Diffusing and scaling evidence-based interventions: eight lessons for early child development from the implementation of perinatal home visiting in South Africa

Mark Tomlinson,1 Xanthe Hunt,1 and Mary Jane Rotheram-Borus2

1Department of Psychology, Stellenbosch University, Stellenbosch, South Africa. 2Semel Institute, Department of Psychiatry and Biobehavioral Sciences, University of California Los Angeles, Los Angeles, California

Address for correspondence: Mark Tomlinson, Department of Psychology, Stellenbosch University, Stellenbosch, 7602, South Africa. markt@sun.ac.za

Most low- and middle-income countries lack resources with which to implement public health programs. As such, there is a necessity to facilitate programing that judiciously makes use of what resources there are. However, despite evidence for the efficacy of many interventions, translating these into real-world effectiveness, and then into scalability, is complex and has often been neglected. We draw on a case study of Philani+ (a maternal and child health intervention implemented in South Africa) to distil eight features of health programing that aid intervention effectiveness. We argue that implementation science should turn its attention to the human resource “process” features of interventions. We describe the importance of staff selection (rigorous selection and hiring procedures); training (developing a set of common core pragmatic problem-solving skills); monitoring (feedback about quality); community and institutional support (rapport with intervention communities); the importance of stable leadership (consistent leadership focusing on how to optimize the potential of staff); the importance of implementing with sustainable, long-term change in mind; and, finally, we describe how cultivating consistency within an organization requires disciplined action and disciplined focus on the organization’s vision.

Keywords: home visiting; perinatal health; early child development; implementation science; scaling up; diffusing interventions

Introduction

Evidence-based public health interventions are often not easily scaled, and, when scaled, lose their efficacy (Does an intervention work under optimal conditions?). Translating efficacy into effectiveness (Does an intervention work under “real-world” conditions?), and then into scalability is complex and has often been neglected.1 Thus, we need to move from questioning whether an intervention works under optimal circumstances to asking whether it works under real-world settings.1 Bridging the gap between efficacy studies and large-scale interventions is going to depend on effective strategies to support the management and supervision of intervention staff.2 In this article, we focus on what is going to be needed to scale efficacious interventions for community health workers (CHWs), in particular, CHWs who conduct perinatal home visits. Across low-resource contexts, CHWs are one of the most prominent groups conducting work in early child development (ECD).3 While multiple randomized controlled trials (RCTs) have found perinatal visits by CHWs efficacious,4–6 when these interventions are scaled, efficacy disappears.1,2,6 In the work of Peacock et al.,6 only 21 of 71 studies were included in the review, due to quality concerns. The result was that only four studies from low- and middle-income countries (LMICs) were included. It would be misleading to draw conclusions from this review alone about implementation of ECD in LMICs. Some recent work in high-income countries has found home-visiting to be scalable, but little is available in LMICs.7

doi: 10.1111/nyas.13650
While the need to evaluate program outcomes is well recognized, the study of formative outcomes—those that indicate the extent to which a project is effectively implemented in a specific setting—is less common. Exploring how to optimize the (often scarce) resources available to be employed in health programming is essential. This question extends across human resources (How to make staff do the job best?), infrastructure (What technologies best aid the job being done?), and intervention characteristics (What features of programming make a difference, and if so, how?). The majority of this science is concerned with the latter question, particularly fidelity to manualized interventions \textsuperscript{8–14} or questions of intervention duration (dosage) \textsuperscript{8,15,16} “implementation fidelity” being the degree to which interventions are implemented as dictated by the program manual/or as intended by the intervention’s creators.\textsuperscript{15} The value of these evidence-based features is clear (and elaborated by Nores and Fernandes\textsuperscript{17}). Yet, there is a need to conduct systematic replication work, with attention to context, when manualized interventions have shown efficacy. However, there is also a need to consider how features related to the process of intervention and its implementation by individuals may impact effectiveness. This implies an expanded understanding of implementation, as described by Yousafzai et al.\textsuperscript{18}

In ECD and maternal and child health research, there is a substantial evidence base on the efficacy (and effectiveness) of early interventions.\textsuperscript{19} Our knowledge, however, of how to translate these data into larger scale programs or into effective regional or national policies is limited. Scientific standards have established a sequenced, lock-step process to develop, validate, and begin to diffuse evidence-based interventions (EBIs).\textsuperscript{20} In almost all fields of public health, manuals have been created and tested in RCTs, which then are retested in effectiveness trials and, then, perhaps may become diffused slowly over time. Yet, if we examine the major factors influencing public health, the timeline for development, testing, and diffusion is far shorter. In the remainder of this article, we examine a set of “process” factors embedded in intervention delivery and manuals that are as important to address as the content in every EBI.

Drawing on a case study of Philani–(a maternal and child health intervention implemented in South Africa),\textsuperscript{21,22} we distil some of the features of health programming that aid intervention effect. From a series of four evaluations of the Philani intervention model over the last 10 years, we have identified a set of principles critical for the effective scaling of evidence-based perinatal interventions.\textsuperscript{21,23,24} This is presented as a case model for other researchers, health administrators, and policy makers to consider when implementing efficacious public health interventions. Particularly, we suggest that the human resource and process features of interventions (selection, training, and monitoring) in addition to programmatic features, such as fidelity to a manual, are the keystones around which successful projects should be built (see Box 1).

