

Behavior Change for Newborn Survival in Resource-Poor Community Settings: Bridging the Gap Between Evidence and Impact

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Despite an established evidence base of simple, affordable, and low-cost interventions to avert neonatal deaths, global progress in reducing neonatal mortality has stagnated in recent years. Under-recognition of the critical role played by behavior change in ensuring adoption and dissemination of innovations is a major reason for this gap between evidence and impact. A general lack of understanding of the mechanisms underlying behavior change at a population level coupled with an under-appreciation of the sociocultural context of newborn care behaviors has underscored ill-informed approaches towards behavior change that have met with limited success. This article draws upon available evidence from prevention-oriented, community-based newborn survival trials to derive insights into the role of behavior change in neonatal mortality reduction. We propose a simple model, the intervention-causation pathway, to explain the pathway through which behavior change interventions may lead to reductions in mortality. Further, we explore the unique nature of newborn care behaviors and their underlying sociocultural context, along with state-of-the-art advances in social, behavioral, and management sciences. These principles form the basis of the behavior change management framework that has successfully guided intervention design and implementation, leading to high impact on neonatal mortality reduction, in Uttar Pradesh, India. We describe how the behavior change management framework can be applied to inform the design of theoretically and empirically sound behavior change interventions with greater precision, predictability and pace towards reduction in neonatal mortality. We finally touch upon key overarching principles that should guide intervention execution for maximal impact.

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In 2005, global experts proposed that a set of simple and highly cost-effective packages of interventions, when implemented at high coverage, could avert up to 72% of neonatal deaths in resource poor settings.¹ Five years since, nearly 20 million newborns have died, and implementation of effective national programs that deliver proven interventions at high coverage (ie, at scale) remains elusive.² A plausible explanation is the inability to recog-

nize the critical role of behavior change as a “last mile connectivity” in translating available evidence into gains for newborn survival (Table 1). As is evident from Table 1, to have an impact, every element of the recommended package, whether implemented through family-community, outreach, or facility-based modes of service delivery, ultimately depends on behavior change of mothers and caregivers at the household level. The importance of household health behaviors has been aptly summarized as follows³:

It is not sufficient, however, to develop a clinically effective health technology. It is not even sufficient to make it available on a wide scale. A health technology must be utilized consistently and correctly at the household level, in order to realize its potential to significantly improve health.

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Despite being such a critical determinant of newborn survival, there is ambiguity in our understanding about the basic mechanisms of behavior change and the mediators of behavioral interventions. This has led to uninformed behavior change strategies, primarily aimed at “education” and communication of desired behaviors and their benefits through generic messages that are disconnected from the local context, mostly targeted towards an illiterate audience assuming them to be “empty cups” that can be filled with knowledge, largely disregarding the existence of preconceptions, attitudes, choices (or lack thereof), and traditional know-how.

Understandably, there is a growing realization that information by itself does not necessarily translate into action, exposing the so-called knowledge-attitudes-practices gap, or the gap between knowledge and attitudes on one side and practices on the other.⁴

Inability to effectively address household-level behavior change has been associated with an over-emphasis on top-down, disease-specific, vertical approaches to child survival that over-simplify complex multifactorial welfare processes into single-cause problems, leading to simple technological solutions to such problems, with overestimates of their effective-

Table 1 Evidence-Based Cost-Effective Newborn Care Intervention Packages: Associated Behavioral Prerequisites for Effectiveness

