Lab and Village: Reimagining how science can serve children

By James Radner, Karlee Silver and Nathaniel Foote

From oral rehydration therapy to vaccination, antiretroviral drugs and insecticide-treated bednets, the fruits of biomedical innovation are saving millions of children's lives each year. These successful interventions generally derive from a straightforward strategy of innovation: target a single disease or risk factor by inventing a device or drug to fight it. To successfully mobilize science to help more children survive and thrive – especially those who do not have access to current 'solutions'[7] – we need to change how we innovate by moving out of the laboratory and working more fully with resources, people and challenges in the real world.

The need for integrated innovation design

Converging evidence from neuroscience, epigenetics and developmental biology all suggest that the very risks that threaten children's lives – poverty, malnutrition, social exclusion, infectious diseases and violence – also jeopardize the physical and mental development, and hence the future, of the children who survive.[16] These threats operate persistently and through multiple channels, limiting the impact of interventions targeted at a single risk factor. For example, researchers are finding that vaccination efficacy is blunted in developing countries by diverse inhibiting factors including micronutrient malnutrition and enteric pathogens. Moreover, the effects of multiple risk factors tend to accumulate in early childhood and then cause damage throughout the life cycle.[1,16,20] We need to develop solutions that acknowledge the multiple sources of both adversity and protection in a child's environment. We call any such solution – which may involve combining and adapting existing tools or designing new ones –'holistic'.

Meanwhile, the question of how to deliver solutions to places where the need is greatest and assure acceptance and uptake there remains sorely underexplored, with grave consequences for vulnerable children.[2,18] We need innovation to create 'delivery' strategies that respond to local needs by bringing to bear the knowledge and capacity of all relevant actors, from village mothers to multinational businesses.

The overall concept of combining social, scientific and business innovations for better, sustainable results at scale is known as 'integrated innovation'[6]. Our efforts to apply this concept in practice have suggested ways to design collaborations that help innovators generate the holistic solutions and complete delivery strategies needed to ensure that children survive and thrive.

Sketching a proposed design

Our proposed design has two main components, which we call 'co-creation' and 'fast-cycle learning':

a. Co-creation: Generating solutions by jointly mobilizing both scientists and each child's community (including his or her family).
b. Fast-cycle learning*:* Building the capacity of the system as a whole – scientists, communities, families, and public and private sector partners – to learn and adapt quickly based on what's happening on the ground.

This design is neither top-down nor bottom-up, but rather horizontal: a way to combine, on an equal footing, local and traditional knowledge and capacities (*see Community in Figure 1 below*) with emerging contributions from the fields of biology and medicine (*see Scientist in Figure 1*).

Figure 1: Co-creation

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In our model, scientist and community interact as peers, at the same level, in a two-way communication. Both sides teach and learn. They work together to set goals and then to discover, design and try out ways to achieve those goals, ways that they agree are practical and potentially effective. In Example 1, the scientific team led by Dr. Vishwajeet Kumar of the Community Empowerment Lab collaborated with community health workers, traditional birth attendants and local leaders around the joint goal of saving lives at birth. Similar co-creation lies at the core of each of the other examples below.

The co-creation model sketched in Figure 1 is also the key building block in our approach to fast-cycle learning. Once scientists and community members have designed an intervention in partnership, they can continue to learn from each other as results come in and can then adjust the programme design accordingly. Participants in this approach report that they find working together this way – in their words, 'on the same level' and 'without hierarchy' – to be both motivating and productive.

The examples below highlight our experiences with innovations serving young children that illustrate the core co-creation model as well as ways of building on it for greater impact and reach.

