)	7·3%
Uganda	7·3% (2·37)	9·8%

Table shows estimates based on seven sub-Saharan African and four south Asian high-prevalence countries with sufficient data. GDP=gross domestic product. SE=standard error.

Table 3: **Costs of inaction for not reducing stunting to 15% prevalence**

	Cost of inaction as a proportion of GDP (SE)		Total governmental expenditure on education as total proportion of GDP
	Home visits	Preschool	
Guatemala	1·4% (0·96)	3·6% (0·94)	2·8%
Nicaragua	2·1% (1·38)	4·1% (1·08)	..
Colombia	0·2% (0·14)	0·9% (0·24)	4·9%
Peru	0·1% (0·11)	0·4% (0·12)	3·3%
Ecuador	0·3% (0·21)	0·2% (0·05)	4·2%
Chile	0·05% (0·02)	0·3% (0·07)	4·6%

Table shows estimates for identified children in six Latin American countries with sufficient data. GDP=gross domestic product. SE=standard error.

Table 4: **Costs of inaction of not improving child development through universal preschool and home visits**

how costs of inaction change with different benefit–cost ratios are provided in the appendix (pp 94–105). There are also considerable challenges in estimating impacts, particularly those that occur after substantial lags. Further, the estimates are context-specific and contexts are likely to vary importantly (eg, with regard to prices, resources, preferences, or macroeconomic conditions) across countries and over time. Our assumption is that, in the future, contexts will yield about the same returns to reducing stunting as found in the past. Finally, our estimates do not adjust for possible general equilibrium effects on returns to more skilled workers, which might work in either direction depending on the induced shifts in supplies of and demands for such workers.

Total government health expenditure covers the provision of health services (preventive and curative), family planning activities, nutrition activities, and emergency aid designated for health, but does not include provision of water and sanitation or the private cost of time in health-enhancing activities (appendix p 97). The costs of inaction as a percentage share of GDP do not change if both the numerator and denominator are adjusted for general price movements between 2011 and 2013 (appendix pp 94–119).

The costs of inaction as a percentage of GDP are given with their standard errors calculated on the basis of the underlying estimates (appendix pp 94–119), described above. General governmental expenditure in 2013 on education (current, capital, and transfers) includes expenditure funded by transfers from international sources to governments.[85]

Given our assumptions, the costs of inaction for stunting in high prevalence countries are large. For instance, India is experiencing costs of inaction twice what it currently spends on health by not taking action to reduce stunting from 48% to 15%. These costs are

	Contribution of improved early childhood development to achieve the goal
Goal 1: eradicate poverty	Early childhood development interventions increase adult productivity and income, and reduce inequities[65]
Goal 2: end hunger and improve nutrition	Interventions to promote nurturing care help to improve young children's growth and development[91]
Goal 3: ensure healthy lives	Supporting early childhood development increases quality of home care practices, protects against stress, increases timely care seeking for childhood illness, and reduces risks of chronic disease and mental ill health in adulthood[92]
Goal 4: ensure lifelong learning	Early stimulation increases duration of schooling, school performance, and adult income[65,81,82]
Goal 5: achieve gender equality	Early childhood development interventions improve opportunities and motivation for learning, particularly for girls, so that boys and girls can benefit equally from schooling and enter the job market[93]
Goal 10: reduce inequality in and among countries	Early childhood stimulation and food supplementation interventions enable children with low birthweight or stunting, or living in extreme poverty, to attain developmental outcomes similar to their peers[3,44,64]
Goal 16: promote peaceful societies	Children who are well nourished, healthy, and secure have improved coping strategies, even in conditions of adversity[94]
Goal 17: strengthen the means of implementation	Early childhood development interventions have the potential to strengthen coordination across sectors for common health, social, and economic goals, and to bring together international, governmental, and civil society partners (panel 2)

SDG=Sustainable Development Goal.

Table 5: **Investing in early childhood development is essential for attainment of the SDGs**

considerable: $176·8 billion (95% CI 100·9–262·6) per birth cohort at nominal exchange rates; and $616·5 billion (365·3–898·9) at exchange rates adjusted for purchasing power parity.[86]

The costs of inaction for not improving child development through preschool education are lower than for stunting, because of fairly good access to preschools in these countries (table 4; appendix pp 106–119). However, the costs of inaction for not improving child development through preschool and home visits rise sharply in settings with few preschool services, as is the case in Guatemala (35% of children in preschool) and Nicaragua (40% of children in preschool), in addition to settings with high prevalence of children at risk of poor development, which is anticipated for many countries in south Asia and sub-Saharan Africa.

Although the uncertainty is fairly large, as reflected in the standard errors, the simulated means seem to be considerably different from zero for both stunting and preschool interventions. For home visits, the simulated means are relatively high, in particular for Guatemala and Nicaragua, but with a large amount of uncertainty.

Pathways to scaling

> "The Sustainable Development Goals recognise that early childhood development can help drive the transformation we hope to achieve over the next 15 years."
>
> *UN Secretary-General Ban Ki-moon, Sept 22, 2015.*

In line with global strategies and action frameworks that support the SDGs,[87,88] we suggest five actions to accelerate global scale-up of early childhood development across multiple sectors that reach the most disadvantaged children.

Expand political will and funding through advocacy for the SDGs

The SDGs call for equitable opportunities for people everywhere to achieve their full potential, and for all countries to prioritise the most vulnerable and those currently left the farthest behind. Millions of children are currently denied the possibility to lead safe, decent, dignified, and rewarding lives and to access lifelong learning opportunities that enable them to participate fully in society. There are gross inequalities in children's exposure to factors that threaten their development. The life course perspective of the SDGs provides new impetus for collaboration and innovation to protect and support early childhood development and advance global progress towards equity and lifelong opportunities for all.

The MDGs showed that investments and areas of action in focus can be increased rapidly.[89,90] Under the broader SDG umbrella, investment in early childhood development has become not only an aim in itself, but also a requisite to achieve the SDGs to address poverty, inequality, and social exclusion and to promote peace and security (table 5). SDG target 4.2 under the learning goal provides unprecedented opportunity to scale up early childhood development services for young children, and has been integrated in the Global Strategy for Women's, Children's and Adolescent's Health, as well as the Strategic Plan (2014–20) of the Global Partnership for Education.

This definitive moment is stimulating bold new commitments and actions by national policy makers and the global stakeholder community to intensify and coordinate investments in early childhood development. Global leadership in the UN (eg, WHO, UNICEF, World Bank) has signalled support for the health sector to use its reach to pregnant women, families, and young children to promote early childhood development.[95–97]

Encourage the adoption and monitor the implementation of policies to create supportive environments for families to provide nurturing care for young children

Our conceptual framework (figure 1) identifies key interventions (panel 1) across several sectors that are needed to achieve benefits[98] across the lifecycle and into subsequent generations.[99]

Governments, with the technical and funding assistance of development partners, must ramp up efforts to analyse their situation, identify gaps and priority areas for intervention, and develop sustainable and costed action plans to promote early childhood development at scale. Local considerations of costs and cost-effectiveness drive where and how much to invest. Additional empirical data are needed about cost-effectiveness of the full range of early childhood development services, beyond those modelled in table 4. Nevertheless, the evidence for effective interventions (panel 1)[100] and for programmes and policies at scale (panel 2) shows that investment in early childhood development can be made through mutually reinforcing policies and services across different sectors (figure 1).[101]

Build capacity to promote early childhood development through existing health, nutrition, education, social, and child protection services

Based on our analysis of scaled up programmes, the integration of interventions for early childhood development into existing platforms for service delivery is an effective and efficient way to reach large numbers of families and children.[72,102] Although there is no uniform pathway to scale up services for early childhood development, we highlight three key considerations.[72,102]

First is local adaptation. Services need to be adapted to local context, address existing beliefs and practices, and be delivered through channels that are acceptable and feasible. Findings from multiple studies[103] have shown the importance of engaging community members at an early stage to create understanding, build ownership, and make optimal use of local resources. Formative research is needed, as a principle, to complete a rigorous process of adaptation design and testing.[104]

Second is competency-based capacity building. Front-line workers (eg, physicians, nurses, midwives, and community health workers) are usually the first point of contact for young children and their families. However, basic training curricula for primary health workers often do not include the essential knowledge and skills to promote early childhood development.

Pre-service and in-service training are the two most common opportunities to build competencies. A review of principles related to fidelity, quality, and capacity for integration of child development into health services found that a structured curriculum, concrete messages,[105] and supportive supervision are important to ensure quality of services.[106]

The final consideration is ensuring quality of care. Incremental scale-up, rapid learning cycles, and continuous improvement are essential to establish and maintain quality and coverage of services and achieve impact at scale.[107] Among many challenges is the already stretched health workforce, giving impetus to the movement to expand paraprofessionals (including community health workers) and families as resources to support nurturing care for children.[108,109] Technology can facilitate training, service delivery, data collection, and programme improvement.[110]

Strengthen multisectoral coordination in support of early childhood development and facilitate community engagement

In many countries, services for early childhood development are provided through a disjointed set of non-governmental organisations that can be brought together with government services, as has been done in the Chile Crece Contigo programme (panel 2). Bridges must be built between health and nutrition, education, and social and child protection, among others, to address the multiple needs of young children, especially the most vulnerable.

Often, even when high-level horizontal coordination is achieved, implementation and integration frequently fall short at the local level. Therefore, vertical coordination to local levels is also needed to ensure effective implementation.

More attention must be given to engagement of families and communities to understand the importance of early childhood development and the crucial part they play in their children's learning. This engagement further enables families and communities to demand and monitor quality of services to support their young children.[106]

Ensure accountability for early childhood development services, increase research, and foster global and regional leadership and action

Accountability is essential to strengthen coordination of early childhood development services, including through improved data collection, analysis, and action. A global monitoring framework with clear indicators of policies, programmes, and outcomes for early childhood development is needed.[111]

Ensuring the inclusion of a core set of indicators—which go beyond access and process, and hold stakeholders accountable for child development outcomes—in the global metrics for the SDGs is of paramount importance. SDG target 4.2, which calls for universal access to high-quality early childhood development, care, and pre-primary education, most directly addresses early childhood development (table 5).[112] The Global Partnership for Education 2020 and the global community united under Every Woman Every Child have a unique opportunity to support

indicator 4.2.1: "Percentage of children under 5 years of age who are developmentally on track in health, learning and psychosocial wellbeing." Indicators of early childhood development outcomes and of household resources and caregiver behaviours are included in Demographic and Health Surveys and Multiple Indicator Cluster Surveys and work is underway to expand these to cover children 0–3 years of age.

Although the scientific evidence for investing in early childhood development is strong, more is needed to generate political will. Research that links detailed longitudinal data about policies and programmes with outcomes, allowing causal modelling, is essential. An initial policy and research agenda has been developed through a WHO-led research priority exercise for early childhood development using the Child Health and Nutrition Research Initiative methodology.[113] Key themes emerging from the exercise include awareness and promotion, identification of risk factors, indicators, impact of interventions, implementation science for interventions, integration and coordination, and use of health economics and social protection strategies.[114]

We suggest the appointment of a UN Special Advisor for Early Childhood Development as a way to put the issue high on political agendas, facilitate coordination, and promote accountability. The shift in focus from child survival to child development has been solidly initiated under the umbrella of the SDGs. We must now act to ensure that the investments are made in early childhood development that are essential for the future health, wellbeing, economic productivity, prosperity, peace, and security of individuals and nations.

Conclusion

Strong biological, psychosocial, and economic arguments exist for intervening as early as possible to promote, protect, and support children's development, specifically during pregnancy and the first 2–3 years.[5,6] An emphasis on the first years of life is articulated within a life course perspective that also requires quality provisions at older ages, especially during child day care and preschool, following on through schooling and into adolescence so as to capitalise on dynamic complementarities between investments made during successive lifecycle stages.[115]

Health services are particularly well placed to reach children early with services that support families to deliver nurturing care and facilitate early childhood development.[52,100] Coordination with education is needed to promote learning, and with social and child protection to reach the most vulnerable populations. Evidence consolidated in this Series points to effective interventions and delivery approaches at a scale never envisaged before. All sectors must play their part in supporting families to provide nurturing care for children. However, the time has come for the health sector to expand its vision of health beyond prevention and treatment of disease to include the promotion of nurturing care for young children as a crucial factor in the realisation of the human potential of all people. The UN Secretary General's new Global Strategy for Women's, Children's and Adolescents' Health provides the framework to translate this vision into action and, together with education, social, and child protection, and other sectors, build the foundation for "the transformation we all hope to achieve over the next 15 years".

Contributors

LMR, GLD, BD, and JL conceptualised and wrote the paper. LMR, ZAB, RP-E, and JEL did literature reviews. JH, FLB, JRB, CL, TD, ZAB, KS, PG, and RP-E did data analysis and interpretation. JH and LMR contributed figures. All authors reviewed the drafts, made critical additions and editions, and approved the final submission.

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Declaration of interests

We declare no competing interests.

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References

1 UN. Transforming our world: the 2030 agenda for sustainable development. Version 1, September, 2015. Geneva: United Nations, 2015.

2 Grantham-Mcgregor SM, Cheung Y, Cueto S, Glewwe P, Richter L, Strupp B, for the International Child Development Steering Group. Developmental potential in the first 5 years for children in developing countries. *Lancet* 2007; **369:** 60–70.

3 Engle PL, Fernald LCH, Alderman H, et al. Strategies for reducing inequalities and improving developmental outcomes for young children in low-income and middle-income countries. *Lancet* 2011; **378:** 1339–53.