Period	Nature of the Intervention	Reduction in All-Cause Neonatal Mortality	Associated Behavioral Prerequisites for Effectiveness
Antenatal/ intrapartum/ postnatal	Family care: clean home delivery, hygienic cord care, thermal care, breastfeeding promotion	10%-50%	Discarding existing high-risk practices and adopting improved newborn care practices by the birth attendant and primary care givers of the newborn
Preconception	Folic acid supplementation	Incidence of neural tube defects: 40%-85%	Adherence to folic acid prescription
Antenatal	Antenatal care: physical examination, tetanus toxoid vaccination, detection and treatment of syphilis and pre-eclampsia	10%-20%	Preventive care-seeking for antenatal care, acceptance of vaccines, adherence to treatment
	Malaria (intermittent presumptive treatment during pregnancy)	10%-30%	Adherence to treatment
	Detection and treatment of asymptomatic bacteriuria	Incidence of prematurity or low birth weight: 20%-55%	Preventive care-seeking for antenatal care, follow-up with pathologist and health provider, adherence to treatment
Intrapartum	Skilled maternal and immediate neonatal care	Skilled birth care: 20%-30%; resuscitation: 5%-20%	Acceptance of and active demand for skilled birth attendance
	Emergency obstetrical care: management of complications—obstructed labor, hemorrhage, hypertension, infection	10%-15%	Active demand for institutional delivery, timely recognition and care-seeking for complications from equipped facility, adherence to advice on referral
	Antibiotics for preterm premature rupture of membranes	Incidence of infections: 15%-45%	Timely recognition and care-seeking for complications from appropriate health providers, adherence to treatment
	Antenatal corticosteroids for preterm labor	25%-50%	Timely recognition and care-seeking for complications from appropriate health providers
Postnatal	Extra care for low birth weight infants: extra warmth, hygiene, feeding	20%-40%	Weighing of infant, discarding existing high-risk practices and adoption of improved newborn care practices by primary care givers of the newborn
	Case management for pneumonia	10%-35%	Adherence to advice on referral, and treatment
	Emergency neonatal care: management of serious illness (infections, asphyxia, prematurity, jaundice)	15%-50%	Timely recognition and care-seeking for complications from appropriate health providers, adherence to treatment

Adapted from Darmstadt et al.¹

Table 2 Comparison of Intervention Inputs from a Behavior Change Perspective In Community-Based RCTs to improve newborn survival

	Kumar et al, 2008 (Shivgarh, India)	Darmstadt et al, 2010 (Mirzapur, Bangladesh)	Baqui et al, 2008 (Sylhet, Bangladesh) Community Care	Manandhar et al, 2004 (Makwanpur, Nepal)	Tripathy et al, 2010 (Jharkhand and Orissa, India)	Azad et al, 2010 (Three Districts, Bangladesh)
Study area population	104,000	292,000	480,000 (estimated)	170,000	228,186	503,163
Targeted behaviors				Not specified, differed by women's group	Not specified, differed by women's group	Not specified, differed by women's group
• Antenatal care		ANC visits, TT immunization, iron-folic acid consumption, diet, care-seeking for maternal danger signs	ANC visit, consumption of iron-folic acid administration, TT immunization, care-seeking for maternal danger signs	✓	✓	✓
• Birth preparedness	Prepare postdelivery confinement room, identify delivery and newborn care roles, clean birth kit, etc.	Plan for facility delivery, prepare room, identify roles, clean birth kit, etc.	✓			
• Skilled/hygienic delivery	Delivery in hands, hand-washing, use of clean instruments	Avoid contact with floor, use clean kit	✓	✓	✓	✓
• Thermal care	Delay in first bath, drying and wrapping, skin to skin care	Delay in first bath, drying and wrapping	Delay in first bath	✓	✓	✓
• Umbilical cord care/skin care	Clean cord-cutting, avoid applications on cord, do not remove vernix	Clean cord-cutting, avoid applications on cord	Clean cord-cutting	✓	✓	✓
• Breastfeeding	Initiation within 1 h, feed colostrum, no prelacteal feeds	Initiation within 1 h, feed colostrum, no prelacteal feeds	Initiation within 1 h	✓	✓	✓
• Care-seeking for newborn illnesses	Recognize danger signs and seek care from qualified provider	Active surveillance for illness; seek care for newborn illnesses	Seek care for signs of serious illnesses	✓	✓	✓
Target group composition	Pregnant women with family (including men), newborn care providers (traditional and formal), community gatekeepers	Pregnant women with family (including men), traditional health providers	Diverse community members, pregnant women encouraged to attend	Women's groups with attendance from pregnant women	Women's groups with attendance from pregnant women	Women's groups with attendance from pregnant women
Agents of behavior change	Intervention worker, community volunteers, newborn care stakeholders	Intervention worker	Intervention worker	Women's groups	Women's groups	Women's groups
Intervention worker inputs						
Home visits by CHWs (number of visits)	2 antenatal, 2 postnatal	2 antenatal, 4 postnatal	NA	NA	NA	NA
Frequency of community interactions	Monthly with each target group of stakeholders	NA	Once in 4 mo by female workers; once in 10 mo by male workers	Monthly with each women's group	Monthly with each women's group	Monthly with each women's group
Worker-to-population ratio	1:3500	1:4000	1:18,000	1:7000	1:6338	1:27,953
Community ownership						
Problem identification	Passive	Passive		Active	Active	Active
Intervention design	Passive	Passive		Active	Active	Active
Intervention delivery	Active		Passive	Active	Active	Active
Intervention evaluation				Active	Active	Active
Approach towards behavior change						
Behavior change communication	✓	✓	✓			