Example 1
Scientist-Community Partnership: Community Empowerment Lab
Shivgarh, Uttar Pradesh

A physician-led research team engaged with local community leaders and members to improve newborn survival. Rather than starting with a package of proposed changes, they began by agreeing on the shared survival objective and then worked together to align existing cultural values, traditions and beliefs – e.g., 'evil spirits' and the 'evil eye' – with scientists' understanding of causes of infection. On this basis, they co-created a package of preventive behaviour changes – e.g., clean delivery, skin-to-skin care and early breastfeeding – that fit the resources and worldviews of local birth attendants and mothers in a unified, easily understood way. In its design, the intervention was both holistic (i.e., it addressed multiple causes of infant deaths) and responsive to local delivery challenges (it was designed with and for local providers). Uptake of the behaviour changes was strong. For example, 85 per cent of newborns in the treatment communities received skin-to-skin care in the first day of life, compared to 10 per cent in nearby control communities. The results were impressive: After 16 months of work in the treatment communities, newborn mortality was 41.0 per 1,000 live births, compared to 84.2 in control communities.[10,11]

Community Empowerment Lab: Developing and adapting interventions
LEFT: A community meeting to discuss behaviour change interventions to save lives at birth. The community was a partner with scientists in design of the intervention, and they worked together to convey new ideas through channels that fit the cultural context, such as songs and dances (RIGHT).

Community Empowerment Lab: Adopting new behaviours

One of the needs identified through the process pictured on the previous page was for long-duration skin-to-skin care, which both protects newborn survival and stimulates neurodevelopment.

LEFT: A father providing skin-to-skin care. As community members noted, after childbirth mothers are tired and also have daily chores; fathers and other family members can play an important role in providing skin-to-skin care. Skin-to-skin care is also a way to express love and strengthen emotional bonds with a newborn.

BELOW: A mother and a father providing skin-to-skin care.

(Photos, on this and previous pages, courtesy of Community Empowerment Lab)

Toward impact at scale

An intervention co-created as described above will be, by design, sensitive to the local context. So to work out how to scale up such an intervention and extend it to other places, the scientific team can form additional community partnerships and jointly adapt both the intervention content and the delivery model to multiple new settings (*see Figure 2*)
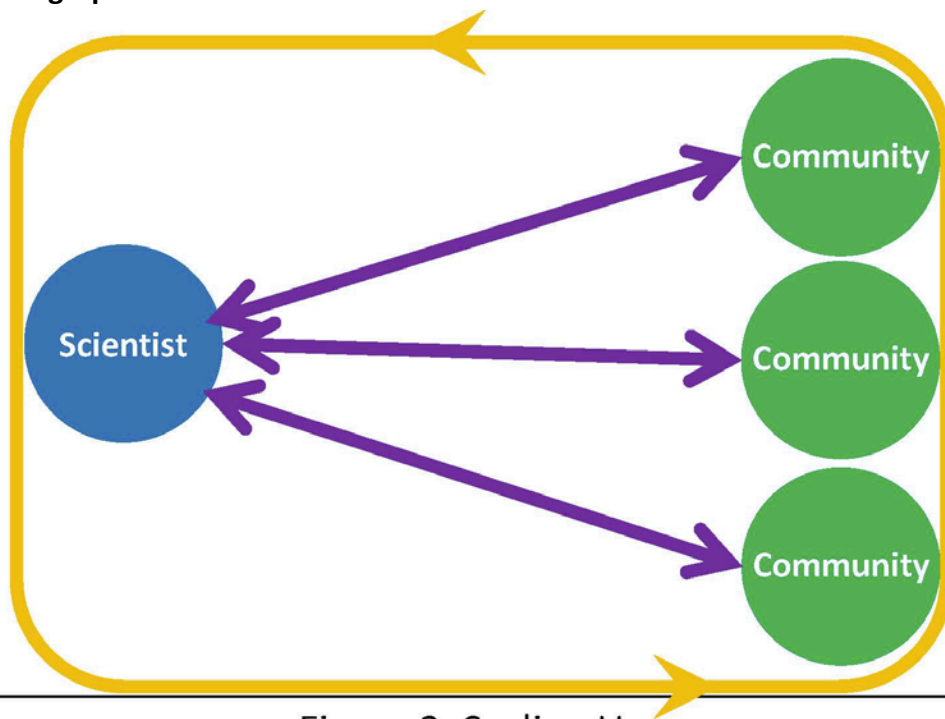
Figure 2: Scaling Up