4 Walker S, Wachs TD, Grantham-McGregor S, et al. Inequality in early childhood: risk and protective factors for early child development. *Lancet* 2011; **378:** 1325–38.

5 Black MM, Walker SP, Fernald LC, et al, for the *Lancet* Early Childhood Development Series Steering Commitee. Early childhood development coming of age: science through the life course. *Lancet* 2016; published online Oct 4. http://dx.doi.org/10.1016/S0140-6736(16)31389-7.

6 Britto PR, Lyes S, Proulx K, et al, with the Early Childhood Development Interventions Review Group, for the *Lancet* Early Childhood Development Series Steering Commitee. Nurturing care: promoting early childhood development. *Lancet* 2016; published online Oct 4. http://dx.doi.org/10.1016/S0140-6736(16)31390-3.

7 UNESCO. Conference calls for new commitment to early childhood care and education. 2010. http://www.unesco.org/new/en/media-services/single-view/news/conference_calls_for_new_commitment_to_early_childhood_care_and_education/#.VpyahPl97IV (accessed Jan 16, 2016).

8 UNESCO. New publication strengthens knowledge base on early childhood care and education personnel in low- and middle-income countries. 2015. http://www.unesco.org/new/en/media-services/single-view/news/new_publication_strengthens_knowledge_base_on_early_childhood_care_and_education_personnel_in_low_and_middle_income_countries/#.VpzYyPl97IU (accessed Jan 18, 2016).

9 UNESCO. Supporting childhood care and education is key for the success of sustainable development goals. 2015. http://en.unesco.org/news/supporting-childhood-care-and-education-key-success-sustainable-development-goals (accessed Jan 18, 2016).

10 Britto PR. A historic moment for early childhood development. 2015. https://blogs.unicef.org/blog/a-historic-moment-for-early-childhood-development/ (accessed Jan 16, 2016).

11 International Bank for Reconstruction and Development Bank. World Bank support to early childhood development: an independent evaluation. 2015. http://www.slideshare.net/SegenMoges/world-bank-support-to-early-childhood-development-51313205 (accessed Jan 16, 2016).

12 Berlinski S, Schady N. The early years: child well-being and the role of public policy. New York, NY: MacMillan; Washington, DC: Inter-American Development Bank, 2015.

13 Every Woman Every Child. High level event to launch the global strategy for women's, children's and adolescents' health. 2015. http://www.everywomaneverychild.org/news-events/news/1135-high-level-event-to-launch-the-global-strategy (accessed Jan 16, 2016).

14 Zeid S, Gilmore K, Khosla R, et al. Women's, children's and adolescents' health in humanitarian and other crises. *BMJ* 2015; **351:** h4346.

15 Reed R, Fazel M, Jones L, Painter-Brick C, Stein A. Mental health of displaced and refugee children resettled in low-income and middle-income countries: risk and protective factors. *Lancet* 2012; **379:** 250–65.

16 Sherr L, Cluver LD, Betancourt TS, Kellerman S, Richter LM, Desmond C. Evidence of impact: health, psychological and social effects of adult HIV on children. *AIDS* 2014; **28:** S251–59.

17 Parsons CE, Young KS, Rochat TJ, Kringelbach ML, Stein A. Postnatal depression and its effects on child development: a review of evidence from low- and middle-income countries. *Br Med Bull* 2011; **101:** 57–59.

18 WHO/UNICEF. Care for child development. Improving the care for young children. Geneva: World Health Organization, 2012.

19 Yousafzai AK, Rasheed MA, Rizvi A, Armstrong R, Bhutta ZA. Effect of integrated responsive stimulation and nutrition interventions in the lady health worker programme in Pakistan on child development, growth, and health outcomes: a cluster-randomised factorial effectiveness trial. *Lancet* 2014; **384:** 1282–93.

20 Ertem IO, Alay G, Bingoler BE, Dogan DG, Bayhan A, Sarica D. Promoting child developmental at sick child visits: a controlled trial. *Pediatrics* 2006; **118:** e124–31.

21 Jin X, Sun Y, Jiang F, Ma J, Morgan C, Shen X. Care for development intervention in rural China: a prospective follow-up study. *J Dev Behav Pediatr* 2007; **28:** 128–18.

22 Gowani S, Yousafzai AK, Armstrong R, Bhutta ZA. Cost-effectiveness of responsive stimulation and nutrition interventions on early child development outcmes in Pakistan. *Ann NY Acad Sci* 2014; **1306:** 140–61.

23 Gillespie S, Menon P, Kennedy A. Scaling up impact on nutrition: what will it take? *Adv Nutr* 2015; **6:** 440–51.

24 Black MM, Pérez-Escamilla R, Rao SF. Integrating nutrition and child development interventions: scientific basis, evidence of impact, and implementation considerations. *Adv Nutr* 2015; **6:** 852–59.

25 Jayaratne K, Kelaher M, Dunt D. Child health partnerships: a review of program characteristics, outcomes and their relationship. *BMC Health Serv Res* 2010; **10:** 172.

26 Love JM, Chazan-Cohen R, Raikes H, Brooks-Gunn J. What makes a difference: Early Head Start evaluation findings in a developmental context. *Monogr Soc Res Child Dev* 2013; **78:** vii–viii.

27 Mtahabwa L. Parental demand, choice and access to early childhood education in tanzania. *Early Child Dev Care* 2011; **181:** 89–102.

28 Higgs ES, Goldberg AB, Labrique AB, et al. Understanding the role of mhealth and other media interventions for behavior change to enhance child survival and development in low- and middle-income countries: an evidence review. *J Health Commun* 2014; **19:** 164–89.

29 Shiffman J, Smith S. Generation of political priority for global health initiatives: A framework and case study of maternal mortality. *Lancet* 2007; **370:** 1370–79.

30 Darmstadt GL, Shiffman J, Lawn JE. Advancing the newborn and stillbirth global agenda: priorities for the next decade. *Arch Dis Child* 2015; **100:** S13–S18.

31 Pérez-Escamilla R, Curry L, Minhas D, Taylor L, Bradley E. Scaling up breastfeeding promotion programs in low- and middle-income countries: the "breastfeeding gear" model. *Adv Nutr* 2012; **3:** 790–800.

32 Victora CG, Hanson K, Bryce J, Vaughan J. Achieving universal coverage with health interventions. *Lancet* 2004; **364:** 1541–48.

33 Hajizadeh M, Heymann J, Strumpf E, Harper S, Nandi A. Paid maternity leave and childhood vaccination uptake: longitudinal evidence from 20 low- and-middle-income countries. *Soc Sci Med* 2015; **140:** 104–17.

34 Heymann J, Raub A, Earle A. Creating and using new data sources to analyze the relationship between social policy and global health: the case of maternal leave. *Public Health Rep* 2011; **126:** 127–34.

35 Haas L, Hwang P. The impact of taking parental leave on fathers' participation in childcare and relationships with children: lessons from sweden. *Community Work Fam* 2008; **11:** 85–104.

36 Victora CG, Bahl R, Barros AJD, et al, for the *Lancet* Breastfeeding Series Group. Breastfeeding in the 21st century: epidemiology, mechanisms and lifelong impact. *Lancet* 2016; **387:** 475–90.

37 Heymann J, Raub A, Earle A. Breastfeeding policy: a globally comparative analysis. *Bull World Health Organ* 2013; **91:** 398–406.

38 Atabay E, Moreno G, Nandi A, et al. Facilitating working mothers' ability to breatsfeed: global trends in guaranteeing breastfeeding breaks at work, 1995–2014. *J Hum Lact* 2015; **31:** 81–08.

39 Heymann J. Forgotten families: ending the growing crisis confronting children and working parents in the global economy. New York, NY: Oxford University Press, 2006.

40 Yoshikawa H, Aber JL, Beardslee WR. The effects of poverty on the mental, emotional and behavioural health of children: Implications for prevention. *Am Psychol* 2012; **67:** 272–84.

41 Morris J, Donkin AJM, Wonderling D, Wilkinson P, Dowler, EA. A minimum wage for healthy living. *J Epidemiol Community Health* 2000; **54:** 885–89.

42 Majid MF, Rodríguez JMM, Harper S, Frank J, Nandi A. Do minimum wages improve early life health? Evidence from developing countries. *Soc Sci Med* 2016; **158:** 105–13.

43 Maloney WF, Núñez Mendez J. Measuring the impact of minimum wages. Evidence from Latin America. In: Heckman J, Pagés C, eds. Law and employment: lessons from Latin America and the Caribbean. Chicago: University of Chicago Press, 2004: 109–30.

44 Nores M, Barnett WS. Benefits of early childhood interventions across the world: (under) investing in the very young. *Econ Educ Rev* 2010; **29:** 271–82.

45 Neuman M, Devercelli AE. What matters most for early childhood development: a framework paper. Washington, DC: World Bank, 2013.

46 UCLA Fielding School of Public Health. WORLD policy analysis center. http://ph.ucla.edu/research/centers/world-policy-analysis-center (accessed Jan 18, 2016).

47 UNESCO Institute for Statistics. International standard classification of education (ISCED)—2011. Paris: United Nations Educational, Scientific and Cultural Organization; Montreal: UIS, 2011.

48 Jensen SKG, Bouhouch RR, Watson JL, et al. Enhancing the child survival agenda to promote, protect and support early child development. *Semin Perinatol* 2015; **39:** 373–86.

49 Attanasio OP, Fernández C, Fitzsimons EOA, et al. Using the infrastructure of a conditional cash transfer program to deliver a scalable integrated early child development program in colomba: cluster randomized controlled trial. *BMJ* 2014; **349:** g5785.

50 Fernald LC, Hidrobo M. Effect of Ecuador's cash transfer program (bono de desarrollo humano) on child development in infants and toddlers: a randomized effectiveness trial. *Soc Sci Med* 2011; **72:** 1437–46.

51 Fernald LC, Schnaas L, Neufeld L, Knauer H, Garcia Guerra A. Adding a parental support intervention to conditional cash transfers improves child development in rural Mexico. *FASEB J* 2014; **28:** 378.

52 Engle PL, Young ME, Tamburlini G. The role of the health sector in early childhood development. In: Britto PR, Engle PL, Super CM, eds. Handbook of early childhood development research and is impact on global policy. New York, NY: Oxford University Press, 2013: 183–201.

53 Daelmans B, Black MM, Lombardi J, et al. Effective interventions and strategies for improving early child development. *BMJ* 2015; **351:** h4029.

54 Hamadani JD, Nahar B, Huda SN, Tofail F. Integrating early child development programs into health and nutrition services in bangladesh: Benefits and challenges. *Ann N Y Acad Sci* 2014; **1308:** 192–203.

55 Conde-Agudelo A, Belizan JM, Diaz-Rossello J. Kangaroo mother care to reduce morbidity and mortality in low birthweight infants. *Cochrane Database Syst Rev* 2011; **3:** CD002771.

56 Schneider C, Charpak N, Ruiz-Peláez JG, Tessier R. Cerebral motor function in very premature-at-birth adolescents: a brain stimulation exploration of kangaroo mother care effects. *Acta Paediatr* 2012; **101:** 1045–53.

57 Spittle A, Orton J, Anderson P, Boyd R, Doyle LW. Early developmental intervention programmes post-hospital discharge to prevent motor and cognitive impairments in preterm infants. *Cochrane Database Syst Rev* 2012; **11:** CD005495.

58 Bhutta Z, Das JK, Rizvi A, et al, for the *Lancet* Nutrition Interventions Review Group and the Maternal and Child Nutrition Study Group. Evidence-based interventions for improvement of maternal and child nutrition: what can be done and at what cost? *Lancet* 2013; **382:** 452–77.

59 Chang SM, Grantham-McGregor SM, Powell CA, et al. Integrating a parenting intervention with routine primary health care: a cluster randomised trial. *Pediatrics* 2015; **136:** 272–80.

60 Potterton J, Stewart A, Cooper P, Becker P. The effect of a basic home stimulation programme on the development of young children infected with hiv. *Dev Med Child Neurol* 2010; **52:** 547–51.

61 Ertem IO. Developmental difficulties in early childhood: prevention, early identification, assessment and intervention in low- and middle-income countries. Geneva: World Health Organization, 2012.

62 Rahman A, Fisher J, Bower P, et al. Interventions for common perinatal mental disorders in women in low-and middle-income countries: a systematic review and meta-analysis. *Bull World Health Organ* 2013; **91:** 593–601.

63 Hamdani SU, Minhas FU, Iqbal Z, Rahman A. Model for service delivery for developmental disorders in low-income countries. *Pediatr Rev* 2015; **136:** 1166–72.

64 Grantham-McGregor SM, Powell CA, Walker SP, Himes JH. Nutritional supplementation, psychosocial stimulation, and mental development of stunted children: the Jamaica study. *Lancet* 1991; **338:** 1–5.

65 Gertler P, Heckman J, Pinto R, et al. Labor market returns to an early childhood stimulation intervention in Jamaica. *Science* 2014; **344:** 998–1001.

66 Grantham-McGregor SM, Fernald LCH, Kagawa RMC, Walker S. Effects of integrated child development and nutrition interventions on child development and nutritional status. *Ann N Y Acad Sci* 2014; **1308:** 11–32.

67 Brown TW, van Urk FC, Waller R, Mayo-Wilson E. Centre-based day care for children younger than five years of age in low-and middle-income countries. *Cochrane Database Syst Rev* 2014; **9:** CD010543.

68 Leroy J, Gadsen P, Guijarro M. The impact of programmes on child health, nutrition and development in developing countries: a systematic review. *J Dev Effect* 2012; **4:** 472–96.