**Box 1.**

**Key messages**

- Translating public health intervention efficacy into effectiveness and then into scalability is complex and has often been neglected.
- We examine what is going to be needed to scale efficacious interventions for community health workers (CHWs) in low-income settings, where past work in the field has failed to translate intervention success demonstrated in clinical trials, into impact at scale.
- Drawing on a case study from South Africa, we propose that selection, training, and monitoring for scale are human resource and process features of program implementation which determine a significant amount of that program’s success.
- Selection, training, and monitoring of staff are the bedrock on which successful and sustainable programs are implemented; external to programs, community and institutional support, and involvement are imperative.
- The well-established organizational theories of Collins are used to understand and guide the development of effective and sustainable public health programming using CHWs.
Philani child health and nutrition project

The Philani Child Health and Nutrition Project\textsuperscript{21,22} is a community-based nongovernmental organization (NGO) operating in Africa (Ethiopia, Swaziland, and Botswana) but predominantly in South Africa.\textsuperscript{25} The Philani Mentor Mothers Program trains women from the communities in which it works to act as CHWs. These women (known as “mentor mothers”) conduct routine community-based outreach in their neighborhoods, identifying all pregnant women and inviting them to take part in the child health and nutrition program.\textsuperscript{22}

Building on two phase 2 comparison studies, a cluster RCT was mounted between 2009 and 2014. The RCT was conducted to evaluate the effectiveness of the mentor mother program in improving maternal and child health. To date, caregivers and children have been assessed at baseline (antenatal), 2 weeks after birth, 6 and 18 months after birth, and at 3, 5, and 7.5 years of age. The Philani RCT has both high internal (85% follow-up) and external validity (98% recruitment). Previously, we have shown how the intervention has improved overall maternal and child health across a number of different outcomes, with 50% higher cumulative rate of adherence to prevention of mother to child transmission of HIV (PMTCT) tasks and less stunting.\textsuperscript{23} The intervention also had fewer low birth weight infants than the control condition, improved breastfeeding,\textsuperscript{26} better child growth over 18 and 36 months,\textsuperscript{23,26} improved maternal emotional well-being, and better child language development.\textsuperscript{26} This success spurred the South African Department of Health to pilot the Philani model at a second location in the Eastern Cape, as a social franchise in partnership with the local government in the area.

Philani mentor mothers are employed 60%-time and paid at the same rate as provincially employed government CHWs (this is more of a stipend but amounts to roughly US$180 a month). Mentor mothers carry a case-load of approximately 50 women/families at one time, but a large proportion of these cases do not involve daily or weekly visiting but rather monthly check in visits.

During the Philani RCT, and now during its roll out, it has become apparent that certain features of the model undergird Philani’s success. We discuss each of these in turn using the concepts of selection, training, and monitoring as a framework.

Implementation lessons from Philani

As noted, most RCTs focus on results, and not on the processes involved in implementing an intervention. When they do, the issues in question are predominantly those of fidelity and dosage, as these are known to be important.\textsuperscript{27} Features of implementation such as staff selection, training, and the processes of supervision and other functional factors are frequently not reported (notable exceptions in the present issue being the work of Yousafzai \textit{et al.}\textsuperscript{28}). Implementation factors are not routinely reported; yet, without high-quality implementation, efficacy routinely disappears. Fidelity is key, and there is unequivocal evidence showing that intervention effects (participant outcomes) are worst when programs are poorly implemented and deviate from their intended working.\textsuperscript{29,30}

Drawing on our work with Philani, we elaborate the human resource and process components of implementation which impact scalability. We propose a model for the scaling and sustaining evidence-based programs that is based on process and the human resource elements in addition to simply fidelity to the manual of an evidence-based program. The model, Selection, Training, and Evaluation\textsuperscript{a} for Effective Program Scaling and Sustainability (STEPPS), outlines three key issues central to the implementation of programs:

- **Selection**: Ensuring that there is a rigorous selection and hiring procedure for all staff is key. Hiring should be based on demonstrated social skills, managing an organized household, counseling skills, and raising their own thriving children.

- **Training**: There are set of common core skills that most evidence-based interventions share and that should form the basis of training.\textsuperscript{31,32} These include engagement, goal setting, problem solving, praise, social rewards, exposure, role-play, awareness of feelings, assertiveness training, self-monitoring, communication skills, and shaping.

\textsuperscript{a}We employ the term \textit{monitoring}, rather than \textit{evaluation}, as it implies continuity in the process, and is less static and outcome driven than evaluation.
- **Monitoring**: CHWs or other paraprofessionals require feedback about the quality and frequency of their interventions. Mobile technologies create the opportunities for unobtrusively monitoring actions in real time on a sustainable basis.

**Lesson 1—Selection**

The theoretical underpinning of Philani’s selection process is the *positive peer deviant* model. Positive peer deviants—outlier women who are managing to raise healthy children despite the challenges of their context—are selected and approached for training. In order to avoid community and client perception that positive peer deviants are better parents, the Philani program also endeavors to select mentor mothers with good social skills, the capacity to form warm and trusting relationships, good problem-solving skills, common sense, and basic listening skills. These skills/capacities coupled with an ongoing emphasis on nonjudgmental engagement help to mitigate any possible negative perceptions of the positive peer deviant model. Pearson et al. note that there is consensus in the ECD literature that essential dispositional qualities of staff, including respectful, responsive, and trustful interactions with children, caregivers, and communities, are imperative if a nurturing care agenda is to be advanced. This is reflected in Philani’s selection strategy. Further, underlying the philosophy is a belief in the value of transferring back to intervention communities the capacity to solve every day health challenges to improve ECD.