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A scientific team can build on the success of an initial "co-created" intervention by forming multiple partnerships to sort out how to adapt the intervention for broader application. Here the green "community" circles may include local research partners as well. In Example 2, the research team led by Dr. Susan Walker of the University of the West Indies worked initially in Jamaica and then collaborated in Bangladesh and Colombia. The purple arrows represent science-researcher partnerships as described in Figure 1; the yellow cycle arrow represents ongoing exchange of ideas and lessons. In Example 2, Grand Challenges Canada convenes participants from Jamaica, Bangladesh and Colombia (among others) for such learning exchange.

Example 2
Researcher as Developer with Partners in Diverse Settings: Jamaica and worldwide

A research team at The University of the West Indies piloted a community-based package of low-cost toys and picture books that local home visitors could use with mothers and their young children to stimulate learning and play. The team then adapted the materials and 'curriculum' across languages and cultures, with successful clinical trials in Bangladesh, Colombia and Jamaica. Especially encouraging is evidence from these trials that this low-cost stimulation intervention can protect severely malnourished children against the disruptions in cognitive development that malnutrition generally causes.[5,8,9,13,19] This intervention depends on a key scarce resource: the time of community health workers. Therefore, innovators in Bangladesh and Colombia are now running trials on alternative ways of using these workers' time, in order to develop sustainable delivery strategies for scaling-up to reach all the disadvantaged communities in their countries. The Jamaica team is drawing on these and other ongoing local experiments to create a web-based platform to facilitate adaptation and uptake in other parts of the world, with the ultimate goal of benefiting vulnerable children everywhere.

Play that supports brain development, in Jamaica and worldwide
LEFT: The Jamaica intervention, developed at the University of the West Indies. A mother and community home visitor in Jamaica celebrate the child's completion of a puzzle. The materials used in the program, like the puzzle pictured here, are inexpensive, easy to make, and culturally appropriate. Home visitors can be readily trained to work with mothers using these materials. RIGHT: In Bangladesh, mothers use materials adapted for the local context – in this case, a mobile. (Photos University of the West Indies; International Centre for Diarrhoeal Disease Research, Bangladesh.)

Figure 2 describes a design for adapting and scaling up a single intervention. But as we have noted, children in needy communities generally face multiple threats to healthier development. Under those circumstances, a well-tailored combination of interventions may be needed, as illustrated in Figure 3 below. Here the community acts as a 'solutions integrator', working with a variety of teams of scientists to pull together a custom solution. This innovation structure parallels the way developers and solutions integrators often work in the information technology business, for example.[4]
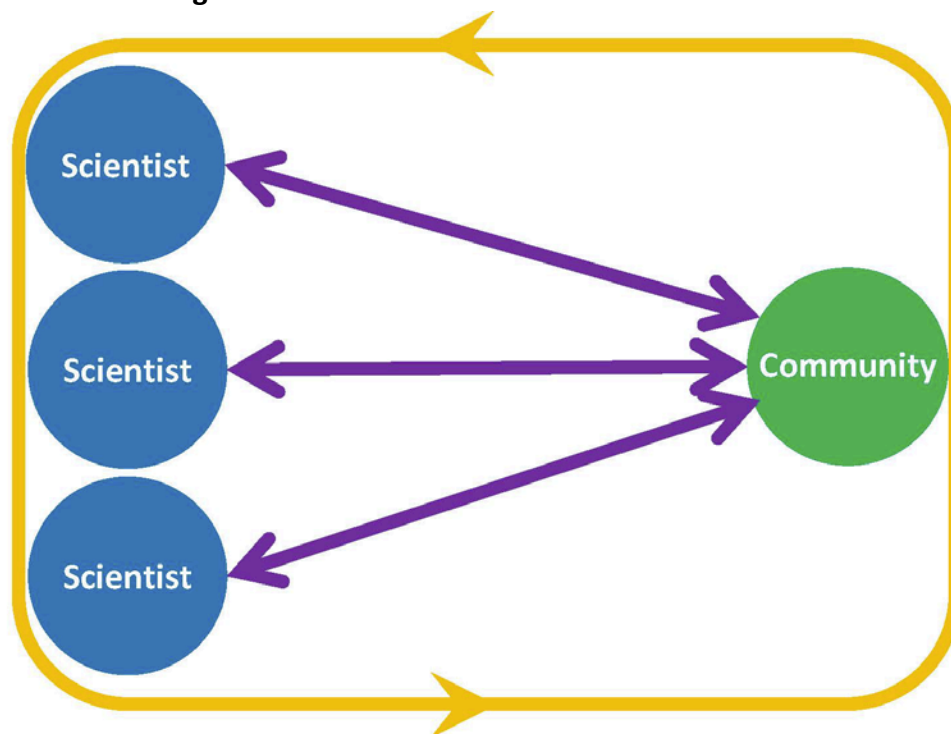
Figure 3: Toward an integrated solution