69 Mwaura P, Sylva K, Malmberg LE. Evaluating the madrasa preschool programme in East Africa: a quasi-experimental study. *Int J Early Years Educ* 2008; **16:** 237–55.

70 Fernald LC, Gertler PJ, Neufeld LM. Role of cash in conditional cash transfer programmes for child health, growth, and development: an analysis of Mexico's *Oportunidades*. *Lancet* 2008; **371:** 828–37.

71 Macours K, Schady N, Vakis R. Cash transfers, behavioral changes, and cognitive development in early childhood: evidence from a randomized experiment. *Am Econ J Appl Econ* 2012; **4:** 247–73.

72 Barker P, Reid A, Schall MW. A framework for scaling up health interventions: Lessons from large-scale improvement initiatives in Africa. *Implement Sci* 2016; **11:** 12.

73 Bump J, Cashin C, Chalkidou K, et al. Implementing pro-poor universal health coverage. *Lancet Glob Health* 2016; **4:** e14–16.

74 Vargas-Barón E. Building and strengthening national systems for early childhood development. In: Britto PR, Engle PL, Super CM, eds. Handbook of early childhood development research and its impact on global policy. New York, NY: Oxford University Press and Society for Research in Child Development, 2013.

75 Harrison D, Biersteker L. Appendix 7: organization and management of ECD programmes. In: Richter LM, Berry L, Biersteker L, et al, eds. South Africa's national ECD programme. Pretoria: Human Sciences Research Council, 2014.

76 World Bank Group. Early childhood development—country reports 2013. http://saber.worldbank.org/index.cfm?indx=8&pd=6&sub=2 (accessed Oct 7, 2015).

77 Bennett IM, Schott W, Krutikova S, Behrman JR. Maternal mental health, and child growth and development, in four low-income and middle-income countries. *J Epidemiol Community Health* 2015; published online Sept 10. DOI:10.1136/jech-2014-205311.

78 Stenberg K, Axelson H, Sheehan P, et al. Advancing social and economic development by investing in women's and children's health: a new global investment framework. *Lancet* 2014; **383:** 1333–54.

79 Batura N, Hill Z, Haghparast-Bidgoli H, et al. Highlighting the evidence gap: how cost-effective are interventions to improve early childhood nutrition and development? *Health Policy Plan* 2015; **30:** 813–21.

80 Duflo E. Schooling and labor market consequences of school construction in Indonesia: Evidence from an unusual policy experiment. *Am Econ Rev* 2001; **91:** 795–814.

81 Hoddinott J, Behrman JR, Maluccio JA, et al. Adult consequences of growth failure in early childhood. *Am J Clin Nutr* 2013; **98:** 1170–78.

82 Hoddinott J, Alderman H, Behrman JR, Haddad L, Horton S. The economic rationale for investing in stunting reduction. *Matern Child Nutr* 2013; **9** (suppl 2)**:** 69–82.

83 Stevens GA, Finucane MM, Paciorek CJ, et al. Trends in mild, moderate, and severe stunting and underweight, and progress towards mdg1 in 141 developing countries: a systematic analysis of population representative data. *Lancet* 2012; **380:** 824–34.

84 Dunn LM, Dunn DM. Spanish version of the peabody picture vocabulary test (PPVT). Bloomington: Pearson Clinical, 2007.

85 The World Bank. World development indicators: education inputs. 2015. http://wdi.worldbank.org/table/2.10 (accesssed July 20, 2015).

86 Fink G, Peet E, Danaei G, et al. Schooling and wage income losses due to early-childhood growth faltering in developing countries: national, regional, and global estimates. *J Clin Nutr* 2016; **4:** 104–12.

87 Every Woman Every Child. The global strategy for women's, children's and adolescents' health (2016–2030). New York, NY: United Nations, 2015. http://globalstrategy.everywomaneverychild.org/ (accessed Aug 30, 2016).

88 Global Partnership for Education. Global Partnership For Education 2020 Strategic Plan: improving learning and equity through stronger education systems, 2016. http://www.globalpartnership.org/content/gpe-2020-strategic-plan (accessed Aug 30, 2016).

89 Every Woman Every Child. Saving lives, protecting futures. Progress report on the global strategy for women's and children's health 2010–2015. New York, NY: United Nations, 2015.

90 Victora CG, Requejo JH, Barros AJ, et al. Countdown to 2015: a decade of tracking progress for maternal, newborn, and child survival. *Lancet* 2015; **387:** 2049–59.

91 Eshel N, Daelmans B, Mello MCD, Martines J. Responsive parenting: interventions and outcomes. *Bull World Health Organ* 2006; **84:** 991–98.

92 Shonkoff JP, Richter LM, Van Der Gaag J, Bhutta ZA. An integrated scientific framework for child survival and early childhood development. *Pediatrics* 2012; **129:** e460–72.

93 Heckman J. The developmental origins of health. *Health Econ* 2012; **21:** 24–29.

94 Cozolino L. The neuroscience of human relationships: attachment and the developing social brain. New York: WW Norton & Company, 2014.

95 Chan M. Linking child survival and child development for health, equity, and sustainable development. *Lancet* 2013; **381:** 1514–15.

96 Chan M. Investing in early child development: an imperative for sustainable development. *Ann N Y Acad Sci* 2014; **1308:** vii–viii.

97 Lake A, Chan M. Putting science into practice for early child development. *Lancet* 2015; **385:** 1816–17.

98 Kieling C, Baker-Henningham H, Belfer M, et al. Child and adolescent mental health worldwide: evidence for action. *Lancet* 2011; **378:** 1515–25.

99 Ngure FM, Reid BM, Humphrey JH, Mbuya MN, Pelto G, Stoltzfus RJ. Water, sanitation, and hygiene (WASH), environmental enteropathy, nutrition, and early child development: making the links. *Ann N Y Acad Sci* 2014; **1308:** 118–28.

100 Britto PR, Yoshikawa H, van Ravens J, et al. Strengthening systems for integrated early childhood development services: a cross-national analysis of governance. *Ann N Y Acad Sci* 2014; **1308:** 245–55.

101 WHO. A policy guide for implementing essential interventions for reproductive, maternal, newborn and child health. A multisectoral policy compendium for RMNCH. Geneva: World Health Organization, 2014.

102 Bradley EH, Curry LA, Taylor LA, et al. A model for scale up of family health innovations in low-income and middle-income settings: a mixed methods study. *BMJ Open* 2012; **2:** e000987.

103 Kumar V, Kumar A, Ghosh AK, et al. Enculturating science: community-centric design of behavior change interactions for accelerating health impact. *Semin Perinatol* 2015; **39:** 393–415.

104 WHO. What are the options? Using formative research to adapt global recommendations on hiv and infant feeding to local context. Geneva: World Health Organization, 2004.

105 Yousafzai AK, Aboud FE. Review of implementation processes for integrated nutrition and psychosocial stimulation intervention. *Ann N Y Acad Sci* 2014; **1308:** 33–45.

106 Yousafzai AK, Rasheed MA, Daelmans B, et al. Capacity building in the health sector to improve care for child nutrition and development. *Ann N Y Acad Sci* 2014; **1308:** 172–82.

107 Glasgow RE, Chambers D. Developing robust, sustainable, implementation systems using rigorous, rapid and relevant science. *Clin Transl Sci* 2012; **5:** 48–55.

108 Singh P, Sachs JD. 1 million community health workers in Sub-saharan Africa by 2015. *Lancet* 2013; **382:** 363–65.

109 Tomlinson M, Rahman A, Sanders D, Maselko J, Rotheram-Borus MJ. Leveraging paraprofessionals and family strengths to improve coverage and penetration of nutrition and early child development services. *Ann N Y Acad Sci* 2014; **1308:** 162–71.

110 Braun R, Catalani C, Wimbush J, Israelski D. Community health workers and mobile technology: a systematic review of the literature. *PLoS One* 2013; **8:** e65772.

111 Frongillo E, Tofail F, Hamadani JD, Warren AM, Mehrin SF. Measures and indicators for assessing impact of interventions integrating nutrition, health, and early childhood development. *Ann N Y Acad Sci* 2014; **1308:** 68–88.

112 The Partnership for Maternal Newborn and Child Health. The global strategy for women's, children's and adolescents' health 2016–2030. 2015. http://www.who.int/pmnch/activities/advocacy/globalstrategy/en/ (accesssed Jan 29, 2016).

113 Rudan I, El Arifeem S, Black R, Campbell H. Childhood pneumonia and diarrhoea : Setting our priorities right. *Lancet Infect Dis* 2007; **7:** 56–61.

114 Dua T, Tomlinson M, Tablante E, et al. Global research priorities to advance early child development in the sustainable development era. *Lancet Glob Health* 2016; published online Oct 4. http://dx.doi.org/10.1016/S2214-109X(16)30218-2.

115 Heckman J, Cunha F, Lochner I, Masterov DV. Interpreting the evidence on lifecycle skill formation. In: Hanushek E, Welch F, eds. Handbook of the economics of education. Amsterdam: North Holland, 2006.

Generation of global political priority for early childhood development: the challenges of framing and governance

Yusra Ribhi Shawar, Jeremy Shiffman

Despite progress, early childhood development (ECD) remains a neglected issue, particularly in resource-poor countries. We analyse the challenges and opportunities that ECD proponents face in advancing global priority for the issue. We triangulated among several data sources, including 19 semi-structured interviews with individuals involved in global ECD leadership, practice, and advocacy, as well as peer-reviewed research, organisation reports, and grey literature. We undertook a thematic analysis of the collected data, drawing on social science scholarship on collective action and a policy framework that elucidates why some global initiatives are more successful in generating political priority than others. The analysis indicates that the ECD community faces two primary challenges in advancing global political priority. The first pertains to framing: generation of internal consensus on the definition of the problem and solutions, agreement that could facilitate the discovery of a public positioning of the issue that could generate political support. The second concerns governance: building of effective institutions to achieve collective goals. However, there are multiple opportunities to advance political priority for ECD, including an increasingly favourable political environment, advances in ECD metrics, and the existence of compelling arguments for investment in ECD. To advance global priority for ECD, proponents will need to surmount the framing and governance challenges and leverage these opportunities.

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See **Online** for appendix

Introduction

Over the past decade, global and national priority for early childhood development (ECD) has grown. An increasing number of global actors have become involved with ECD, including international organisations, foundations, and academic centres. *The Lancet* has published two series (in 2007 and 2011) on the subject. High-profile resolutions on ECD have appeared.[1–3] The Sustainable Development Goals (SDGs) include many targets that address ECD. New national initiatives have emerged in low-income and middle-income countries (LMICs).[4] And researchers have produced a large body of scholarship confirming the effect and cost-effectiveness of ECD interventions.[5–7]

Despite progress, ECD remains a neglected issue, particularly in low-income countries. Less than 50% of children aged 3–6 years receive any form of pre-primary education.[8] A mere 2% of the education budget in Africa is allocated to pre-primary education.[9] A quarter of children younger than 5 years worldwide are physically stunted, harming brain development and delaying school enrolment.[10] Consequently, about 200 million children—a third of the world's children younger than 5 years—are hampered in reaching their full potential in cognitive development.[11]

Undoubtedly many reasons stand behind insufficient priority for ECD in LMICs, including scarce resources in these settings, inadequate understanding of its benefits, competing development priorities, and structures of inequality that mitigate against addressing problems faced by the poorest people. An additional reason might be the way in which the global community of individuals and organisations concerned with ECD has organised to address the issue. We investigate this community, analysing the challenges and opportunities it faces in augmenting global political priority for ECD. Examination of this community is crucial given its potentially instrumental role in advancing the issue during the SDG era. National-level dynamics are of course a critical facet of priority generation; however, we focus on the role of the global ECD community in generating international resources, resolutions, and political support to address the issue.

Qualitative policy analysis

To undertake this analysis, we triangulated among several data sources, including 19 semi-structured interviews with individuals involved in global ECD leadership, practice, and advocacy (see appendix for organisational affiliations), as well as peer-reviewed research, organisation reports, and grey literature. Drawing on social science scholarship on collective action[12,13] and a policy framework[14] that elucidates why some global initiatives are more successful in generating political priority than others, we undertook a thematic analysis of the collected data.[15] Codes were based on this policy framework,[14] which includes 11 determinants of political priority, grouped in four categories: (1) actor power: the strength of concerned individuals and organisations; (2) ideas: the way in which those involved with the issue understand and portray it; (3) political contexts: the environments in which these actors operate; and (4) issue characteristics: features of the problem. The panel details how the interviews, literature review, and qualitative policy analysis were done. The study protocol underwent ethics review and was approved by the Institutional Review Board of American University (Washington, DC, USA). All interviews were recorded and transcribed with consent from participants. We did not aim to resolve disagreements among community members. Rather, we investigated how community members understood the issues, and the effects of their debates on political support, with the aim of sparking future productive discussions among them on advancing priority for ECD.

Panel: **Literature review, interviews, and analysis**

Literature review

We searched Google Scholar, ProQuest, and JSTOR databases. The search was restricted to literature in English, between the years 1985 and 2016, and associated with ECD globally, as well as in low-income and middle-income countries. The search terms used were: "early childhood development (ECD)", "early childhood care and education (ECCE)", "early childhood education and care (ECEC)", "early childcare", and "early childhood", in combination with "global", "policy", "evaluation", "strategy", "developing country", "low-and-middle income countries", "governance", and "data".