The actual process of selection is a multistage strategy:

- Potential CHWs are sourced using three strategies—community stakeholders and leaders put forward names; open advertising on community networks; and word of mouth using existing mentor mothers.
- Interviews of prospective CHWs are conducted by individuals from every rung of the organization—including the director, middle management, supervisors, mentor mothers, and cleaning staff; analog simulation tasks (Dooley) facilitate observations by program staff. In replications of the Philani Program, staff complete a 5-min task, functioning as listener and discloser to another about an easy problem in their life. These tasks provide good behavior samples to observe social skills, beyond an interview setting.
- Following the interviewing process, twice as many mentor mothers are selected than are needed based on the understanding that it is only through the process of training, role-plays, and observations that it will be clear who is suitable. Final selection of mentor mothers to be employed, therefore, only happens post-training and is based on performance during training (coming on time, keeping notes, demonstrating problem-solving ability, and interpersonal competence), and observations of supervisory CHWs during trainings and of trainees’ homes.

**Lesson 2—Training**

The Philani model of training approaches the multiple risks facing caregivers and children in poverty...
using a model of pragmatic problem solving with cognitive–behavioral intervention strategies. The training model, outlined in Figure 1, begins with assuring that each mentor mother knows the foundational skills (or practice elements that are common across EBIs). Chorpita and Daleiden have reviewed and rated the manuals of about 800 EBIs aimed to improve child or family outcomes. They observed that 80% of all EBIs use 14 skills. Labeled practice elements, these common skills are used by socially competent persons often in daily life. If mentor mothers are going to be able to problem solve and support the mothers in their communities, each will need a repertoire of these skills. For most mentor mothers, these practice elements/skills are used often, without a label to describe what she is doing. In CHW training, mentor mothers learn a label and practice using these skills, within the context of the program’s goals. Level 2 refers to the common processes identified by Rotheram-Borus and colleagues when rating the manuals of EBI addressing adolescent HIV. Every EBI functions to address five processes: (1) the program frames the issue (e.g., spending time with your baby is setting his/her well-being for life; this is one of the most important periods of your child’s life); (2) provides health information (e.g., breastfeeding promotes healthy children), though such information is useless if mothers do not apply the health information consistently in their daily routines; to accomplish this, mentor mothers help mothers (3) build skills and (4) remove the barriers that would stop implementation of the desired ECD actions; and finally, the mentor mother (5) helps the mother identify and build sources of support on an ongoing basis for herself. These same processes apply to a wide range of outcomes. Mentor mothers do need to be educated and provide, for example, sample role-plays, scripts, and prompts to demonstrate key messages for health information. However, when entering a household, the social skills of the mentor mother allow her to tailor her interaction based on her experience with the population.

Thus, the mentor mothers’ social competence and the ability to engage with others forms part of this foundation. Philani emphasizes training which is both thorough and iterative. Mentor mothers undergo classroom-based trainings as well as role-plays with field exposure. Further, while their training and expertise includes subject knowledge of relevant fields (including occupational therapy, basic home-based care, early childhood development, and child abuse), it is supported by solid training in pragmatic models of problem solving. By being trained first and foremost as problem-solving partners for the women with whom they work, the mentor mothers are able to confidently assist women to come up with tailored solutions to challenges faced.

In addition to initial training, there is ongoing refresher training with mentor mothers constantly adding new capabilities to their repertoire. It has been shown that opportunities for skills development are positively related to job satisfaction, which in turn potentially protects against the high staff turnover common in many LMIC CHW programs. Each knowledge domain required of a mentor mother is built upon these foundational skills (Fig. 1) and constitutes the specific knowledge and skills requisite to address a particular content domain within the intervention (be it HIV prevention, child stimulation, or nutrition). We consider this topic-specific information to be the walls, doors, and windows of the house, that is, the second layer of the framework.
Finally, where the focus in most programming is fidelity and replication of interventions in accordance with the intervention designers’ intention, the mentor mother intervention is built on the understanding that local tailoring and adaptation is of paramount importance. The rationale for paraprofessionals not to replicate the above EBIs for target behaviors as carbon copies of prototype interventions is that most of these intervention components were not designed with their respective populations in mind. Philani actively encourages adaptation of its intervention packages by probing those in the know (mentor mothers and other local stakeholders) for how to best deliver key intervention components. The model of training allows the tracking of mentor mother performance and adherence to the model as well (Figs. 2 and 3).

**Lesson 3—Monitoring**

Mobile health (mHealth) technologies have been variously employed either as interventions in their own right or as aids to CHWs delivering interventions. The incorporation of mHealth components into existing interventions, however appealing, runs the risk of perpetuating the use of technology for technology’s sake, rather than adding to intervention effectiveness. To facilitate task shifting to CHWs in LMICs, mHealth needs to be functional in the first instance, aiding CHWs rather than presenting a complex component requiring extensive training and attention. For Philani, we developed a system of daily monitoring of mentor mother visits that included a focus on scheduling and planning of visits; fidelity monitoring; intervention delivery support and individual case monitoring; and caseload reporting and information management. We were able to track visit duration (total time spent on the intervention) in order to describe the potentially dose-dependent response to the intervention. We also developed a series of short questions on mentor mother mobile phones when the CHW entered the participant ID. These served as a reminder about core messages to be covered at each visit, as well as data for the scheduling of follow up visits and intervention content.