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Here a community works with multiple scientific teams – generally recruited by the community itself – to build a solution that meets the core needs of children living there. In Example 3, the community is New Haven, CT, and the scientific team based there is led by Dr. Megan Smith of Yale University. They have in turn engaged with researchers and intervention developers from, for example, the University of Oregon, the Center for the Study of Social Policy, and the Annie E. Casey Foundation.

Example 3: The Community as Solutions Integrator: The New Haven MOMS Partnership, in Connecticut: http://newhavenmomspartnership.org/index.aspx

A multi-neighborhood initiative in New Haven, Conn., has developed a strategy that draws on the experience of communities with Lady Health Workers[3] in Pakistan. New Haven's Community Mental Health Ambassadors (CMHAs) are neighborhood mothers, peers of those being served. They identify families' needs, participate in service delivery, suggest new strategies and provide feedback to modify existing ones. They are members of both the neighborhoods where they live and work and the citywide Guide Team that integrates feedback from all sources and takes decisions for the partnership. The Guide Team includes representatives of all participants in the partnership – local businesses, social service groups, CMHAs, government agencies and researchers.

Thus, MOMS has a structure that can a) identify needs at the family level; b) draw on a range of local resources to craft solutions; and c) bring service shortfalls and unmet needs to the fore. But MOMS has also been able to link the needs it identifies locally with national sources of innovative strategies: In 2012, MOMS joined a national learning network[15] on early childhood science, policy and practice. Stimulated by the ambassadors and the unmet needs they highlighted, MOMS has identified and adapted interventions from throughout that network, ranging from video coaching to stress reduction to building social capital and employability skills.[17]

A major unaddressed issue identified by CMHAs was stress in mothers' lives. The MOMS Partnership adapted an eight-week cognitive behavioral therapy intervention, structured and presented it as a stress management course delivered in a group setting, and trained the CMHAs to co-lead the groups with a clinical psychologist. A large clinical trial is in progress, and the work is already showing promise, e.g., in the level of uptake: 72 per cent of enrollees are completing the course (attending at least six of eight), whereas comparable rates for delivery outside the MOMS context are less than half that.[12] MOMS has now begun work with scientists at the University of Oregon to adapt an individual video coaching programme to a group setting as a follow-up to the cognitive behavioral sessions.

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Peer Outreach, New Haven, Connecticut

A Community Mental Health Ambassador (CMHA), doing outreach work at a supermarket used by mothers in at-risk neighborhoods in New Haven. CMHA's work in their own neighborhoods, talking with mothers about health and wellness as well as needs and services. They also work with scientists, healthcare providers, and agency leaders in a multi-sector guide team to develop community-wide responses to mothers' needs, drawing on and adapting service designs from both local and external sources.

Photo: The MOMS Partnership.