Interviews

We undertook 19 confidential, semi-structured interviews with individuals considered key ECD leaders or advocates. Specifically, we interviewed those involved in child health, child education, child rights, human development, and neurobiology. All were employed by prominent international organisations, non-governmental organisations, foundations, or academic institutions. We identified these individuals through consultation of published and grey literature on ECD, and by asking interviewees whom they considered to be most centrally involved in ECD. Most of the respondents represented global institutions that are located in North America or Europe, reflecting the dominance of institutions in these regions in the global ECD community. With use of a purposive rather than general sampling selection strategy, we reached theoretical saturation, the point at which all major concepts have been identified, and additional interviews were judged to be unlikely to reveal new information. Interviews were conducted over the phone between November, 2014, and January, 2015, each lasting approximately 1 h. The detailed notes taken during the interviews, audio recordings, and audio transcriptions were de-identified and secured to ensure respondent confidentiality. Although we did interview respondents focused on ECD efforts in Asia, sub-Saharan Africa, and the Middle East, no respondents came from China or India, which is a limitation of this study. Another limitation is the difficulty in drawing inferences from a single case study.

Qualitative policy analysis

We focused our examination on the policy framework's four categories of determinants of political priority: actor power, ideas, political context, and issue characteristics. We concentrated our thematic analysis on: (1) the nature of and interactions among the actors and institutions that make up the ECD governance system, (2) their understanding of the nature of the problem and solutions, (3) the efficacy of the public framings they have used to attract political support, and (4) the way in which they operate in the global political context.

We compared interview findings with one another and with the collected literature to extract and verify information about major developments that have occurred surrounding ECD priority generation. This triangulation of data sources was crucial to minimise bias. Rather than take a position on the debates surrounding appropriate governance structures, definitions and terminologies, and intervention strategies related to ECD, we purposefully limited our examination to the content of these debates and how they were understood by the ECD actors themselves to assess their effect on political support for their cause. The focus of the analysis was limited to political priority for ECD at the global level, rather than regional, national, or community level actors, debates, and events, except in instances when regional or national actors have influenced global ECD advocacy efforts.

Challenges and opportunities for generation of global priority

The analysis reveals two primary challenges that the ECD community faces in advancing global political priority, the first pertaining primarily to ideas and the second to actor power. The first challenge is framing: generation of internal consensus on the definition of the problem and solutions, agreement that could facilitate the discovery of a public positioning of the issue to generate political support. The second challenge is governance: building of effective institutions to achieve collective goals. ECD is an intersectoral issue—including health, education, nutrition, social welfare, and protection—making these challenges particularly stark. However, several developments present the community with strong opportunities to advance political priority.

The framing challenge

Members of the ECD community that we interviewed disagreed on several fundamental issues pertaining to the definition of the problem and its solutions, hampering their ability to make the case for investment. These issues include the boundaries of the field, the time period constituted by early childhood, and priority interventions. These issues overlap: the field's boundaries, for example, concern the scope of services and the age range that comprises early childhood. As one prominent member of the ECD community notes: "We don't have a unified problem statement…we desperately need to articulate one" (interview 7).

ECD community members hold divergent views concerning what issues stand inside and outside the field, some labelling its boundaries "arbitrary".[16] Fault lines between health and education groups are particularly marked.[17] For example, community members disagree on whether protection against violence should be a core pillar of the field.[18,19] Furthermore, they diverge on whether ECD should be limited to pre-primary education, or should also include the primary level. Additionally, there is tension surrounding the prominence of child survival

in the agenda. Some members viewed the funding and attention this issue receives as crowding out resources for other elements of the agenda, including pre-primary education, safe and stimulating care environments, and nutrition (interview 1, 2, 4, 5, 12, 13, 14).

Additionally, there were differences over the time period that constitutes early childhood, and consequently the range of programmes and services that ECD should cover. Some interviewees proposed that ECD interventions should begin at conception, whereas others argued that these should not start until birth. There is debate as to whether ECD interventions should target only children until 5 years of age,[20] or also cover children aged 6–8 years during the transition years in primary school.[21] Sectoral priorities contribute to these differences: the nutrition community emphasises the critical first 1000 days of life as the window of opportunity to address stunting,[22] whereas the education community, focused on preschool expansion, prioritises a later age period.

These differences in defining the problem have resulted in disagreements concerning solutions, evidenced by a proliferation in ECD frameworks that diverge in emphases.[21,23,24] One factor behind this situation could be insufficient evidence about which interventions are most effective. Moreover, in the growing number of countries where the case for investing in ECD has been made, policy makers do not have evidence-based guidance about how to best allocate resources and scale up quality programmes. As one article notes: "We are struck by how much we do not know as compared with what we do know."[25] While all ECD frameworks emphasise a holistic intervention strategy, interviewees remarked that they differ in focal targets (ie, the pregnant woman, the child, parents and families, the ECD workforce), place of delivery (ie, homes, centres, schools, health facilities, non-formal settings), and interventions (health, nutrition, education, social welfare, child protection) (interview 6, 11, 13, 15, 16).

Another manifestation of differences concerning problems and solutions is the proliferation of divergent nomenclature. Some within the community note that, "these differences go beyond mere labels: they imply different purposes, pedagogical practices, and forms of delivery".[26] The variety of terms is so broad that some question the very identity of early childhood as a distinctive field.[26] The term ECD, which is used in this *Lancet* Series, emphasises a holistic approach attending to the child's physical, emotional, social, and cognitive development and is used widely in health circles and by institutions such as UNICEF, WHO, and the World Bank.[26] Education sector actors commonly use the terms early childhood education (ECE), early childhood care and education (ECCE; eg, by the UN Educational, Scientific and Cultural Organization [UNESCO]), and early childhood education and care (ECEC; eg, by the European Union and the Organisation for Economic Co-operation and Development). Early childhood care (ECC) is another term associated with the promotion of the child's health, nutrition, and hygiene in low-income settings.

These differences surrounding problem definitions and solutions have made it difficult for community members to advance a case for ECD that political leaders and the public can easily understand (interview 1, 5, 6, 7, 9, 11, 12, 13, 14, 15, 16, 19). As one respondent noted, ECD is "too nebulous of a concept" (interview 7). Part of the difficulty in positioning the issue lies in the fact that there are real cross-national differences in ECD challenges (interview 12). Additionally, respondents indicated that there is a misperception in some countries that there are no immediate payoffs to investment in ECD, which makes the issue less attractive politically (interview 6, 12, 14, 15, 16, 18). Weak data availability and monitoring mechanisms in each key sector and across the ECD system have also hampered informed advocacy (interview 6, 11, 12).[27] Perhaps most critically, policy makers remain confused about what exactly the community is asking them to do (interview 7, 15, 16, 19).

The governance challenge

Governance pertains to the institutions that actors create to pursue collective goals. The intersectoral nature of the issue makes ECD governance particularly challenging. ECD community members identified fragmentation as a persistent problem, pointing to difficulties surrounding global individual leadership, global institutions, and national coordinating mechanisms (interview 1, 2, 6, 7, 11, 12, 14). Several respondents pointed to individuals with the credibility to exercise global leadership (interview 2, 13), and identified sectoral and national champions (interview 2, 4, 7, 13). However, most respondents noted the absence of global unifying individual leaders (interview 1, 2, 4, 6, 8, 9, 11, 18), and a couple identified this dearth as one of ECD's greatest challenges (interview 4, 6). ECD community members also identified a lack of institutional leadership, particularly among UN agencies (interview 1, 2, 6, 8, 9, 11, 12, 13, 14, 15, 16). They noted that UNICEF, UNESCO, and WHO have all played central roles in advancing ECD, but none has been able to unite the diverse community, as each has been associated too strongly with its sectoral mandate.

National-level fragmentation among ECD actors is also a critical challenge.[21,28,29] A wide range of government ministries, development agencies, philanthropic foundations, non-governmental organisations, and private sector representatives are involved in ECD policy development and implementation. The multitude of actors, although necessary, complicates ECD service delivery and makes the policy environment challenging and at times contentious.[27] One problem is that responsibilities for advancing ECD across government institutions (eg, ministry of education, ministry of health, ministry of gender, and/or social welfare) are often not clearly delineated and mutually understood, leading to duplication and inefficiencies. Furthermore,

vertical coordination—from national to local—is rarely adequate.[30]

Effective governance is hampered by incentive structures that hinder collaboration. Funding is usually directed to sectors, leading to competition for scarce resources.[31] Job descriptions for health and education staff—especially at district and provincial levels—rarely mention coordination.[30] Offices are often physically separated.[30] One respondent noted that, "Competition and silos dominate. People are jockeying for money and trying to get credit for what they are doing" (interview 2).

These coordination challenges have resulted in differences in opinion concerning which ECD governance strategies are optimal.[31] Some community members argued that individual sectoral strategies work best, so long as policies and interventions for young children are clearly delineated and well-functioning coordinating mechanisms exist (interview 2, 4, 5, 8). Others advocated for integrated programmes in which health, nutrition, education, and other services are jointly funded, managed, implemented, and evaluated as "seamless services" at the local level (interview 9, 10, 11, 14).[4]

Opportunities

These framing and governance challenges notwithstanding, there are several reasons to be optimistic concerning ECD's potential to emerge as a global priority. First is a development concerning actor power: growth in the number of global actors focused on the ECD issue, and increased efforts among them to coordinate. For example, the Saving Brains programme[32]—a partnership of Grand Challenges Canada, Aga Khan Foundation Canada, Bernard van Leer Foundation, and the Bill & Melinda Gates Foundation, among other funders—has brought together individuals and organisations focused on ECD in LMICs. Additionally, the World Bank and UNICEF have established an ECD network linking governments, civil society, development partners, funders, and private actors.[33] Other collaborative ECD initiatives that seek to facilitate collective action include R4D and the International Step by Step's Early Childhood Workforce Initiative, and the Consultative Group on Early Childhood Care and Development. Although the growth in the number of actors could exacerbate conflict in a community already facing considerable disagreements, it might also lead to greater resources and a more powerful political coalition backing the issue.

Second are developments concerning the political context. These include several high-profile global resolutions on ECD; the inclusion of ECD-related targets in the SDGs (including SDG 1 on poverty, 2 on hunger, 3 on health, 4 on education, 5 on gender equality, 8 on economic growth, and 16 on peace and justice); a substantial increase in the number of LMICs adopting ECD policy over the last decade;[34] and the publication of this *Lancet* Series, which includes the most up-to-date scientific evidence and may raise global attention for the issue.

Third is a factor pertaining to issue characteristics: growing momentum surrounding ECD metrics, many catalysed by the community's efforts to ensure the issue's inclusion in the post-2015 development agenda. These metrics include UNICEF's multiple indicator cluster surveys,[8] which incorporated early childhood development indicators in 2005/06; UNESCO's holistic early childhood development index,[35] with targets spanning health, nutrition, education, social protection, poverty, and parental support; and the World Bank's SABER-ECD Survey,[36] which details ECD policies and programmes. These tools and metrics—which are holistic and address multiple dimensions of ECD—could create incentives for sectors to collaborate to ensure progress.

Fourth is a factor connected to ideas: the proliferation of research supporting a strong investment case for ECD (interview 6, 8, 13, 18, 19). This research has provided compelling evidence justifying ECD as: (1) a human right;[1] (2) a macro-economic imperative;[7] (3) a necessity for a child's school readiness and educational achievement;[37–39] (4) a requisite for lifetime health;[5,37,40,41] (5) a factor influencing poverty reduction;[39,41,42] (6) a pathway to enhanced gender equity across the life course;[43] (7) a critical intervention to shape behaviour, given the brain's plasticity;[44] and (8) an imperative for Millennium Development Goal (MDG) and SDG achievement.[45] This research may help the ECD community to come to consensus about how the problem should be understood, the strategies that should be pursued in order to address the problem, and the rationales to motivate policy maker and public action on the issue. The challenge for the community will be to weave these arguments into a coherent case for ECD investment, one that can be easily understood by the political leaders whose support is needed to advance the agenda.

The role of the global ECD community in building priority

With the growth in the number of concerned actors, the establishment of networks linking them, the proliferation of research showing the benefits of addressing ECD, and the inclusion of ECD-related indicators in the SDGs, proponents are well positioned to advance global priority for the issue. To do so, ECD community members must surmount framing and governance challenges that impede their ability to act collectively.

Sectoral differences underpin both challenges. Many ECD proponents view the issue through the lens of the sector that they most closely associate with, whether that be health, education, nutrition, social welfare, or protection. Incentive structures also hamper collaboration: competition among sectors for scarce resources is intense, and institutions at global and national levels often hinder rather than facilitate cooperation.

For more on **R4D and the Early Childhood Workforce Initiative** see http://www.resultsfordevelopment.org/focus-areas/fresh-focus-early-childhood-workforce

For more on the **Consultative Group on Early Childhood Care and Development** see: http://www.ecdgroup.justinluke.us

The framing and governance challenges are intertwined. If ECD proponents were able to come to evidence-based consensus on a definition of the problem, on solutions, and on the public positioning of the issue, trust among them would probably grow, facilitating the establishment of strong global governance mechanisms that could guide collective action on the issue. Similarly, if such governance arrangements were in place, community members might find it easier to come to consensus on framing.