An additional component of the web-based management system allows supervisors to access the console to monitor real-time information about each participant, and information on caseloads. From the remote console, supervisors are able to generate a visit-time report that not only allows supervisors to see how many visits have been made by mentor mothers but also the cumulative amount of time the mentor mother has spent in that particular home. What this allows is for supervisors to schedule what we termed a “shadow” or “spot visit” for the supervisor to conduct checks on the quality of home visits. The focus of the mHealth monitoring system utilized by Philani mentor mothers was on how to optimize existing human capital, rather than develop technologies that could function in lieu of it, or to use the technology as the basis of the intervention itself. By focusing on how technologies can work for existing human resources, rather than replace or overburden them, mHealth served implementation in the Philani project. Monitoring includes the subcomponents of supervision and accountability.

**Supervision and accountability.** The centrality of supervising CHWs and holding them accountable for their work has been underscored in past work, and is discussed in other work in the special issue “Implementation Research and Practice for...”

---

**Figure 3.** Mentor mother 2: use of practice elements during her visits; summary of practice elements during the last 150 home visits.
Early Childhood Development.”46 A recent technical report by Pearson et al.3 concluded that the need for ongoing mentoring and supervision for ECD cadres, including CHWs, is imperative. Although accountability has been attended to in implementation science work, it most often relates to manager accountability, or the responsibility of those in charge of organizations to maintain intervention quality and fidelity.1,47,48 Within Philani’s organizational structures, supervision, support, debriefing, and performance appraisals are routine. Supervision takes the form of both administrative as well as reflective supervision—both are seen as essential.

Further, instead of maintaining a narrowly performance-based conception of accountability, in Philani the bidirectional nature of accountability is highlighted. Not only are the mentor mothers accountable to their supervisors, but these supervisors are accountable to the mentor mothers and responsible for providing the support, supervision, and oversight necessary to enable the mothers to best do their job. In line with this, the organization’s staff ratio is 10–12 mentor mothers to one assistant coordinator (an experienced mentor mother who has shown good leadership skills).

A particularly important function of supervision within Philani is debriefing. Recent work has cautioned about the psychological risk to researchers working in such contexts. Particularly, those workers who are closest to the communities in which they are working (in terms of geography, social, or demographic proximity) are at greatest risk of experiencing forms of vicarious stress due to exposure to participants’ traumatic experiences.49 As such, an important aspect of implementation in contexts of poverty and privation is the ability of an organization to cater to the psychological needs of its employees. Philani conducts regular debriefing sessions with mentor mothers, during which experiences, grievances, and difficult emotional work can be discussed.

Employee burnout—one of the major obstacles encountered by community-based organizations—leads to high staff turnover, which in turn hinders intervention effect and longevity.50 Within Philani, this is addressed by regular oversight and debriefing (and referral where necessary), and by building social support networks between both management staff and mentor mothers and mentor mothers across sites in which Philani is working.

Lesson 4—Community and institutional support and involvement
Evidence from integrated ECD interventions has shown that comprehensive community engagement strategies are central to sustainability and scale up.51 For sustainability, high-level buy-in and institutional support are critical to intervention success, particularly in communities in which informal local hierarchies and governance structures are prominent. This is reflected in contemporary guidelines for community-based participatory research, which include obtaining community buy-in to all phases of the research.52 Philani is embedded within the communities in which it works and has community buy-in at every level. In South Africa, Philani does not see itself as being independent of the health systems but rather an adjunct to it, and serves as the means by which Department of Health funding for CHWs is distributed.

In addition, Philani’s recruitment of women from the communities in which it is based helps it to establish rapport with, and gain a foothold in, intervention communities. The longevity and durability of the programs in these communities has resulted in Philani being approached by chiefs, headmen, grandmothers, and fathers in intervention communities. The longevity and durability of the programs in these communities has resulted in Philani being approached by chiefs, headmen, grandmothers, and fathers in intervention communities. The longevity and durability of the programs in these communities has resulted in Philani being approached by chiefs, headmen, grandmothers, and fathers in intervention communities. The longevity and durability of the programs in these communities has resulted in Philani being approached by chiefs, headmen, grandmothers, and fathers in intervention communities.

Past intervention work has indicated that EBIs that are integrative and flexible (rather than doggedly devoted to replicating a manualized program) may enjoy greater uptake by stakeholders in community settings.53 As such, implementation strategies that aim to maintain this flexibility of approach, and focus on fostering relationships within intervention communities, are necessary.