Table 2 Continued

	Kumar et al, 2008 (Shivgarh, India)	Darmstadt et al, 2010 (Mirzapur, Bangladesh)	Baqui et al, 2008 (Sylhet, Bangladesh) Community Care	Manandhar et al, 2004 (Makwanpur, Nepal)	Tripathy et al, 2010 (Jharkhand and Orissa, India)	Azad et al, 2010 (Three Districts, Bangladesh)
Community mobilization	Multiple levels: community volunteers (men and women), traditional care providers, community gatekeepers and members		✓	Women's groups—community action cycle	Women's groups—community action cycle	Women's groups—community action cycle
Behavior change management	✓					
Role of intervention worker						
Facilitate community meetings	✓		✓	✓	✓	✓
Provide information/knowledge	✓		✓	✓	✓	✓
Negotiate/address barriers to change	✓	✓				
Develop customized plan for family	✓					
Assess behavioral risks	✓					
Use specific algorithm for clinical assessment		Integrated management of childhood illness-based algorithm				
Refer sick newborns to health facility		✓				
Manage newborns at home						
What did the family receive? (directly or indirectly)				Differed by group	Differed by group	Differed by group
Contextualized information	Contextualized BCC messages, central theme of "hypothermia"	Contextualized BCC messages		Picture card game	Picture card game	Picture card game
Motivation	Intrinsic: barriers addressed through path of least resistance, social influence	Intrinsic: barriers negotiated Extrinsic: distributed clean birth kits	Intrinsic: promotion of birth and newborn care preparedness	Extrinsic: for example, clean birth kits, stretchers	✓	✓
Behavioral skills and self-efficacy	Counseling and assistance by CHW for practicing new behaviors	Counseling by CHW for practicing new behaviors				
Enabling environment and support systems	Support from family, peers, health workers and volunteers.	Referral transport and free-of-charge care at facility.	Support from religious community	Social support through women's group initiatives, eg, health funds	Social support through women's group initiatives	Social support through women's group initiatives
Mechanisms for maintaining, sustaining and institutionalizing new behaviors	Involvement of community volunteers and role models in intervention delivery, incorporating BCC messages into local folk songs			Transferring ownership of community action cycle to women's groups?	Transferring ownership of community action cycle to women's groups?	Transferring ownership of community action cycle to women's groups?

Abbreviations: ANC, antenatal care; BCC, behavior change communication; CHW, community health worker; NA, not applicable; RCT, randomized controlled trial; TT, tetanus toxoid.

tiveness, and often with the need for dedicated systems to support and sustain their delivery.⁵ Lately, disenchantment with the limited success of traditional methods for behavior change has also led to the use of financial incentives to attract economically deprived communities towards improved behaviors and facility-based care while potentially undermining their intrinsic motivation, lowering their self-esteem, and adversely affecting non-incentivized behaviors—a trend that could potentially have long-term adverse social, economic, and health consequences.^{6,7}

Fortunately, behavior change may not be as mystifying as it appears. Evidence from community-based randomized controlled trials (RCTs) aimed at affecting newborn survival through behavioral interventions provides interesting insights to the process, effect, and limitations of behavior change.⁸⁻¹³ Furthermore, lessons from behavioral science and social psychology, although nascent in their application to newborn care, provide guiding principles for theoretically and empirically sound intervention development.¹⁴⁻¹⁶