It is not the role of outsiders to suggest what framing strategies and governance arrangements the community ought to adopt; decisions will stick only if members themselves generate and come to consensus on strategies. We do, however, offer three suggestions pertaining to the deliberative process, each grounded in research on collaborative governance.[46–49]

First, pursue small wins. Establishing strong framing and governance arrangements are large challenges and will not happen overnight. Effective collaboration must build over time through a series of short-term accomplishments that deepen trust, commitment, and shared understanding. Second, adopt arrangements that allow both for stability and flexibility. Collaborative governance research indicates that some measure of centralisation is necessary to lift initiatives and provide initial momentum. However, if sustained for too long, overly centralised arrangements produce rigidity that do not allow for learning and necessary adaptation as circumstances change. Third, and most critically, ensure that the process is inclusive. Many global health initiatives are dominated by actors and institutions in North America or Europe, and reflect donor priorities rather than the demands and needs of individuals, civil society institutions, and governments in LMICs. A top-down process that reflects only the ideas and priorities of well-resourced institutions in North America or Europe is not likely to produce decisions that are accepted as legitimate. Effective framing and governance requires that those most affected by the issues have primary voice in how any initiative is designed and unfolds.

Contributors

YRS undertook the interviews, did the literature review, analysed the data, and wrote the draft with support from JS. JS contributed to the data analysis and drafting of the paper. Both authors designed the study. Both authors have seen and approved the final version of this manuscript for publication.

Declaration of interests

We declare no competing interests.

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References

1 UNESCO. The Dakar framework for action. Education for all: meeting our collective commitments. Goal One. Paris, France. April, 2000. http://unesdoc.unesco.org/images/0012/001211/121147e.pdf (accessed Feb 5, 2016).

2 Commission on Social Determinants of Health. Closing the gap in a generation: health equity through action on the social determinants of health. Final Report of the Commission on Social Determinants of Health. Geneva: World Health Organization, 2008.

3 Convention on the Rights of the Child (CRC). Implementing child rights in early childhood. General Comment No. 7. New York: United Nations, 2005.

4 Vargas-Barón E. Going to scale: Early childhood development in Latin America. Washington, DC: The RISE Institute, 2009.

5 Irwin L G, Siddiqi A, Hertzman C. Early child development: a powerful equalizer. Final report to the WHO Commission on Social Determinants of Health. Geneva: World Health Organization, 2007.

6 Engle PL, Black MM, Behrman, et al. Strategies to avoid the loss of developmental potential in more than 200 million children in the developing world. *Lancet* 2007; **369**: 229–42.

7 Heckman J, Knudsen E, Cameron J, Shonkoff J. Economic, neurobiological and behavioral perspectives on building America's future workforce. *World Economics* 2006; **7**: 320–64.

8 United Nations Children's Fund. Inequalities in early childhood development: What the data say. New York, NY: UNICEF, 2012. http://www.unicef.org/lac/Inequities_in_Early_Childhood_Development_LoRes_PDF_EN_02082012(1).pdf (accessed Feb 5, 2016).

9 African Child Policy Forum. The African report on child wellbeing: budgeting for children. Addis Ababa, The African Child Policy Forum. 2011. http://resourcecentre.savethechildren.se/sites/default/files/documents/3764.pdf (accessed Feb 5, 2016).

10 United Children's Fund (UNICEF). Improving child nutrition: the achievable imperative for global progress. New York: UNICEF, 2013. http://www.unicef.org/gambia/Improving_Child_Nutrition_-_the_achievable_imperative_for_global_progress.pdf (accessed Feb 5, 2016).

11 Grantham-McGregor S Cheung YB, Cueto S, et al. Developmental potential in the first 5 years for children in developing countries. *Lancet* 2007; **369:** 60–70.

12 Shiffman J, Quissell K, Schmitz HP, et al. A framework on the emergence and effectiveness of global health networks. *Health Policy Plan* 2016; **31** (suppl 1): i3–16.

13 Shiffman J, Schmitz HP, Berlan D, et al. The emergence and effectiveness of global health networks: findings and future research. *Health Policy Plan* 2016; **31** (suppl 1): i110–23.

14 Shiffman J, Smith S. Generation of political priority for global health initiatives: a framework and case study of maternal mortality. *Lancet* 2007; **370**: 1370–79.

15 Bradley EH, Curry LA, Devers KJ. Qualitative data analysis for health services research: developing taxonomy, themes, and theory. *Health Serv Res* 2007; **42**: 1758–72.

16 Penn, H. Understanding early childhood: issues and controversies. Maidenhead: McGraw-Hill Education, 2014; 202.

17 Lannen P, Ziswiler M. Potential and perils of the early years: the need to integrate violence prevention and early child development (ECD+). *Aggress Violent Behav* 2014; **19**: 625–28.

18 Efevbera Y, McCoy DC, Wuermli AJ, Betancourt TS. Early childhood development plus violence prevention in low–and middle–income countries: a qualitative study. *Children & Society* 2016; published online June 24. DOI:10.1111/chso.12169.

19 WHO and UBS Optimus Foundation. Meeting report: ECD+ workshop preceding the WHO's 6th Milestones in the Global Campaign for Violence Prevention Meeting. Mexico City, Mexico; 2013. http://www.who.int/violence_injury_prevention/violence/child/ecd_workshop.PDF (accessed Feb 5, 2016).

20 Debissa DA, Sayre R, Wodon Q, Elder L, Rawlings L, Lombardi J. Stepping up early childhood development: investing in young children for high returns. Washington: DC, World Bank, 2014.

21 World Bank. What matters most for early childhood development: a framework paper. In SABER Working Paper Series. Volume 5. Washington, DC: The World Bank, 2013 http://wbgfiles.worldbank.org/documents/hdn/ed/saber/supporting_doc/Background/ECD/Framework_SABER-ECD.pdf (accessed Feb 5, 2016).

22 Black MM, Dewey KG. Promoting equity through integrated early child development and nutrition interventions. *Ann N Y Acad Sci* 2014; **1308:** 1–10.

23 Center on the Developing Child at Harvard University. A science-based framework for early childhood policy: using evidence to improve outcomes in learning, behavior, and health for vulnerable children. 2007. http://www.developingchild.harvard.edu (accessed Feb 5, 2016).

24 The Consultative Group on Early Childhood Care and Development. 4 cornerstones of early childhood care and development. 2007. http://www.ecdgroup.com/about-eccd-2/4-cornerstones/ (accessed Feb 5, 2016).

25 Behrman JR, Urzúa S. Economic perspectives on some important dimensions of early childhood development in developing countries. In: Rebello Britto P, Engle PL, Super CM, eds. Handbook of early childhood development: translating research to global policy. New York: Oxford University Press, 2013: 123–41.

26 UNESCO. Early childhood care? Development? Education? UNESCO Policy Briefs on Early Childhood. 2002. http://www.unesco.org/education/pdf/ecf_dev_ed.pdf (accessed Feb 5, 2016).

27 Pelletier D, Neuman MJ. Advancing the nutrition and early childhood development agenda: indicators and guidance. *Ann N Y Acad Sci* 2014; **1308:** 232–44.

28 Maunganidze L, Tsamaase M. Early childhood education in Botswana: a case of fragmented "fits". *Int Educ Stud* 2014; **7:** 1–7.

29 Neuman, M. Good governance of early childhood care and education: lessons from the 2007 Education for All Global Monitoring Report. UNESCO Policy Briefs. Paris: UNESCO, 2007.

30 Britto PR, Yoshikawa H, Van Ravens J, et al. Understanding governance of early childhood development and education systems and services in low-income countries. New Haven, CT: Yale Child Study Center, 2013.

31 DiGirolamo AM, Stansbery P, Lung'aho M. Advantages and challenges of integration: opportunities for integrating early childhood development and nutrition programming. *Ann N Y Acad Sci* 2014; **1308:** 46–53.

32 Saving Brains. Innovations. http://www.savingbrainsinnovation.net (accessed Aug 19, 2016).

33 World Bank. World Bank Group, UNICEF urge greater investment in early childhood development. April, 2016. http://www.worldbank.org/en/news/press-release/2016/04/14/world-bank-group-unicef-urge-greater-investment-in-early-childhood-development (accessed Aug 19, 2016).

34 Vargos-Baron E. Paper commissioned for the EFA Global Monitoring Report 2015. Policies on early childhood care and education: their evolution and some impacts. UNESCO, 2015. http://unesdoc.unesco.org/images/0023/002324/232459e.pdf (accessed Feb 5, 2016).

35 UNESCO. HEDCI framework. 2014. http://unesdoc.unesco.org/images/0022/002291/229188e.pdf (accessed Feb 5, 2016).

36 UNESCO. Global Monitoring Report. 2012. http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/ED/pdf/gmr2012-report-ch1.pdf (accessed Feb 5, 2016).

37 World Bank. SABER in action. Early childhood development: nurturing healthy children to reach their full potential. 2015. http://wbgfiles.worldbank.org/documents/hdn/ed/saber/supporting_doc/in_actions/SABER_in_Action_Early_Childhood_Development.pdf (accessed Feb 5, 2016).

38 Zuilkowski SS, Fink G, Moucheraud C, Matafwali B. Early childhood education, child development and school readiness: Evidence from Zambia. *S Afr J Child Educ* 2012; **2:** 117–36.

39 Fink G, Peet E, Danaei G, et al. Schooling and wage income losses due to early-childhood growth faltering in developing countries: national, regional, and global estimates. *Am J Clin Nutr* 2016, **104:** 104–12.

40 Naudeau S. Investing in young children: an early childhood development guide for policy dialogue and project preparation. Washington: World Bank Publications, 2011.

41 McCoy DC, Peet ED, Ezzati M, et al. Early childhood developmental status in low-and middle-income countries: national, regional, and global prevalence estimates using predictive modeling. *PLoS Med* 2016; **13:** e1002034.

42 Campbell F, Conti G, Heckman JJ, et al. Early childhood investments substantially boost adult health. *Science* 2014; **343:** 1478–85.

43 Schweinhart LJ, Montie J, Xiang Z, et al. Lifetime effects: The HighScope Perry Preschool study through age 40. (Monographs of the HighScope Educational Research Foundation, 14). Ypsilanti, MI: HighScope Press, 2005.

44 Shonkoff JP, Richter L, van der Gaag J, Bhutta ZA. An integrated scientific framework for child survival and early childhood development. *Pediatrics* 2012; **129:** e460–72.

45 Jaramillo A, Mingat A. Early childhood care and education in Sub-Saharan Africa: what would it take to meet the millennium development goals. *Africa's Future, Africa's Challenge* 2003; 51–70.

46 Malone EW, Shawar YR, Shiffman J. Insights from public administration scholarship for addressing global health governance challenges. In: Kim S, Ashley S, Lambright WH, ed. Public administration in the context of global governance. Northampton: Edward Elgar Publishing, 2014: 189–201.

47 Ansell C, Gash A. Collaborative governance in theory and practice. *J Public Adm Res Theory* 2008; **18:** 543–71.

48 Quissell K, Walt G. The challenge of sustaining effectiveness over time: the case of the global network to stop tuberculosis. *Health Policy Plan* 2016; **31** (suppl 1): 17–32.

49 Provan KG, Lemaire RH. Core concepts and key ideas for understanding public sector organizational networks: using research to inform scholarship and practice. *Public Adm Rev* 2012; **72:** 638–48.

Global research priorities to accelerate early child development in the sustainable development era

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Between 1990 and 2015, the under-5 mortality rate declined by 53%, resulting in approximately 48 million more children reaching their fifth birthday than would have occurred had 1990 mortality rates continued.[1] Many of these children, however, continue to live in conditions of adversity—marked by extreme poverty, undernutrition, conflict, and insecurity—and are not afforded the level of care required to ensure that they meet their developmental potential.[2] Neuroscience research in the past two decades is unequivocal that the period from conception through early childhood (ie, at least the first 3 years) is foundational in terms of brain development. There is increasing evidence (mostly from high-income countries) that delivering quality interventions in the early years is cost-effective,[3] reduces health inequities,[4] improves learning and academic attainment,[5] lowers crime and violence,[5] and can substantially improve adult health and economic productivity.[6] For the first time, the foremost global development framework—the new Sustainable Development Goals (SDGs)—includes child development, under target 4.2.[7] This is also reflected in the new Global Strategy for Women's, Children's and Adolescents' Health (2016–2030),[8] within which one of the core objectives is to ensure that all women, children, and adolescents have an equal chance to thrive (and not simply survive). Thus, any research agenda that aims to give young children the chance to both survive and thrive must ensure that early child development (ECD) is prioritised in order to inform policy and programmatic implementation and achieve the SDG target. Although the scientific evidence is clear, donor and policy neglect of ECD has been striking. Recently however, high-level support for ECD has been emerging,[9,10] including in the

	Ranking
Improve awareness and promotion	
What are cost-effective ways to promote an understanding of child development at the community level?	25
What is the impact of demand-side strategies designed to reduce access barriers for poor and vulnerable groups on pre-primary enrolment?	27
What is the impact of social mobilisation campaigns on use of positive discipline?	40
Advance identification of risk factors, and better understanding of the burden	
What factors contribute to growth and development recovery following early nutritional deficiencies?	14
What is the strength of association between stunting and cognitive development?	28
What are the most appropriate tools for population-level assessment of development in children <8 years in resource limited settings at scale?	29
Improve impact of interventions	
Can early child development packages focusing on nurturing care and parent support improve child cognitive development in rural low-income settings?	1
What approaches to improve quality of early childhood care and education programmes result in improved developmental outcomes for young children?	2
What is the impact and sustainability of nutritional supplementation to improve the physical and cognitive health of children?	5
Enhance implementation of interventions	
Can community health workers/paraprofessionals be trained to deliver ECD interventions effectively?	3
Can group-based parenting support programmes in the postnatal period increase self-efficacy of new mothers?	8
Are group-based interventions more effective than home visiting to deliver ECD interventions?	10
Expand integration and coordination	
Would the integration of an ECD counselling model within an integrated maternal, newborn, and child health strategy lead to better child development outcomes?	4
Can ECD programmes be taken to scale and maintain the degree of integrity/fidelity necessary to assure effectiveness?	11
Can ECD programmes be integrated with existing routine health care visits?	12
Increase understanding of health economics and social protection strategies	
What are the additive costs of integrating health/nutrition interventions into early childhood education programmes?	6
What is the impact of unconditional cash transfer programmes in pregnancy on child development?	17
What are the most cost-effective parenting interventions to promote ECD?	21

ECD=early child development.