Synthesis
We suggest that the human resource and process implementation features of the Philani mentor mother program are the foundations of its success and longevity over three decades. Philani is now a recognized social franchise and has expanded into a number of other countries—Swaziland, Ethiopia, and more recently Botswana. We have argued that key to its success is careful selection and training of mentor mothers with a focus on building on...
Eight lessons for diffusing and scaling evidence-based interventions

Lesson 5—Leadership matters

While intervention characteristics in Philani are important, organizational characteristics, particularly those to do with human resources, are paramount. Leadership of Philani is key, but the focus of this leadership is not on what Collins calls larger-than-life charismatic leaders, but rather, on consistent leadership focusing on how to optimize the potential of staff member. Collins notes that—rather than visionary charismats—most organizational success stories come about under the stewardship of consistent low-profile leaders. The organization’s vision, then, is not dependent on the charisma and strength of personality of one individual, but rather, exists as an entity in itself. Those leaders who are present within the organization focus on developing the skills and competencies—and optimizing the potential—of each staff member. We believe that implementation science needs to conceptualize and find a way of measuring the growth and development of nonmanagerial staff. If projects are to endure and be sustainable, all staff need to have opportunities for growth. Similarly, recent work has shown that adequate remuneration is not only essential for staff retention, but also plays a role in intervention efficacy. As noted by Gladstone et al., CHWs may feel that they are performing tasks over and above those befitting their pay. Rather than focusing on individual health-workers capacity to deliver a verbatim intervention, the focus should be on assessing whether individual staff members feel confident in their work, and guided by the overall mission, vision, and values of the intervention. This would depend on the leadership within organizational partners, through whom projects are implemented, prioritizing skills development, and being consistent in their approach. This consistency, in turn, is dependent on generations of leadership sharing the organizational vision, rather than being the sole purveyor of the organizational vision. In line with this, it has been argued that within implementation research the more that individuals within the organizations responsible for intervention delivery see congruity between the ethos of the intervention, and that of the intervention’s management, the more likely they are to buy into and try to enact it. Similarly, implementation is optimized when there is an organizational climate in which leaders express their own fallibility, where responsibility is bidirectional, and where team members feel that they are valued and that their knowledge contributions are essential.

Lesson 6—First who then what

When implementing an intervention, in the case of Philani, the who (which organizations are partnered with, which staff are hired) has been of equal import to the what (the nature of the intervention). The delivery of the intervention through an established organization has been central to its success. While EBIs are important, and any attempt to implement programing should be built upon a solid foundation of evidence in favor of the programing in question, the people involved in the project are fundamental. The importance of who exists at two levels: first, which organizational partners are selected as intervention implementers; and second, which staff are hired to implement the program on the ground.

In the first instance, potential implementers of community projects should select partners with an existing relationship in the intervention communities. Working with well-established NGOs and community-based organizations (CBOs) with reliable networks and a good rapport with the community is of substantial benefit to project implementation. In the second instance, we have described the effective selection approach of Philani. Attention is drawn away from questions of focusing solely on replicating existing interventions, and instead moves to...
the relational nature of community interventions: who the intervention is being delivered by, and their capacity to relate to participants and inhabit participants’ worlds, may be as important as what intervention is being delivered.

**Lesson 7—Change is a 20-mile march**

Many of the health challenges facing communities in LMICs are intergenerational in nature, where poverty and risk factors are felt across the life course and across generations. As such, interventions attempted with sustainable, long-term change in mind must necessarily take time. This has been the case for Philani, and it is reasonable to contend that this will hold for other programs. This is not to say that dosage must be increased (that longer interventions are better), but, rather, that several iterations of an intervention might be required, and that community-based programs will likely only be of good and enduring effect if they continue over the course of many years. This principle—that change is slow—encourages implementers to not only consider how to intervene across time, but also how to ensure that they are sustainable and are able to exist with the communities in which they work across time.

**Lesson 8—Culture of discipline**

Cultivating both flexibility and consistency within an organization or project requires discipline, both disciplined action and disciplined focus on the program’s vision. As noted, the pillars of Philani’s success largely have to do with selection, training, and monitoring. When implementing community-based projects, each of these should be done in a manner that facilitates individual confidence to carry out the intervention and innovate as necessary in the given context; but also to be disciplined in their delivery of key components, their fulfillment of responsibilities, and their adherence to the vision of the intervention. Fundamental to both is accountability and the manner in which accountability is managed within an organization. Indeed, the emphasis on organizational accountability is one of the factors that led to the emergence of implementation science as a field. Measures exist for assessing the quality of health care in hospitals, for instance, and these are used to promote improvements in the standard and delivery of care, and to increase transparency. However, assessing accountability on numerous levels within diffuse networks, or egalitarian community-based organizations, will require a conceptualization of accountability that—as noted earlier—flows directionally between managers and staff, and between individual members of teams.

**Conclusion**

The eight distillable features of Philani’s implementation discussed above contribute to its success and bear consideration as lessons for implementation science generally. In summary, these include (1) a focus on selecting staff from intervention communities and who possesses the kinds of transferable soft skills that will support their development within the project; (2) iterative training that centers on foundational skills instead of content knowledge only; (3) monitoring and supervision within organizations and projects that judiciously incorporate technological innovations, as well as accountability that permeates the whole organizational culture; (4) cultivating buy-in from communities to facilitate intervention longevity and uptake; (5) nurturing leadership within each staff member at each level of the organization; (6) partnering with CBOs who are likely to make the intervention effective and enduring rather than those who may be capable but lack contextual knowledge; (7) maintaining a long-term perspective not only on human behavior change within interventions over time, but also on creating an enduring presence in communities; and (8) developing a conception of discipline that takes into account the need for flexibility in intervention work and exists as a common focus on a program’s vision and ethos, rather than rigidity.