The MOMS Partnership has a strategy, illustrated above, for discovering and addressing unmet needs. This emphasis on what remains undone, rather than on a programme's successes, also drives the fast-cycle learning strategy now being piloted in Washington State.

Figure 4: The Washington State innovation cluster

R&D Teams at:
1. University of California at Berkeley
2. University of Calif. at San Francisco
3. University of Oregon
4. University of Washington

Community Agencies
A. Centralia College
B. Childhaven
C. Children's Home Society of Washington
D. Educational Service District 112
E. Hope for the Future Childcare & Preschool

Convenor supports shared, fast-cycle learning
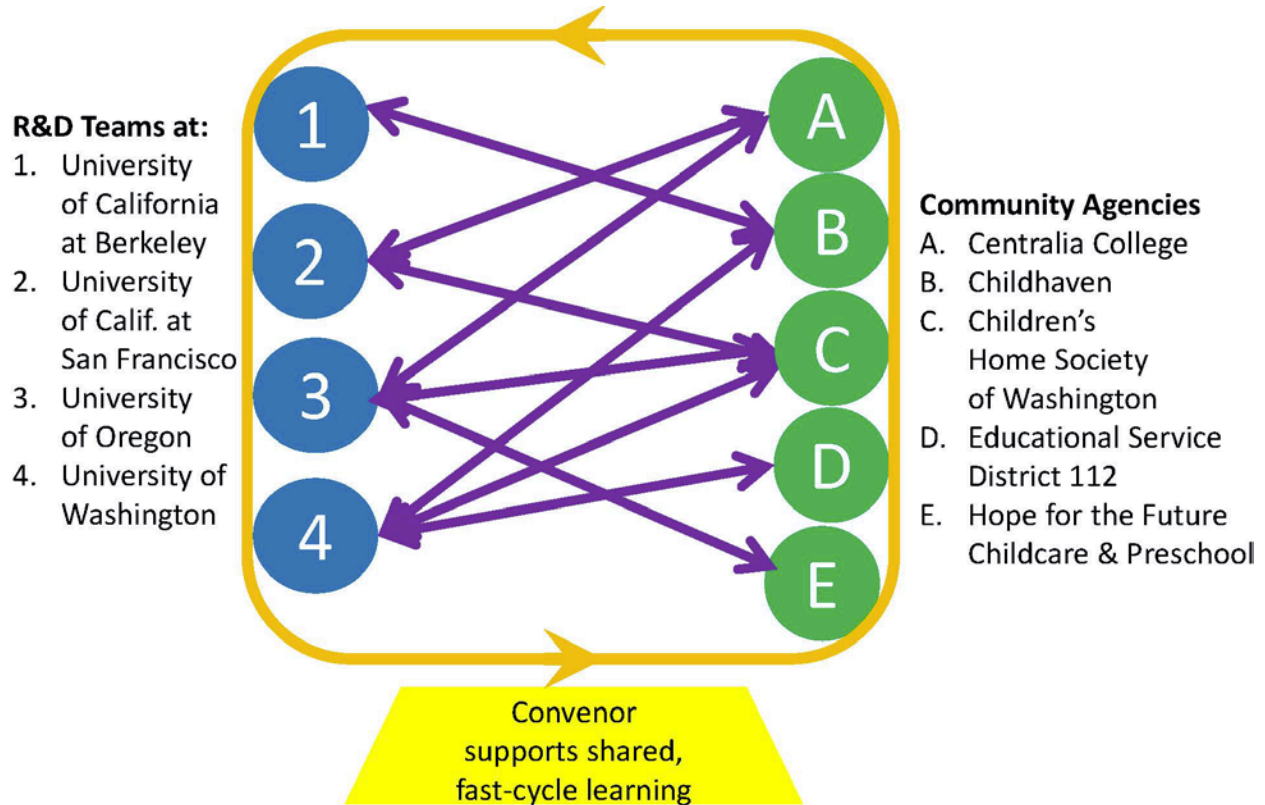
Figure 4: The Washington State Innovation Cluster

This figure illustrates Example 4 above. Each purple arrow ⟷ represents a distinctive partnership for co-creation between scientists and communities as described in Figure 1 above. Not every scientific team is currently partnering with every community agency, nor is that an objective for the cluster. Rather, each scientific team seeks enough field trials to adapt their intervention for impact at scale, while each agency seeks to apply those interventions which, in suitable combination, will best meet the needs of the population they serve. However, the cluster as a whole actively shares learning across the different partnerships. The yellow cycle arrow ⬓ represents shared learning throughout the cluster.