***Table*: Top three priority research questions in each thematic goal**

recent *Lancet* series.[11–13] To optimise the impact of this new momentum, ECD research prioritisation is required.

Between February and November, 2015, we conducted a priority-setting exercise to set research priorities for ECD to 2025. This is part of WHO's larger initiative to set priorities for maternal, newborn, child, and adolescent health. We used the Child Health and Nutrition Research Initiative (CHNRI) methodology for setting priorities in health research investments because: (a) it is a carefully developed and documented conceptual framework available in the public domain; (b) it has demonstrated usefulness in several previous exercises; and (c) it is increasingly being used by policy makers, large donors, and international organisations.[14,15] We adapted a set of five criteria from the CHNRI methodology—answerability, effectiveness, feasibility, impact, and effect on equity—against which an expert group scored research investment priorities. Library searches and snowball sampling were used to identify 348 experts (both researchers and programme experts) who were then approached by email to provide their three to five top research questions. 74 participants responded, generating 406 research questions, which we then collated into a composite set of questions by eliminating redundancies and overlaps, excluding irrelevant questions, and identifying thematic areas. This process yielded 54 questions that were then scored by 69 of the original experts against the five criteria outlined above. Composite scores ranging from 0 to 100% were calculated for each research question. The experts who completed scoring were geographically diverse, with 7% from WHO African Region, 34% from the Americas, 5% from Eastern Mediterranean Region, 18% from European Region, 11% from South-East Asian Region, and 8% from Western Pacific Region; 18% considered themselves international (WHO or UNICEF or international non-governmental organisations or agencies).

The research questions were organised by six thematic goals. The table presents the goals and the top three research questions for each of the goals, including their ranking. Research priority scores among the top 10 priorities ranged from 82% to 87%. All of the top-ranked priorities were related to the impact of implementation of interventions, whether by community health workers or through increased support to parents and families. Three of the top 10 ranked priorities related to integration, such as integrating ECD services within maternal, newborn, and child health services or the additive costs of integrating health or nutrition interventions into early childhood education programmes. There were no questions in the top 10 about epidemiology, basic science, or discovery, although questions arose about interactions between nutrition and physical and cognitive development.

The results of this process clearly indicate that the crucial priorities for future research relate to the need for services and support to parents to provide nurturing care and the training of health workers and non-specialists. What is most striking about the top-ranked priorities is the emphasis on creating enabling environments to support families in providing nurturing care for young children, which is a key message of *The Lancet* series on Early Child Development.[11–13] In addition, the emphasis on integration is important—also emphasised in *The Lancet* series—as it speaks to the importance of implementing programmes using existing delivery platforms such as maternal and child health and nutrition services.[13] Given the current global focus on quality of care, the high priority given to questions of maintaining impact when going to scale is important as well as improving the policy environment, improving quality of interventions, and increasing effectiveness and improving demand.

Currently, research funding for the "thrive" component of the Global Strategy is lower than for the survival agenda for children. The SDG agenda places ECD in the centre of global efforts to improve human capital. We encourage international organisations, national governments, research institutes, and donors to consider the findings of this exercise in order to address key gaps in our knowledge and enhance the ECD agenda and the achievement of the SDGs.

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1 UNICEF. For every child, a fair chance: the promise of equity. New York: UNICEF, 2015.

2 Grantham-McGregor S, Cheung YB, Cueto S, et al. Developmental potential in the first 5 years for children in developing countries. *Lancet* 2007; **369:** 60–70.

3 Heckman JJ. Skill formation and the economics of investing in disadvantaged children. *Science* 2006; **312:** 1900–02.

4 Marmot M, Friel S, Bell R, Houweling TA, Taylor S. Closing the gap in a generation: health equity through action on the social determinants of health. *Lancet* 2008; **372:** 1661–69.

5 Reynolds AJ, Temple JA, Robertson DL, Mann EA. Long-term effects of an early childhood intervention on educational achievement and juvenile arrest: a 15-year follow-up of low-income children in public schools. *JAMA* 2001; **285:** 2339–46.

6 Campbell F, Conti G, Heckman JJ, et al. Early childhood investments substantially boost adult health. *Science* 2014; **343:** 1478–85.

7 United Nations. Transforming our world: the 2030 Agenda for Sustainable Development. http://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E (accessed Nov 24, 2015).

8 Every Woman Every Child. The Global Strategy for Women's, Children's and Adolescent's Health (2016-2030). New York: United Nations, 2015.

9 Chan M. Linking child survival and child development for health, equity, and sustainable development. *Lancet* 2013; **381:** 1514–15.

10 Lake A, Chan M. Putting science into practice for early child development. *Lancet* 2014; **385:** 1816–17.

11 Black MM, Walker SP, Fernald LC, et al, for the Lancet Early Childhood Development Series Steering Committee. Early childhood development coming of age: science through the life course. *Lancet* 2016; published online Oct 4. http://doi.org/10.1016/S0140-6736(16)31389-7.

12 Britto PR, Lyes S, Proulx K, et al, with the Early Childhood Development Interventions Review Group, for the Lancet Early Childhood Development Series Steering Committee. Nurturing care: promoting early childhood development. *Lancet* 2016; published online Oct 4. http://doi.org/10.1016/S0140-6736(16)31390-3.

13 Richter LM, Daelmans B, Lombardi J, et al, with the Paper 3 Working Group, for the Lancet Early Childhood Development Series Steering Committee. Investing in the foundation of sustainable development: pathways to scale up for early childhood development. *Lancet* 2016; published online Oct 4. http://doi.org/10.1016/S0140-6736(16)31698-1.

14 Rudan I, Kapiriri L, Tomlinson M, Balliet M, Cohen B, Chopra M. Evidence-based priority setting for health care and research: tools to support policy in maternal, neonatal, and child health in Africa. *PLoS Med* 2010; **7:** e1000308.

15 Rudan I, Chopra M, Kapiriri L, et al. Setting priorities in global child health research investments: universal challenges and conceptual framework. *Croat Med J* 2008; **49:** 307–17.

Risk of poor development in young children in low-income and middle-income countries: an estimation and analysis at the global, regional, and country level

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Summary

Background A 2007 study published in *The Lancet* estimated that approximately 219 million children aged younger than 5 years were exposed to stunting or extreme poverty in 2004. We updated the 2004 estimates with the use of improved data and methods and generated estimates for 2010.

Methods We used country-level prevalence of stunting in children younger than 5 years based on the 2006 Growth Standards proposed by WHO and poverty ratios from the World Bank to estimate children who were either stunted or lived in extreme poverty for 141 low-income and middle-income countries in 2004 and 2010. To avoid counting the same children twice, we excluded children jointly exposed to stunting and extreme poverty from children living in extreme poverty. To examine the robustness of estimates, we also used moderate poverty measures.

Findings The 2007 study underestimated children at risk of poor development. The estimated number of children exposed to the two risk factors in low-income and middle-income countries decreased from 279·1 million (95% CI 250·4 million–307·4 million) in 2004 to 249·4 million (209·3 million–292·6 million) in 2010; prevalence of children at risk fell from 51% (95% CI 46–56) to 43% (36–51). The decline occurred in all income groups and regions with south Asia experiencing the largest drop. Sub-Saharan Africa had the highest prevalence in both years. These findings were robust to variations in poverty measures.

Interpretation Progress has been made in reducing the number of children exposed to stunting or poverty between 2004 and 2010, but this is still not enough. Scaling up of effective interventions targeting the most vulnerable children is urgently needed.

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Introduction

Early child development forms the foundation of adult health and wellbeing and is a necessary component of the Sustainable Development Goals (SDGs). Recognition of the formative aspect of early childhood has increased emphasis on reducing risks for poor child development.[1] Improvement of measures for global prevalence of children at risk of poor development is necessary to accurately assess challenges, effectiveness of interventions, gauge progress, and plan future investment.

Quantification of young children with poor development is challenging because there are, as yet, no established global standards for measuring child development, nor are there population-representative data for children's early skills in low-income and middle-income countries. Available evidence from low-income and middle-income countries suggests that children's early exposure to stunting and poverty is closely associated with deficits in their subsequent cognitive and social-emotional development, their educational performance, adulthood income, and risks of chronic diseases.[2–10] In the 2007 *Lancet* Child Development in Developing Countries Series,[2] stunting and poverty were used to estimate the number of children aged younger than 5 years who were at risk of not fulfilling their developmental potential, an indicator of poor child development. About 219 million children, 39% of children younger than 5 years in low-income and middle-income countries in 2004, were estimated to be exposed to one of these two risk factors.[2] The estimated average deficit in adult annual income, resulting from deficits in schooling associated with stunting or extreme poverty, was 19·8%.[2]

Major advances in the availability of data have occurred since 2007 when the 2004 estimates were made. New data for stunting and poverty have become available with a revised definition of stunting (WHO)[11] and extreme poverty (World Bank),[12,13] leading to upward revised estimates of both.[11–13] As a result of improved data availability and use of micro-level data, we were able to produce better quality data for generating direct measures of country-level estimates for stunting and poverty. With use of the most updated data and the new definitions of stunting and extreme poverty, we updated the 2004 estimates and applied the same methods to produce estimates for 2010—the year that most developing countries had stunting and poverty data

Research in context

Evidence before this study

The 2007 Lancet Child Development in Developing Countries Series estimated that, in 2004, approximately 219 million children younger than 5 years were at risk of not fulfilling their developmental potential because of their exposure to stunting or poverty. We searched PubMed for studies in English published between Jan 1, 2008, and Dec 31, 2015, measuring the number and prevalence of children exposed to stunting or extreme poverty at the global level, with the keywords "early child development" in abstracts. Our search yielded no publications during the period.

Added value of this study

With use of the most updated data for stunting and extreme and moderate poverty based on revised definitions and improved estimation methods, our study adds to the body of knowledge about the prevalence of children at risk of poor development, measured by children at risk of not fulfilling their development potential resulting from exposure to stunting or extreme poverty, by updating the 2004 estimates and producing estimates for 2010. We also expanded the definition of children at risk of poor development by producing a set of estimates including children exposed to moderate poverty. The analysis enables us to estimate the progress in reducing children at risk of poor development between 2004 and 2010. With expanded availability of micro-level and macro-level data, we were able to develop estimation and validation methods for missing data and we produced the first set of child-level poverty ratios for a subset of countries. We did sensitivity tests for estimates with the use of various poverty measures. These efforts improved the accuracy and comparability of the estimates, and allowed disparity analyses across and within countries.

We found that progress has been made during the period, but unevenly across regions, with sub-Saharan Africa having the smallest reduction and the highest prevalence of children at risk of poor development. A significant disparity in exposure to risk factors of early development between income groups has been observed, and disproportionate exposure to the risk of poor development was found in low-income countries.

Implications of all the available evidence

The evidence in this study taken together with previous evidence clearly indicates that the challenge to improve child development is large and requires immediate action, such as political prioritisation of efforts to scale up effective interventions targeting the most vulnerable children.

available at the time of this analysis. The exercise allowed us to examine whether progress has been made over time in reducing the prevalence of young children at risk of poor development. With available nationally representative household surveys, we were able to improve estimation for missing data and produce estimates of the percentage of children younger than 5 years living in extreme poverty or moderate poverty for a subset of countries. We also did sensitivity tests with the use of various poverty measures.

See Online for appendix

Methods

Definitions and data sources

We followed the strategy used previously[2] and measured the number of children aged younger than 5 years who had been exposed to stunting or extreme poverty. Estimation was done in 2004 and 2010 at the country, regional, and global levels for 141 low-income and middle-income countries, including 40 low-income countries, 56 lower-middle-income countries, and 45 upper-middle-income countries, classified by the World Bank in 2010[14] (appendix p 1).

Child stunting was defined as height-for-age below –2 SDs from the median of the international reference population recommended by WHO in 2006.[11] We took the definition of extreme poverty by the World Bank (living on less than US$1·25 per day at 2005 international prices) to measure children living in extreme poverty.[15] To test the sensitivity of estimates, we also expanded our estimation of children at risk by including children living in moderate poverty (living on less than $2 per day, according to the World Bank[15]).

Data sources for country-level populations younger than 5 years, stunting prevalence of children younger than 5 years, and the percentage of the population living in extreme or moderate poverty are presented in the appendix (p 1). We chose to use estimates of stunting prevalence and their uncertainties published in *The Lancet* because these data have the largest number of countries with available estimates (126 countries in our sample; appendix p 1) in 2004 and 2010.[16] We imputed the stunting prevalence for the remaining 15 countries (2% of total child populations in the 2 years; appendix p 2).

Data for the percentage of children aged younger than 5 years living in extreme poverty were not available. We addressed this issue in two ways. First, we used the 2007 assumption and used population-level poverty ratios produced by the World Bank;[2] and second, we generated child-level poverty ratios using nationally representative population-based surveys for a subset of countries.