LMIC contexts are often marked by a dearth of resources with which to conduct inquiry and intervene. As such, there is a necessity to facilitate programming that judiciously makes use of what resources there are, but also has the potential to endure. In these contexts there is also urgency to determine the need to intervene; multiple risk factors interact synergistically to compromise development across the life course, and taking steps to stymie these cascades cannot wait. Developing an evidence base from which to inform interventions is imperative. However, we should not be hasty in assuming that an EBI is going to succeed in real-world settings, without taking due consideration of how it is implemented and by whom. It may be tempting to replicate seemingly effective programs.
across different contexts. Core features of interventions may be consistently important. How these features are implemented, however, may need to be tailored (this point is echoed by Yousafzai et al.\textsuperscript{18}).

In this regard, some features of implementation, such as the types of soft skills required of CHWs or the duration of work and good regard of community-based partners, may be consistently relevant and remain important across replication contexts. However, it may be useful to conceive of each context as requiring its own, tailored, and contextually dependent mode and method of implementation, even if this overstates the case, as it draws our attention to the centrality of contextual idiosyncrasies in determining implementation effect. The process context, as we have noted, is of primary importance. EBIs must be embedded in organizational contexts that are established, and have a leadership structure and ethos that will facilitate their success. This also highlights the need for implementers to take a long-term perspective on intervention, where gaining a sense for the human resource and process features of organizations are given time to accrue and cement. Ultimately, if these process factors become more central to our thinking about implementation science, and embedded in intervention frameworks, the task of translating efficacy into effectiveness, and then into scalability, is more likely.

Acknowledgments

This paper was invited to be published individually and as one of several others as a special issue of Ann. N.Y. Acad. Sci. (1419: 1–271, 2018). The special issue was developed and coordinated by Aisha K. Yousafzai, Frances Aboud, Milagros Nores, and Pia Britto with the aim of presenting current evidence and evaluations on implementation processes, and to identify gaps and future research directions to advance effectiveness and scale-up of interventions that promote young children’s development. A workshop was held on December 4 and 5, 2017 at and sponsored by the New York Academy of Sciences to discuss and develop the content of this paper and the others of the special issue. Funding for open access of the special issue is gratefully acknowledged from UNICEF and the New Venture Fund.

M.T. and M.J.R.B. were responsible for the conceptualization of the paper. X.H. and M.T. developed the first draft of the piece, which was then further developed and refined by M.T. and M.J.R.B. M.T. is supported by the National Research Foundation, South Africa and is a Lead Investigator of the Centre of Excellence in Human Development, University Witwatersrand, South Africa.

Competing interests

The authors declare no competing interests.

References

1. Damshroder, L.J., D.C. Aron, R.E. Keith, et al. 2009. Fostering implementation of health services research findings into practice: a consolidated framework for advancing implementation science. Implement. Sci. 4: 50.
2. Rowe, A.K., D. de Savigny, C.P. Lanata & C.G. Victora. How can we achieve and maintain high-quality performance of health workers in low-resource settings? Lancet 2005; 366: 1026–1035.
3. Pearson, E., H. Hendry, N. Rao, et al. 2017. Reaching expert consensus on training different cadres in delivering early childhood development at scale in low-resource contexts. UK Government Department for International Development, London.
4. Olds, D.L., H. Kitzman, M.D. Knudson, et al. 2014. Effect of home visiting by nurses on maternal and child mortality: results of a 2–decade follow-up of a randomized clinical trial. JAMA Pediatr. 168: 800–806.
5. Olds, D.L., J. Robinson, R. O’Brien, et al. 2002. Home visiting by paraprofessionals and by nurses: a randomized, controlled trial. Pediatrics 110: 486–496.
6. Peacock, S., S. Konrad, E. Watson, et al. 2013. Effectiveness of home visiting programs on child outcomes: a systematic review. BMC Public Health 13: 17.
7. Dodge, K.A., W.B. Goodman, R.A. Murphy, et al. 2014. Implementation and randomized controlled trial evaluation of universal postnatal nurse home visiting. Am. J. Public Health 104(Suppl. 1): S136–S143.
8. Carroll, C., M. Patterson, S. Wood, et al. 2007. A conceptual framework for implementation fidelity. Implement. Sci. 2: 40.
9. Hasson, H. 2010. Systematic evaluation of implementation fidelity of complex interventions in health and social care. Implement. Sci. 5: 67.
10. Fagan, A.A., K. Hanson, J.D. Hawkins & M.W. Arthur. 2008. Bridging science to practice: achieving prevention program implementation fidelity in the community youth development study. Am. J. Community Psychol. 41: 235–249.
11. Dunn, C.J., C.M. Trivette & M. Raab. 2013. An implementation science framework for conceptualizing and operationalizing fidelity in early childhood intervention studies. J. Early Interv. 35: 85–101.
12. Mihalic, S.F., A.A. Fagan & S. Argamaso. 2008. Implementing the LifeSkills Training drug prevention program: factors related to implementation fidelity. Implement. Sci. 3: 5.
13. Breitenstein, S.M., D. Gross, C.A. Garvey, et al. 2010. Implementation fidelity in community-based interventions. Res. Nurs. Health 33: 164–173.

14. Odom, S.L. 2009. The tie that binds: evidence-based practice, implementation science, and outcomes for children. Top. Early Child. Special Educ. 29: 53–61.

15. Dusenbury, L., R. Brannigan, M. Falco & W.B. Hansen. 2003. A review of research on fidelity of implementation: implications for drug abuse prevention in school settings. Health Educ. Res. 18: 237–256.