In this work we attempt to review key community-based trials that provide useful insights and further our understanding of the role, application and outcomes of behavioral interventions. We focus primarily on the elements of interpersonal interaction, rather than mass communication, which are critical to effective promotion of life-saving newborn care behaviors. We discuss some unique attributes of newborn care behaviors, the primacy of sociocultural context, and present behavior change management as an evidence-based framework to guide the design and implementation of behavioral interventions.¹¹ We use the term “behavior change” in a broad sense, encompassing acquisition of new preventive and promotive behaviors, modification of existing risk-enhancing behaviors, and maintenance of these behaviors.

What Does Evidence from Community-Based Trials Tell Us About Behavior Change and Its Impact on Newborn Survival?

We begin by taking stock of what we already know about behavior change from community-based trials on newborn survival. For simplicity in understanding and interpretation, we have selectively reviewed community-based controlled trials that have studied the impact of preventive and promotive interventions on newborn survival. We have applied the prism of behavior change to differentiate and compare the various interventions and outcomes across multiple dimensions and draw inferences about the relationship between behavioral inputs and outcomes.

In a very high (ie, NMR categories as defined in Lawn 2005¹⁷) neonatal mortality rate (NMR) region (NMR in the comparison area: 84.2 per 1000 live births) in Shivgarh (Uttar Pradesh, India), Kumar et al¹¹ tested a package of preventive essential newborn care (ENC) practices delivered by community health workers (CHWs) through 2 antenatal and 2 postnatal home visitations along with community meetings

with multiple levels of newborn care stakeholders, which led to improvements in birth preparedness, hygienic delivery, thermal care (including skin-to-skin care), umbilical cord care, skin care and breastfeeding practices, and reduced NMR by 54%.

In a moderate NMR region (NMR in the comparison area: 27.9 per 1000 live births) in Mirzapur, Bangladesh, Darmstadt et al¹⁰ tested a package of preventive and promotive newborn care practices, illness assessment, and referral of sick newborns that was delivered through 2 antenatal and 4 postnatal home visitations by CHWs, which had a high impact on thermal care practices, a low-to-moderate impact on other targeted practices, including care-seeking, but no impact on NMR. In a high NMR region (NMR in the comparison area: 43.5 per 1000 live births) in Sylhet, Bangladesh, Baqui et al⁹ in their “community care” arm, tested the impact of promotion of birth and newborn-care preparedness and care-seeking from qualified providers through group sessions held by female and male community mobilizers, which has a low impact on reported behaviors and no impact on NMR.

Costello and colleagues tested a community-driven participatory intervention involving women’s groups in 3 regions of South Asia—the Makwanpur district (Nepal)¹², the West Singhbhum and Keonjhar districts (India)¹³, and the Bogra, Faridpur, and Moulavibazar districts (Bangladesh).⁸ The women’s groups identified local perinatal problems and formulated strategies to address them through an action-learning cycle supported by female facilitators. In Makwanpur, a high NMR region (NMR in the comparison area: 36.9 per 1000 live births), the intervention had a high impact on antenatal care, intrapartum, and care-seeking behaviors and a 30% reduction in NMR.^{12,18} In West Singhbhum and Keonjhar, a very high NMR region (NMR in the comparison area: 59.1 per 1000 live births) the intervention had a high impact on intrapartum and cord care behaviors, a moderate impact on breastfeeding, and a 32% reduction in NMR.¹³ In a high NMR region (NMR in the comparison area: 36.5 per 1000 live births) in rural Bangladesh, a scaled-up version of the intervention did not lead to any impact on behaviors or NMR.⁸

Table 2 attempts to compare the documented intervention inputs in these studies along various dimensions to gain a deeper understanding of these interventions from a behavior change perspective. The dimensions include targeted behaviors, target group composition, agents of behavior change, intervention worker inputs, community ownership, approach towards behavior change, role of intervention workers, what the family received directly or indirectly as inputs to aid behavior change, and finally, any documented mechanisms to sustain and institutionalize new behaviors within the community. Table 3 documents the impact of these interventions on NMR and changes in behaviors. Table 4 summarizes key aspects from Tables 2 and 3 and attempts to provide plausible explanations for the observed effects.