Shared, fast-cycle learning across the cluster is facilitated by common (and overlapping) theories of change and common metrics, a common data and evaluation hub (at the University of Washington), cluster meetings 3-4 times yearly, monthly cluster conference calls (weekly during start-up) and web sharing. Intervention foci include parent-child "serve and return" interactions (i.e. helping parents respond to their babies' looks and gestures, by analogy to the way ping pong players return serves), mindfulness, cognitive development via game-playing, and parent-child attachment.

Supporting this learning model is the convenor: ▭ the State of Washington Department of Early Learning, in collaboration with the Center on the Developing Child at Harvard University and the TruePoint Center for Higher Ambition Leadership. The convenor's role includes recruiting participants (researchers and community agencies) and creating contexts for them to both co-create and learn from each other.

**Example 4: Fast-Cycle Learning: State of Washington, United States of America**

In 2012, research and development teams from four universities formed an 'innovation cluster' with five community-based agencies in Washington State. [14] Working with a set of common metrics and a shared overall theory of change that emphasized executive functioning and related cognitive skills,[15] the teams have co-created and field-tested multiple interventions in diverse settings. Keeping the various scientific and practitioner teams connected enabled them to mix and match strategies to meet multiple needs. Each pairing of scientists and community agencies began by asking what was happening with families whose children were not reaching desired outcomes. They then co-created interventions to help those children. No single trial could suddenly solve the identified problems. Therefore, rather than wait for results from one large, multi-year test, the teams used small, quick trials so they could keep building on initial results – including initial failures.

For example, Childhaven, a therapeutic day-care programme for highest-risk children, is working with researchers from Berkeley on experimental games for children between the ages of 4 and 5, with the aim of building executive functioning (EF). After an initial 10-week randomized microtrial, approximately half the children enrolled in the programme showed major gains in cognitive flexibility, a core EF skill. But surprisingly – since the game design targeted EF in general – those children showed no gain in selective attention, a second executive functioning skill. By analyzing detailed data on the different groups of children, the team produced hypotheses on why the second group of children had no benefits, and why the first benefited from only one skill. They are now running a second fast trial, which mixes in a mindfulness intervention already being tried in Washington by a different scientist-agency team in the cluster.

Even disappointing results have been constructive for the Washington cluster because participants have fostered a shared culture of learning, a 'community of practice' committed to discovering solutions for all children. Such communities generally require an engaged sponsor and convenor, a role played in this case by the Washington State Department of Early Learning.