16. Wasik, B.A., S.K. Mattera, C.M. Lloyd & K. Boller. 2013. Intervention dosage in early childhood care and education: it’s complicated. U.S. Department of Health and Human Services, Washington, DC.

17. Nores, M. & C. Fernandez. 2018. Building capacity in health and education systems to deliver interventions that strengthen early child development. Ann. N.Y. Acad. Sci. 1419: 57–73.

18. Yousafzai, A.K., M.A. Rasheed & S. Siyal. 2018. Integration of parenting and nutrition interventions in a community health program in Pakistan: an implementation evaluation. Ann. N.Y. Acad. Sci. 1419: 160–178.

19. Britto, P.R., S.J. Lye, K. Proulx, et al. 2017. Nurturing care: promoting early childhood development. Lancet 389: 91–102.

20. Flay, B.R., A. Biglan, R.F. Boruch, et al. 2005. Standards of evidence: criteria for efficacy, effectiveness and dissemination. Prev. Sci. 6: 151–175.

21. Le Roux, I.M., M. Tomlinson, J.M. Harwood, et al. 2013. Outcomes of home visits for pregnant mothers and their infants: a cluster randomized controlled trial. AIDS 27: 1461–1471.

22. Rotheram-Borus, M.J., I.M. le Roux, M. Tomlinson, et al. 2011. Philani Plus (+): a Mentor Mother community health worker home visiting program to improve maternal and infants’ outcomes. Prev. Sci. 12: 372–388.

23. Rotheram-Borus, M.J., M. Tomlinson, I.M. le Roux, et al. 2014. A cluster randomised controlled effectiveness trial evaluating perinatal home visiting among South African mothers/infants. PLoS One 9: e105934.

24. Le Roux, I.M., M.J. Rotheram-Borus, J. Stein & M. Tomlinson. 2014. The impact of paraprofessional home visitors on infants’ growth and health at 18 months. Vulnerable Child. Youth Stud. 9: 291–304.

25. Austin, S.A. & N. Mbewu. 2009. Philani program: a case study of an integrative approach of empowerment and social and economic development. Soc. Work Public Health 24: 148–160.

26. Tomlinson, M., M.J. Rotheram-Borus, I.M. Le Roux, et al. 2016. 36 month outcomes of a generalist paraprofessional perinatal home visiting intervention in South Africa. Prev. Sci. 12: 372–388.

27. Oakley, A., V. Strange, C. Bonell, et al. 2006. Health services research: process evaluation in randomised controlled trials of complex interventions. Br. Med. J. 332: 413.

28. Yousafzai, A.K., M.A. Rasheed & S. Siyal. 2018. Integration of parenting and nutrition interventions in a community health program in Pakistan: an implementation evaluation. Ann. N.Y. Acad. Sci. 1419: 160–178.

29. McGrew, J.H. & M.E. Griss. 2005. Concurrent and predictive validity of two scales to assess the fidelity of implementation of supported employment. Psychiatr. Rehabil. J. 29: 41.

30. Resnick, S.G., M.S. Neale & R.A. Rosenheck. 2003. Impact of public support payments, intensive psychiatric community care, and program fidelity on employment outcomes for people with severe mental illness. J. Nerv. Ment. Dis. 191: 139–144.

31. Chorpita, B.F., K.D. Becker & E.L. Daleiden. 2007. Understanding the common elements of evidence-based practice: misconceptions and clinical examples. J. Am. Acad. Child Adolesc. Psychiatry 46: 647–652.

32. Chorpita, B.F., E.L. Daleiden & J.R. Weisz. 2005. Identifying and selecting the common elements of evidence based interventions: a distillation and matching model. Ment. Health Serv. Res. 7: 5–20.

33. Rotheram-Borus, M.J., M. Tomlinson, I. Le Roux & J.A. Stein. 2015. Alcohol use, partner violence, and depression: a cluster randomized controlled trial among urban South African mothers over 3 years. Am. J. Prev. Med. 49: 715–725.

34. Chorpita, B.F. & E.L. Daleiden. 2009. Mapping evidence-based treatments for children and adolescents: application of the distillation and matching model to 615 treatments from 322 randomized trials. J. Consult. Clin. Psychol. 77: 566–579.

35. Rotheram-Borus, M., D. Swendeman, E. Rotheram-Fuller & M.K. Yousuf. 2018. Family coaching as a delivery modality for evidence-based prevention programs. Clin. Child Psychol. Psychiatry 23: 96–109.

36. Rowden, R.W. 2002. The relationship between workplace learning and job satisfaction in U.S. small to midsize businesses, HRDQ 13(4): 407–425.

37. Naong, M.N. 2009. Impact of skills development training on employee motivation, perceptions of organizational climate and individual performance. University of KwaZulu-Natal, Westville.

38. da Costa, T.M., B.J. Barbosa, D.A. Gomes e Costa, et al. 2012. Results of a randomized controlled trial to assess the effects of a mobile SMS-based intervention on treatment adherence in HIV/AIDS-infected Brazilian women and impressions and satisfaction with respect to incoming messages. Int. J. Med. Inform. 81: 257–269.

39. Vorrink, S.N., H.S. Kort, T. Troosters, et al. 2016. Efficacy of an mHealth intervention to stimulate physical activity in COPD patients after pulmonary rehabilitation. Eur. Respir. J. 48: 1019–1029.