Table 3 Comparison of Impact of Community-Based RCTs to Improve Newborn Survival on Newborn Care Behaviors and NMR

	Kumar et al, 2008 (Shivgarh, India)	Darmstadt et al, 2010* (Mirzapur, Bangladesh)	Baqui et al, 2008* (Sylhet, Bangladesh) Community Care	Manandhar et al, 2004 (Makwanpur, Nepal)	Tripathy et al, 2010 (Jharkhand and Orissa, India)	Azad et al, 2010 (3 Rural Districts, Bangladesh)
Control NMR at end line	84.2	27.9	43.5	36.9	59.1	36.5
Intervention NMR at end line	41.0	24.0	45.2	26.2	42.9	33.7
Impact on NMR	0.5 (0.4-0.6)	NC	NC	0.7 (0.5-0.9)	0.7 (0.6-0.8)	NC
Impact on MMR				0.2 (0.1-0.9)	NC	
Impact on behaviors						
Antenatal care						
Routine ANC sought (≥ 1)	1.8 (1.1-3.1)	1.4 (1.3-1.5)	1.3 (1.2-1.3)	2.8 (1.4-5.6)	NC	NC
Visited health facility in case of illness during pregnancy	NC			3.4 (1.8-6.4)	NC	
Birth preparedness						
Preparation of room of delivery	1.5 (1.1-2.1)					
Identification of health facility	3.4 (2.1-5.5)					
Identification of newborn attendant	4.9 (3.2-7.6)					
Prior arrangement of money	1.6 (1.2-2.1)					
Intrapartum						
Institutional delivery	NC	1.2 (1.1-1.4)		3.5 (1.6-8.1)	NC	NC
Delivery in hands/plastic sheet	2.9 (2.4-3.5)				3.9 (2.5-5.9)	NC
Birth attended by skilled birth attendant	NC			3.5 (1.5-8.1)	NC	NC
Birth attendant washed hands with soap				5.5 (2.4-12.6)	2.1 (1.1-3.7)	NC
Safe delivery kit used				4.6 (2.8-7.5)	2.1 (1.3-3.4)	NC
Umbilical cord care and skin care						
Cord tied with sterilized/boiled thread					3.9 (1.8-6.3)	
Cord cut with new or boiled blade	1.2 (1.1-1.3)	1.4 (1.4-1.5)	1.2 (1.2-1.3)	3.5 (1.4-8.7)	NC	NC
Avoided application of potentially harmful material on cord	1.6 (0.7-3.6)	1.1 (1.1-1.1)				
Avoided application of potentially harmful material on body	1.4 (0.8-2.2)					
Thermal care						
Newborn wiped within 30 minutes†	5.1 (4.2-6.1)	4.8 (3.4-6.6)			NC	NC
Newborn wrapped within 30 minutes‡	1.5 (1.2-1.8)	5.0 (3.5-7.0)		NC	NC	NC
First bath delayed by at least 24 h§	2.8 (1.2-6.4)	5.8 (5.1-6.7)	1.9 (1.7-2.1)	NC	NC	NC
Skin-to-skin care within first 24 h	8.5 (6.6-10.9)					
Newborn feeding						
Fed colostrums				NC		
Avoided prelacteal feeding	2.7 (0.9-7.9)	1.7 (1.6-1.8)				
Breastfeeding initiation within 1 h of birth	4.6 (3.4-6.2)	1.5 (1.4-1.5)	1.2 (1.2-1.3)	NC	NC	
Exclusive breastfeeding for first 6 wks					1.8 (1.1-2.9)	NC
Newborn care-seeking						
Care-seeking for newborn illnesses from qualified providers	NC	1.6 (1.5-1.8)		2.8 (1.7-4.9)	NC	NC

Abbreviations: ANC, antenatal care; NC, no significant change; NMR, neonatal mortality rate; RCT, randomized controlled trial.

*Odds ratios have been calculated by comparing intervention and comparison arms at end line based on the data provided in the article.