Piloting and adapting a video coaching intervention in Washington State
Filming Interactions to Nurture Development (FIND), a program for caregivers of high-risk children, is one of the interventions being piloted in a variety of community settings by the Washington State Innovation Cluster. ABOVE: Filming mother and child in a natural setting. The film will be carefully edited to create a series of brief clips of developmentally supportive interactions for use in subsequent coaching sessions. The clips are identified based on "serve and return," a concept developed by the Center on the Developing Child at Harvard University. A "serve" occurs when a child initiates an interaction using words or gestures, or by focusing attention on something or someone. The serve is "returned" when the caregiver notices and responds. FIND emphasizes five elements of serve and return, with one element introduced in each coaching session. BELOW: Adapting FIND for use with fathers. FIND was developed by Dr. P.A. Fisher and colleagues at the Oregon Social Learning Center (OSLC) and OSLC Developments Inc. The approach has roots in the tradition of microsocial interaction research at OSLC and in an intervention called Marte Meo, which has been widely implemented in Europe and elsewhere. For more on the serve and return concept, see http://developingchild.harvard.edu/resources/multimedia/videos/three_core_concepts/serve_and_return/. **(Photos: OSLC)**
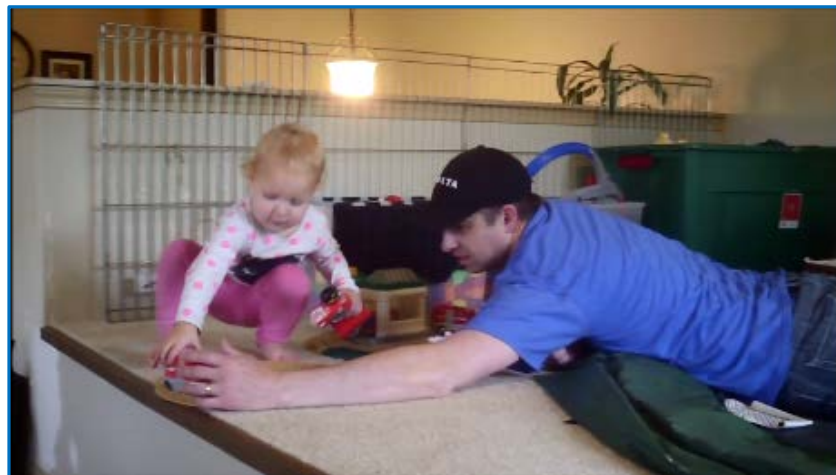
Conclusion

The examples discussed here show that researchers and community members can collaborate effectively, on an equal basis, across long cultural distances. These are early days for results, but the emerging strategies have shown striking local uptake and real promise as part of the larger effort to make holistic, resource-appropriate solutions available to the world's most vulnerable children. These strategies emerged not by accident, but by design. Key principles include:

- Building a shared vision of a better future for all children and translating that into a relentless focus on unmet needs, and on children who are benefiting least from current services;
- Working to identify shared goals between communities and scientists, with co-creation that respects both local and international knowledge and culture;
- Seeing innovation as about developing 'solutions', as opposed to a more traditional approach of developing 'products;'
- Finding ways to incorporate rapid, rigorous feedback and continuous engagement of families and service providers (e.g., through microtrials);
- Assuring that local communities serve as active integrators, since they are best placed to focus precious resources on the elements that need to be developed, adapted and applied;
- Supporting fast-cycle learning across projects with an engaged convenor.

We call on scientists, communities and stakeholders in all sectors to work together so that the potential of the generation now being born is not wasted. The innovators described above have made progress by paying sustained attention to what's not working, and by keeping an eye out for surprises. As more innovators engage from lab to village, we expect their work will continue to surprise us, helping children have better lives.

James Radner is Assistant Professor at the School of Public Policy and Governance, University of Toronto; Senior Fellow at the Center on the Developing Child at Harvard University; Executive Director and co-founder of The Boreal Institute for Civil Society; and Senior Fellow at the Munk Centre for International Studies. His teaching and action research engage with challenges in social and economic development, and applications of quantitative and qualitative tools to make social initiatives more effective.

Karlee Silver is the Vice President of Targeted Challenges for Grand Challenges Canada, which is funded by the Government of Canada and has supported over 500 projects in low- and middle-income countries to date. She holds a doctorate from the University of Oxford, where she trained in genetics and immunology. Her current work focuses on how to apply innovation to

transform the health and wellbeing of women, newborns and children as well as individuals living with mental illness.

Nathaniel Foote is the Managing Director of TruePoint, a founding Board member of The Center for Higher Ambition Leadership, and a Senior Fellow at the Harvard University Center on the Developing Child. A co-author of the recent book, Higher Ambition: How Great Leaders Create Economic and Social Value, he has helped clients to build more effective institutions that achieve objectives for accelerated growth, increased innovation, and improved performance.

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