Of the 141 countries analysed, the World Bank had estimates for 109 countries between 2000 and 2012 (median for years with available data: 2006 [IQR 2003–09]) on the percentage of the total population living below the extreme ($1·25) or moderate ($2) poverty line; 48 countries had poverty measures in 2004 (49·3% of the

total population younger than 5 years) and 42 countries had poverty measures in 2010 (45·3% of the total population younger than 5 years). For countries without poverty measures in 2004 and 2010, we estimated poverty as described in the appendix (p 3).

Evidence has shown that children younger than 12 years have the highest poverty rates among all age groups, especially in low-income countries.[17] The assumption that poverty ratios in children younger than 5 years are the same as those for the total population could lead to underestimation of children aged younger than 5 years living in poverty. We estimated country-level percentages of children aged younger than 5 years exposed to extreme or moderate poverty for a subset of countries using micro-level data such as the Demographic and Health Surveys[18] or the Multiple Indicator Cluster Surveys.[19] Estimation details are presented in the appendix (p 10). The mean of child-level poverty ratios across the countries was not significantly different from the mean of population-level poverty ratios across the same countries, which might be because more than half of the countries in this subset were in the middle-income group.

Estimation of children at risk of poor development

When we added numbers of children stunted to numbers of children living in poverty, to avoid counting children exposed to both stunting and extreme poverty twice, we constructed a dichotomous variable indicating a child exposed to poverty but not stunting using household surveys in 86 countries and obtained the percentage of children living in poverty but not stunting with 95% CIs for the 86 countries. Children jointly exposed to stunting and extreme poverty were excluded from children living in extreme poverty. For the 55 countries without micro-level data (approximately 23% of the total child population), we replaced their missing values in the 2 years with the average percentage of children living in poverty but not stunted by their income groups (appendix, p 13).

With the use of stunting prevalence (with 95% CIs) and the percentage of children living in extreme or moderate poverty but not stunted (with 95% CIs) for the 141 low-income and middle-income countries, we generated two sets of estimates with uncertainty levels for the number and prevalence of children at risk in 2004 and 2010 at the country, regional, and global levels. For the subset of countries with estimates of child-level poverty ratios, we also produced two sets of estimates in 2004 and in 2010. We analysed the change in level, prevalence, and trends of children at risk between 2004 and 2010 and examined the robustness of results by comparing the estimates derived from various poverty measures.

Role of the funding source

The funders of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report. The corresponding author had full access to all the data in the study and had final responsibility for the decision to submit for publication.

	2004	2010
Total number of children in population aged younger than 5 years (in millions)	547·0	575·6
Children at risk of poor development (in millions)		
Stunting or extreme poverty	279·1 (250·4–307·4)	249·4 (209·3–292·6)
Stunting or moderate poverty	353·7 (322·3–384·8)	324·2 (281·4–370·1)
Prevalence of children at risk (%)		
Stunting or extreme poverty	51% (46–56)	43% (36–51)
Stunting or moderate poverty	65% (59–70)	56% (49–64)

Data are n (95% CI) or % (95% CI), unless otherwise specified.

Table 1: **Children at risk of poor development based on stunting or living in extreme or moderate poverty in 141 countries in 2004 and 2010**

Results

Although our recalculation of the 2004 estimate included fewer countries (141) than were included in the calculation by Grantham-McGregor and colleagues (156),[2] our 2004 estimate of children at risk (279 million) is higher than the Grantham-McGregor and colleagues' estimate (219 million), suggesting that improved data availability showed higher estimates of children with poor development. Our analysis of the driving forces behind the difference is shown in the appendix (p 21).

Although the population of children aged younger than 5 years in the 141 low-income and middle-income countries has risen from 547 million in 2004 to 576 million in 2010; there was a decline in both the level and prevalence of children at risk of poor development during this period. When extreme poverty ratios were used, the number of children at risk fell from 279·1 million (95% CI 250·4 million–307·4 million) in 2004 to 249·4 million (209·3 million–292·6 million) in 2010 (table 1). The prevalence of children at risk fell from 51% (95% CI 46–56) in 2004 to 43% (36–51) in 2010.

The use of moderate poverty ratios led to a considerable increase in the number and prevalence of children at risk in both 2004 and 2010 compared to the estimates using extreme poverty, but a decrease in the number of children at risk from 2004 (353·7 million [95% CI 322·3 million–384·8 million]) to 2010 (324·2 million [281·4 million–370·1 million]) was still observed. A decrease in prevalence between 2004 and 2010 was also noted (table 1).

The prevalence of stunting reduced from 190·6 million (35% of child population) in 2004 to 173·7 million (30%) in 2010, and the prevalence of extreme poverty reduced from 174·3 million (32%) in 2004 to 141·8 million (25%) in 2010. In children exposed to both stunting and extreme poverty, the difference between children at risk and the sum of children stunted and living in extreme poverty reduced from 85·8 million in 2004 (16%) to 66·1 million in 2010 (12%). The number of children living in extreme

	Total population aged younger than 5 years (in millions)		Prevalence of stunting (in millions)		Number living with <US$1·25 per day (in millions)		Number living with <$2 per day (in millions)		Number at risk ($1·25; in millions)		Number at risk ($2; in millions)	
	2004	2010	2004	2010	2004	2010	2004	2010	2004	2010	2004	2010
East Asia and the Pacific	136·2	145·7	34·1 (25%)	29·6 (20%)	30·2 (22%)	18·2 (12%)	62·0 (46%)	43·5 (30%)	54·7 (40%)	41·7 (29%)	75·5 (55%)	58·7 (40%)
Europe and central Asia	25·4	27·9	4·8 (19%)	4·8 (17%)	1·1 (4%)	0·8 (3%)	3·0 (12%)	2·0 (7%)	5·6 (22%)	5·4 (19%)	7·0 (28%)	6·3 (23%)
Latin America and the Caribbean	56·8	54·1	9·1 (16%)	8·0 (15%)	4·9 (9%)	3·0 (6%)	10·1 (18%)	6·0 (11%)	11·6 (21%)	9·7 (18%)	15·3 (27%)	11·9 (22%)
Middle east and north Africa	32·3	36·5	8·0 (25%)	8·6 (24%)	1·1 (3%)	1·0 (3%)	5·9 (18%)	5·3 (15%)	8·7 (27%)	9·1 (25%)	11·9 (37%)	12·1 (33%)
South Asia	171·4	168·1	80·6 (47%)	67·6 (40%)	69·5 (41%)	46·5 (28%)	126·6 (74%)	105·8 (63%)	110·9 (65%)	88·8 (53%)	140·8 (82%)	119·7 (71%)
Sub-Saharan Africa	124·9	143·3	53·9 (43%)	55·1 (38%)	67·5 (54%)	72·3 (50%)	94·9 (76%)	104·4 (73%)	87·6 (70%)	94·8 (66%)	103·3 (83%)	115·5 (81%)
Total	547·0	575·6	190·6 (35%)	173·7 (30%)	174·3 (32%)	141·8 (25%)	302·5 (55%)	267·0 (46%)	279·1 (51%)	249·4 (43%)	353·7 (65%)	324·2 (56%)

Data are n (%), unless otherwise specified.

Table 2: **Regional estimates of number (in millions) and prevalence of children at risk of poor development in 2004 and 2010 using extreme or moderate poverty ratios in 141 countries**

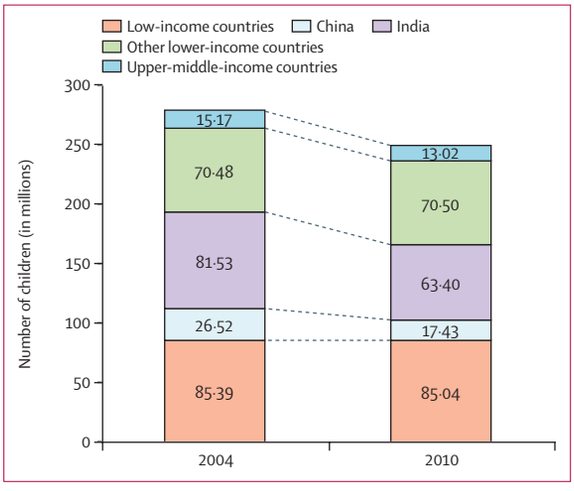

Figure 1: **Number of children exposed to stunting or extreme poverty by country income group**

poverty but not stunted (calculated from the difference between number of children living in extreme poverty and number of children with joint exposure) reduced from 88·5 million (16%) in 2004 to 75·7 million (13%) in 2010. The number of children stunted but not in poverty increased from 104·8 million (19%) in 2004 to 107·6 million (19%) in 2010.

The prevalence of both risk factors declined in all regions during the period. South Asia had the largest drop in both the number and prevalence of children exposed to stunting or extreme poverty, followed by east Asia and the Pacific region. Accompanied by about a 16% increase in the population aged younger than 5 years in the region, sub-Saharan Africa had a rise in the number of children exposed to stunting and poverty, but the prevalence of the two risk factors also declined. Sub-Saharan Africa remained the region with the highest prevalence of children at risk in both years (table 2). The findings were robust when the moderate poverty measure was used.

With the use of extreme poverty measures, we observed a decrease in number of children at risk in all three income groups from 2004 to 2010 (figure 1). Lower-middle-income countries (including China and India) had the largest fall among the three income groups, from 178·5 million to 151·3 million. Upper-middle-income countries fell from 15·17 million in 2004 to 13·02 million in 2010, whereas low-income countries had almost no change (figure 1). China and India are the two countries with the largest populations of children younger than 5 years and have made substantial progress in reducing poverty in the past decade. If India and China were excluded from the lower-middle-income countries, almost no reduction in risk in lower-middle-income countries would be noted during this period (70·48 million in 2004 *vs* 70·50 million in 2010; figure 1). In 2004, 31% of children at risk were from low-income countries, and this increased to 34% in 2010 when extreme poverty measures were used. The findings were robust when using the moderate poverty measure (appendix p 22), suggesting that India and China were the leading force for the reduction of children at risk.

From 2004 to 2010, the prevalence of children at risk of poor development was reduced in all three income groups; low-income countries had the smallest rate of decline. There was a striking disparity in the prevalence across income groups. In 2004, when the extreme poverty measures were applied, the percentage of children at risk was 71% in low-income countries, 39% in

lower-middle-income countries, and 18% in the upper-middle-income countries. The large difference in prevalence between country income groups remained unchanged in 2010. The findings were robust when moderate poverty measures were used (figure 2).

Country-level percentage change in the prevalence of children at risk between 2004 and 2010 when extreme poverty measures were used is shown in figure 3. Of the 141 countries assessed, 123 had reductions in prevalence. Among 27 countries with reduction of 20% or more, 23 were middle-income countries including Vietnam (45%, the largest rate of decline), China (40%, the second largest rate of decline), and India at margin (by 20%). Six sub-Saharan countries also declined by more than 20% (Angola, Botswana, Cape Verde, Congo Brazzaville, Mauritania, and South Africa). Of the 17 countries with no change or an increase in prevalence of children at risk of poor development, 11 were in sub-Saharan Africa.

In 2010, 34 countries had a prevalence of children at risk of 60% or higher: 30 from the low-income group and 28 from sub-Saharan Africa (figure 3). The top ten countries with the largest number of children at risk in 2010 were India, China, Nigeria, Bangladesh, Indonesia, Pakistan, Ethiopia, DR Congo, Tanzania, and the Philippines, the same countries identified in 2004. The sum of children at risk in these ten countries accounted for 64% of all children at risk in 2010. Country-level estimates of children at risk in 141 countries between 2004 and 2010 are presented in the appendix (p 22).

Use of child-level poverty ratios yielded higher numbers of children living in poverty and at risk of poor development than did the population-level poverty ratio. For example, for 68 countries in 2004, the number of children living in extreme poverty was 130 million when using population-level poverty ratio and 145 million when using the child-level poverty ratio. The number of children at risk derived from the child-level extreme poverty ratio was 7 million higher than that derived from the population-level extreme poverty ratio (appendix p 26). The findings were consistent when moderate poverty measures were used.

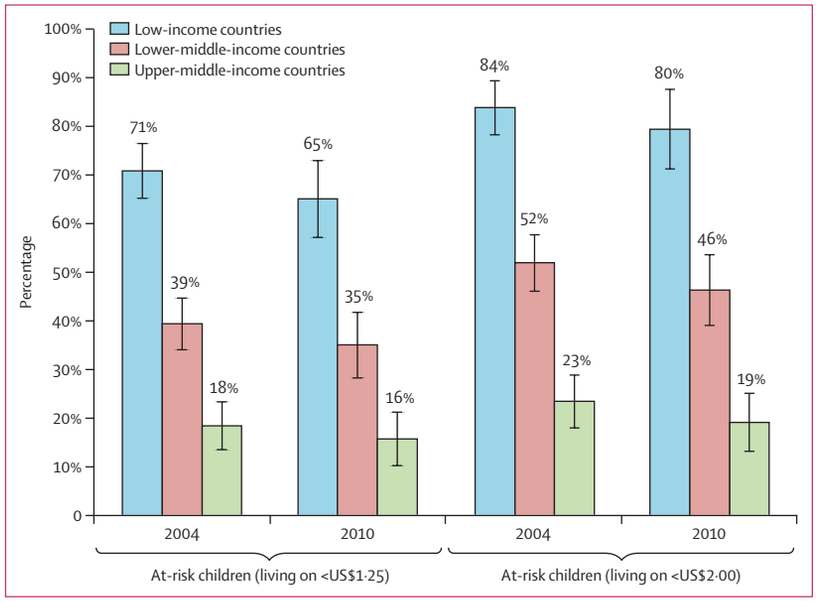

Figure 2: **Prevalence of children at risk of poor development by country income group in 2004 and 2010 using extreme and moderate poverty measures**

Discussion

Driven by the decline in both stunting and poverty prevalence in children younger than 5 years between 2004 and 2010, especially in China and India, a noticeable reduction was observed in both number and prevalence of children at risk of poor development in the 141 low-income and middle-income countries between 2004 and 2010, even though the child population has increased in this time. The declining trend and regional profile remained unchanged when the two different poverty measures (extreme and moderate) were used.