40. Whittaker, R., K. Staik, H. Mcdowell, et al. 2017. MEMO: an mHealth intervention to prevent the onset of depression in adolescents: a double-blind, randomised, placebo-controlled trial. J. Child Psychol. Psychiatry 58: 1014–1022.

41. Chang, L.W., J. Kagaayi, H. Arem, et al. 2011. Impact of a mHealth intervention for peer health workers on AIDS care in rural Uganda: a mixed methods evaluation of a cluster-randomized trial. AIDS Behav. 15: 1776–1784.

42. Chanani, S., J. Wacksman, D. Deshmukh, et al. 2018.-eight lessons for diffusing and scaling evidence-based interventions Tomlinson et al.
43. Morgan, B., X. Hunt. & M. Tomlinson. 2017. Thinking about the environment and theorising change: how could life history strategy theory inform mHealth interventions in low- and middle-income countries? * Glob. Health Action* **10**:1320118.

44. Tomlinson, M., M.J. Rotheram-Borus, T. Doherty, et al. 2013. Value of a mobile information system to improve quality of care by community health workers. *S. Afr. J. Inf. Manag.* **15**: https://doi.org/10.4102/sajim.v15i1.528.

45. Lewin, S.A., J. Dick, P. Pond, et al. 2005. Lay health workers in primary and community health care. *Cochrane Database Syst. Rev.* CD004015.

46. Radner, J.M., M.J.S. Ferrer, D. McMahon, A.H. Shankar & K.L. Silver. 2018. Practical considerations for transitioning early childhood development interventions to scale: lessons from the Saving Brains portfolio. *Ann. N.Y. Acad. Sci.* **1419**: 230–248.

47. Klein, K.J., A.B. Conn & J.S. Sorra. 2001. Implementing computerized technology: an organizational analysis. *J. Appl. Psychol.* **86**: 811.

48. Lukas, C.V., S.K. Holmes, A.B. Cohen, et al. 2007. Transformational change in health care systems: an organizational model. *Health Care Manag. Rev.* **32**: 309–320.

49. Sabin-Farrell, R. & G. Turpin. 2003. Vicarious traumatization: implications for the mental health of health workers? *Clin. Psychol. Rev.* **23**: 449–480.

50. Sievert, K., S. Jayaratne & W.A. Chess. 1991. Job satisfaction, burnout, and turnover in health care social workers. *Health Soc. Work* **16**: 193–202.

51. Costello, A. & S. Dalglish. 2016. Towards a grand convergence for child survival and health: a strategic review of options for the future building on lessons learnt from IMNCI. Geneva: World Health Organization.

52. Cooper, L.A., A.N. Ortega, A.S. Ammerman, et al. 2015. Calling for a bold new vision of health disparities intervention research. *Am. J. Public Health* **105**(Suppl. 3): S374–S376.

53. Wood, J.I., B.D. McLeod, S. Klebanoff & L. Brookman-Frazee. 2015. Toward the implementation of evidence-based interventions for youth with autism spectrum disorders in schools and community agencies. *Behav. Ther.* **46**: 83–95.

54. Collins, J.C. & J.I. Porras. 1996. Building your company’s vision. *Harvard Bus. Rev.* **74**: 65–77.

55. Collins, J.C. 2001. The misguided mix-up of celebrity and leadership. Accessed 15, June 2017. http://www.jimcollins.com/article_topics/articles/the-misguided-mixup.html.

56. Kawakatsu, Y., T. Sugishita, J. Kioko, et al. 2012. Factors influencing the performance of community health workers in Kisumu West, Kenya. *Prim. Health Care Res. Dev.* **13**: 294–300.

57. Takasugi, T. & A. Lee. 2012. Why do community health workers volunteer? A qualitative study in Kenya. *Public Health* **126**: 839–845.

58. Tomlinson, M., L. Sherr, A. Macedo, et al. 2017. Paid staff or volunteers—does it make a difference? The impact of staffing on child outcomes for children attending community-based programmes in South Africa and Malawi. *Glob. Health Action* **10**: 1381462.

59. Gladstone, M., J. Phuka, R. Thindwa, et al. 2018. Care for Child Development in rural Malawi: a model feasibility and pilot study *Ann. N.Y. Acad. Sci.* **1419**: 102–119.

60. Klein, K.J. & J.S. Sorra. 1996. The challenge of innovation implementation. *Acad. Manag. Rev.* **21**: 1055–1080.

61. Nembhard, I.M. & A.C. Edmondson. 2006. Making it safe: the effects of leader inclusiveness and professional status on psychological safety and improvement efforts in health care teams. *J. Organ. Behav.* **27**: 941–966.

62. Lobb, R. & G.A. Colditz. 2013. Implementation science and its application to population health. *Ann. Rev. Public Health* **34**: 235–251.

63. Chassin, M.R., J.M. Loeb, S.P. Schmaltz & R.M. Wachter. 2010. Accountability measures—using measurement to promote quality improvement. *N. Engl. J. Med.* **363**: 683–688.

64. Engle, P.L., M.M. Black, J.R. Behrman, et al. 2007. Strategies to avoid the loss of developmental potential in more than 200 million children in the developing world. *Lancet* **369**: 229–242.

65. Dooley, D. 1975. Selecting nonprofessional counselor trainees with the Group Assessment of Interpersonal Traits (GAIT). *Am. J. Community Psychol.* **3**(4): 371–383.