†Studies had different time bounds: Kumar et al reported wiping of whole body with no mention of time bounds, Darmstadt, et al reported wiping before delivery of placenta, Tripathi et al and Azad et al reported wiping within 30 minutes.

‡Studies had different time bounds: Kumar et al reported wrapping of newborn with no mention of time bounds, Darmstadt et al reported wrapping before delivery of placenta, and Tripathi et al and Azad et al reported wrapping within 30 minutes.

§Studies had different time bounds: Kumar et al, Manandhar et al, Tripathi et al, and Azad et al reported a delay of at least 24 hours, and Darmstadt et al and Baqui et al reported a delay of at least 3 days.

Table 4 reveals the following principal insights on behavior change as an end in itself and as a means to impact newborn survival:

1. Behavior change lies on the pathway to improved newborn survival.
2. Epidemiology plays an important role in the impact that behavior change can have on newborn survival.
3. The effectiveness of an intervention is constrained by the weakest link in the intervention-causation pathway to improved newborn survival.

These insights are elaborated below.

Insight 1: Behavior Change Lies on the Pathway to Improved Newborn Survival

On analyzing Table 4, we find that reduction in NMR in these trials was accompanied by a moderate-to-high reduction in several risk-enhancing behaviors. Where there were no or minimal changes in behavior, neonatal mortality was not affected. Thus, it is logical to conclude that the

Table 4 Summary of Intervention Inputs and Outputs of Community-Based RCTs to Improve Newborn Survival and Plausible Explanations (see [Tables 1](#) and [2](#) for details)

	Kumar et al, 2008 (Shivgarh, India)	Darmstadt et al, 2010 (Mirzapur, Bangladesh)	Baqui et al, 2008 (Sylhet, Bangladesh) Community Care	Manandhar et al, 2004 (Makwanpur, Nepal)	Tripathy et al, 2010 (Jharkhand and Orissa, India)	Azad et al, 2010 (3 Rural Districts, Bangladesh)
NMR profile	Very high (>45 per 1000 live birth)	Moderate (15-29 per 1000 live births)	High (30-45 per 1000 live births)	High (30-45 per 1000 live births)	Very high (>45 per 1000 live births)	High (30-45 per 1000 live births)
Input	Clearly defined intervention package of ENC behaviors promoted via home visits and community meetings, clearly defined multilevel target groups, active community participation, addressed all 4 prerequisites for behavior change, included mechanisms for sustaining behavior change	Clearly defined intervention package of ENC behaviors promoted via home visits plus algorithm for clinical assessment by CHW, addressed most prerequisites for behavior change, no documented mechanisms for sustaining change	Minimal behaviors targeted, suboptimum interaction with target group, did not sufficiently address prerequisites for behavior change, no mechanisms for sustaining change	Targeted behaviors not prespecified and differed by women's groups, strategies for behavior change varied by groups, strong community participation and leadership, mechanisms for sustaining change not documented	Targeted behaviors not prespecified and differed by women's groups, strategies for behavior change varied by groups, strong community participation and leadership, mechanisms for sustaining change not documented	Targeted behaviors not prespecified and differed by women's groups, strategies for behavior change varied by groups, strong community participation and leadership, mechanisms for sustaining change not documented
Outcome: behavior change	Generally, moderate to high impact on all targeted ENC behaviors, except for care-seeking which did not change	Low to moderate impact on all targeted behaviors, including care-seeking, high impact on thermal care behaviors	Low impact on few behaviors that were reported	High impact on ANC, intrapartum and care-seeking behaviors. no impact on thermal care and feeding practices	High impact on intrapartum and cord care, moderate impact on breastfeeding, no impact on antenatal, thermal care and care-seeking	No impact on behaviors
Outcome: NMR impact	54%	—	—	30%	32%	—
Plausible explanation	Epidemiologically sound behavioral targeting coupled with an effective behavior change intervention led to a high impact on NMR	Though behavior change intervention was sufficiently effective, behavioral targeting was not epidemiologically appropriate for a moderate NMR (<30) profile, leading to no impact on NMR	The targeting of behaviors as well as frequency of target group interactions may have been suboptimal, which led to minimal impact on behaviors and no impact on mortality	It is likely that behaviors that recorded higher impact may have received preferential targeting by groups, leading to a significant impact on NMR. High impact on ANC, maternal care-seeking and intrapartum behaviors may explain the MMR impact.	Lesser impact on behaviors compared with Nepal, but similar impact on NMR may be explained by the greater NMR profile of this region.	No impact on NMR can be explained by no impact on behaviors. Women's groups may not have been able to effectively target behaviors and implement strategies.