Progress, however, was uneven across regions, with sub-Saharan Africa having the smallest reduction and the highest prevalence of children at risk during this time period. One notable concern is that disparity in exposure to risk factors between income groups improved little during this period, with a disproportionate exposure to the risks for poor child development in low-income countries.

This study shows encouraging, yet insufficient, progress in reducing risks for poor child development from 2004 to 2010. In 2010, at least 43% of children aged younger than 5 years were at risk of not fulfilling their development potential because of exposure to stunting or extreme poverty; and the prevalence increased to 56% when extreme poverty measures were replaced with moderate poverty measures. Even in south Asia, a region with the greatest progress during the period, more than half of the children were exposed to stunting or extreme poverty in 2010. The evidence clearly indicates that the challenge to improve child development, and thereby human capital and health, remains large in the next decade. The pace of reducing stunting and poverty will have to increase substantially for the vulnerable children, especially in low-income countries.

The present study extended the availability of data in the study by Grantham-McGregor and colleagues[2] and applied updated methods. However, two limitations remain. First, although poverty and stunting are strongly associated with risks for poor child development, other risks for poor development exist that are not necessarily associated with poverty and stunting, such as maternal depression, violence against children, or adverse environmental conditions. Low maternal schooling affects the amount and quality of cognitive stimulation provided to young children.[20,21] Recent reviews on studies of violence against children concluded that the prevalence of child maltreatment worldwide is high and puts millions of children at risk of poor development.[22,23] Children exposed to multiple risk factors have a greater likelihood of poor adult health and wellbeing.[24] A pioneering study in the 15 countries with available data on low maternal schooling

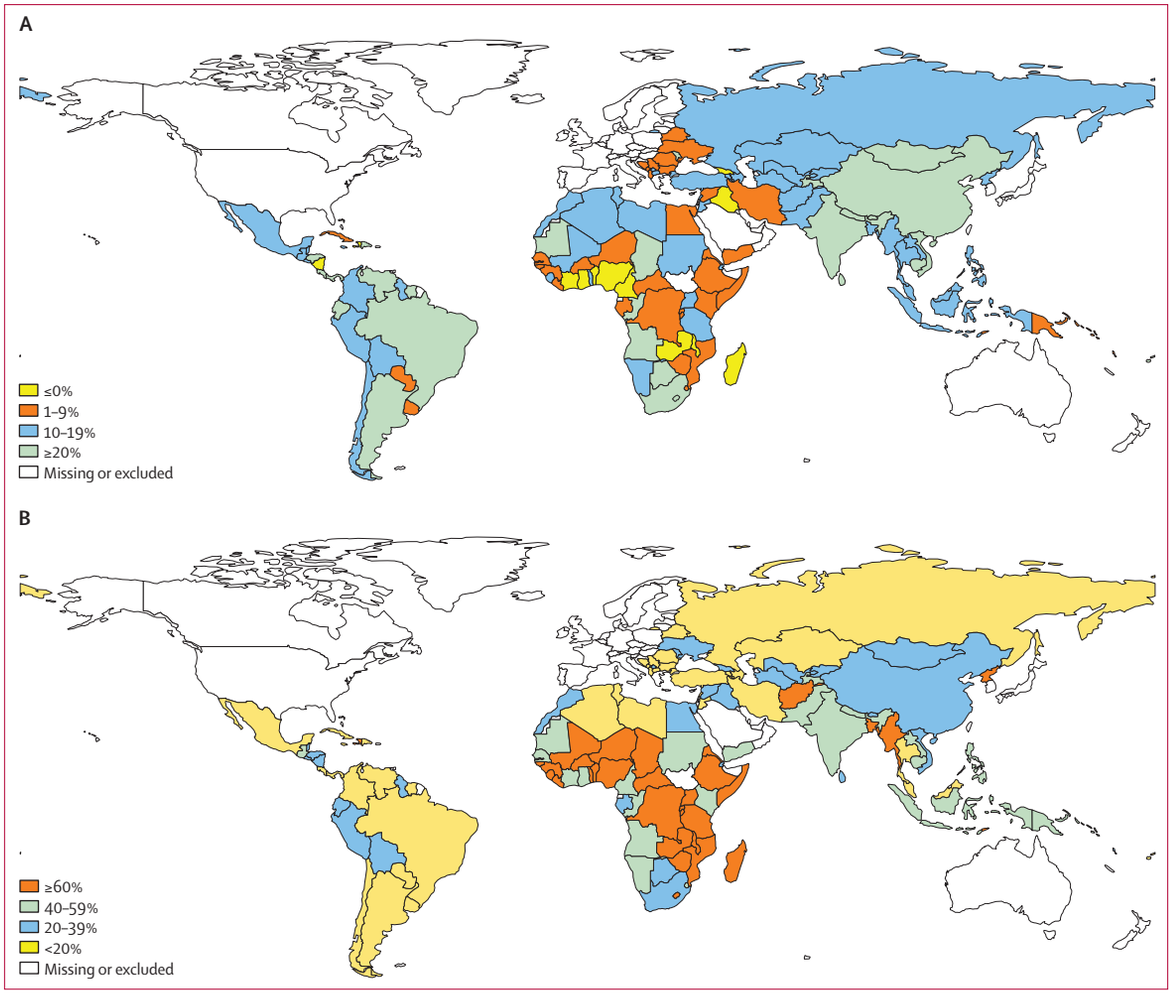

Figure 3: **Country-level percentage of children younger than 5 years at risk of poor development in 141 countries**
(A) Reduction between 2004 and 2010. (B) Prevalence in 2010.

and child maltreatment showed that estimates of children at risk in all 15 countries in 2010 increased substantially from 63% (associated with stunting and extreme poverty) to 75% when low maternal schooling and child maltreatment were added.[25] Because of the insufficient data for these risk factors in low-income and middle-income countries and insufficient validation studies of the existing variables, we were not able to introduce these risk factors into the global estimation. This limitation highlights the need to develop global standards and broad-scale data to measure risk and protective factors for early child development. Although we improved the accuracy and comparability of the estimates across countries and between years with improved data and methods, estimates could go beyond 2010 as the frequency of macro-level and micro-level data increases and time to access the data improves.

Elimination of risks in early child development is a formidable challenge and requires a comprehensive understanding of the state of children's development. Although exposure to risk factors is an effective predictor for poor child development, proximal indicators of child development, such as direct measures of early child development, including intervention coverage and access to protective factors, would complement our knowledge about risk factors and shed light on how to effectively reduce risk factors for poor early child development through interventions.

Future recommendations include continuing to monitor global progress in reducing the number of children aged younger than 5 years at risk of poor development by addressing the limitations of the current methods and investing in data and research strategies to develop standardised indicators for measuring child development. With increased knowledge of evidence-based interventions on maternal health and early child development,[26–30] immediate actions are needed to scale up effective interventions, such as improving maternal and child nutrition, targeting the most vulnerable children in sub-Saharan Africa and south Asia.

Contributors
CL designed the study, conducted the analysis, and wrote the first draft of the manuscript. MMB and LMR interpreted results, made critical comments, and wrote the paper. All authors reviewed the draft versions and approved the final submission.

Declaration of interests
We declare no competing interests.

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References

1 Shonkoff J, Richter L, Van Der Gaag J, Bhutta Z. An integrated scientific framework for child survival and early childhood development. *Pediatrics* 2012; **129:** e460–72.
2 Grantham-McGregor S, Cheung YB, Cueto S, Glewwe P, Richter L, Strupp B. Developmental potential in the first 5 years for children in developing countries. *Lancet* 2007; **369:** 60–70.
3 Hoddinott J, Maluccio JA, Behrman JR, Flores R, Martorell R. Effect of a nutrition intervention during early childhood on economic productivity in Guatemalan adults. *Lancet* 2008; **371:** 411–16.
4 Victora CG, Adair L, Fall C, et al, for the Maternal and Child Undernutrition Study Group. Maternal and child undernutrition: consequences for adult health and human capital. *Lancet* 2008; **371:** 340–57.
5 Stein AD, Wang M, Martorell R, et al. Growth patterns in early childhood and final attained stature: data from five birth cohorts from low- and middle-income countries. *Am J Hum Biol* 2010; **22:** 353–59.
6 Chang SM, Walker SP, Grantham-McGregor S, Powell CA. Early childhood stunting and later behaviour and school achievement. *J Child Psychol Psychiatry* 2002; **43:** 775–83.
7 Adair LS, Fall CH, Osmond C, et al. Associations of linear growth and relative weight gain during early life with adult health and human capital in countries of low and middle income countries: findings from five birth cohort studies. *Lancet* 2013; **382:** 525–34.
8 Hoddinott J, Behrman JR, Maluccio JA, et al. Adult consequences of growth failure in early childhood. *Am J Clin Nutr* 2013; **98:** 1170–78.
9 Denboba A, Sayre RK, Wodon Q, Elder L, Rawlings L, Lombardi J. Stepping up early childhood development: investing in young children with high returns. Washington, DC: The World Bank, 2014.
10 Gertler P, Heckman J, Pinto R, et al. Labor market returns to an early childhood stimulation intervention in Jamaica. *Science* 2014; **1014:** 998–1001.
11 WHO, Multicentre Growth Reference Study Group. WHO child growth standards: length/height-for-age, weight-for-age, weight-for-length, weight-for-height and body mass index-for-age: methods and development. Geneva: World Health Organization, 2006.
12 Chen S, Ravallion M. The developing world is poorer than we thought, but no less successful in the fight against poverty. *Q J Econ* 2010; **125:** 1577–625.
13 Chen S, Ravallion M. How have the world's poorest fared since the early 1980s? *World Bank Res Obs* 2004; **19:** 141–70.
14 World Bank. World Bank list of economies. January 2011. http://librarians.acm.org/sites/default/files/Jan%202011%20World%20bank%20list%20of%20Economies.pdf (accessed Sept 6, 2014).
15 World Bank. Poverty headcount ratio at $1·90 a day (2011 PPP) (% of population). http://data.worldbank.org/indicator/SI.POV.DDAY (accessed Sept 29, 2014).
16 Stevens GA, Finucane MM, Paciorek CJ, et al. Trends in mild, moderate, and severe stunting and underweight, and progress towards MDG 1 in 141 developing countries: a systematic analysis of population representative data. *Lancet* 2012; **380:** 824–34.
17 Olinto P, Beegle K, Sobrado C, Uematsu H. The state of the poor: where are the poor, where is extreme poverty harder to end, and what is the current profile of the world's poor? Washington, DC: World Bank, 2013.
18 United States Agency for International Development. Demographic and Health Surveys, data. http://www.dhsprogram.com/data/ (accessed Sept 6, 2014).
19 UNICEF. Multiple indicator cluster surveys. 2014. http://www.childinfo.org/mics.html (accessed Oct 8, 2014).
20 Walker SP, Wachs TD, Gardner JM, et al. Child development: risk factors for adverse outcomes in developing countries. *Lancet* 2007; **369:** 145–57.
21 Carvalho L. Childhood circumstances and the intergenerational transmission of socioeconomic status. *Demography* 2012; **49:** 913–38.
22 Child Protection Monitoring and Evaluation Reference Group. Measuring violence against children: inventory and assessment of quantitative studies. 2014. http://www.unicef.org/ecuador/CP_MERG_REPORT.pdf (accessed Sept 6, 2014).
23 Stoltenborgh M, Bakermans-Kranenburg MJ, Alink Lenneke RA, IJzendoorn MH. The prevalence of child maltreatment across the globe: review of a series of meta-analyses. *Child Abuse Rev* 2015; **24.1:** 37–50.
24 Evans G, Li D, Sepanski WS. Cumulative risks and child development. *Psychol Bull* 2013; **139:** 1342–96.
25 Richter LM, Darmstadt G, Daelmans B, et al, with the Paper 3 Working Group, for the Lancet Early Childhood Development Series Steering Committee. Investing in the foundation of sustainable development: pathways to scale up for early childhood development. *Lancet* 2016; published online Oct 4. http://dx.doi.org/10.1016/S0140-6736(16)31698-1.
26 Engle PL, Fernald LC, Alderman H, et al. Strategies for reducing inequalities and improving developmental outcomes for young children in low-income and middle-income countries. *Lancet* 2011; **378:** 1339–53.
27 Bhutta ZA, Das JK, Rizvi A, et al. Evidence-based interventions for improvement of maternal and child nutrition: what can be done and at what cost? *Lancet* 2013; **382:** 452–77.
28 Bhutta ZA, Das JK, Rizvi A, et al. Can available interventions end preventable deaths in mothers, newborn babies, and stillbirths, and at what cost? *Lancet* 2014; **384:** 347–70.
29 Ruel MT, Alderman H, and the Maternal and Child Nutrition Study Group. Nutrition-sensitive interventions and programmes: how can they help to accelerate progress in improving maternal and child nutrition? *Lancet* 2013; **382:** 536–51.
30 Lassi ZS, Das JK, Salam RA, Bhutta ZA. Evidence from community level inputs to improve quality of care for maternal and newborn health: interventions and findings. *Reprod Health* 2014; **11** (suppl 2): S2.