Abbreviations: ANC, antenatal care; NC, no significant change; NMR, neonatal mortality rate; RCT, randomized controlled trial.

improved survival may have been modulated in an important way through changes in behavior. The converse, however, as also illustrated through these trials, may not be true; that is, improvements in behavior may not always lead to improved survival, leading us to Insight 2, which is discussed next.

The primary direct causes of newborn deaths include infections, intrapartum-related deaths (birth asphyxia), and complications arising as the result of preterm birth. There are multiple risk-enhancing behaviors that put newborns at risk for risks,¹⁹ for example, lack of hygiene and disruptions in the warm chain²¹ make newborns susceptible to the risk of infection. Limited care-seeking from trained health care providers adds to the risk of death due to intrapartum complications. At the same time, there are risk-reducing behaviors that may not be known to communities, such as skin-to-skin care, which has multiple preventive, promotive, and therapeutic benefits to low birth weight and normal birth weight newborns and reduces the risk of infection and complications of prematurity.^{20,21}

Interventions that target the direct causes of mortality may act downstream, midstream, or upstream along the causal chain. For example, the risk of neonatal infection can be modulated through downstream interventions, such as active sepsis management; midstream interventions, such as recognition of danger signs and timely and appropriate care-seeking from health providers; and upstream interventions, such as adopting preventive behaviors, including hygienic delivery, immediate and exclusive breastfeeding, clean cord care, skin care and thermal care. Midstream and upstream interventions mentioned previously are predominantly behavioral in nature and modifiable through appropriate behavior change strategies. Community participation lies even higher upstream. Further upstream are interventions that are more structural in nature, for example those that lead to poverty reduction, increase accessibility to primary education, etc. As we go from downstream to upstream, the number of possible pathways to target neonatal mortality increases; however, the predictability of their impact on neonatal mortality decreases.

Insight 2: Epidemiology Plays an Important Role in the Impact That Behavior Change Can Have on Newborn Survival

Both the Shivgarh and Mirzapur studies achieved moderate-to-high degrees of household level behavior change but had contrastingly differing impacts on neonatal mortality. The Shivgarh study reported very high levels of change in initiation of breastfeeding, adoption of skin-to-skin care and thermal care, and moderate changes in practices pertaining to hygienic delivery, skin care and cord care, but no changes in care-seeking from health facilities. This was associated with a large reduction in neonatal mortality. The Mirzapur study reported high levels of change in thermal care and low to moderate increases in antenatal care, cord care, breastfeeding and care-seeking from health facilities, but no change in neonatal mortality.

One of the plausible explanations for the different relationship between changes in behavior and changes in NMR across these studies is the difference in the epidemiologic landscape in the 2 study sites: Shivgarh had a very high NMR of 84.2 per 1000 live births compared with Mirzapur with a moderate NMR of 27.9, a 3-fold difference. Greater NMR regions have different cause structures of neonatal deaths than lower NMR regions; the causes are skewed in the former towards preventable infectious conditions, such as sepsis.¹⁷ Immediate initiation of breastfeeding and skin-to-skin care coupled with other hygienic practices appears to have largely contributed to the mitigation of the risk of infection and hypothermia and, thus, subsequent mortality reduction in Shivgarh. In Mirzapur, large gains in thermal care do not appear to have translated into significant mortality gains in a relatively lower NMR region that could have potentially benefited from a greater increase in timely access to high-quality clinical care, particularly skilled intrapartum care, and management of birth asphyxia and complications of prematurity.

Insight 3: The Effectiveness of an Intervention Is Constrained by the Weakest Link in the Intervention-Causation Pathway to Improved Newborn Survival

Figure 1 is a simplistic model of a plausible pathway to improved newborn survival through behavior change, which

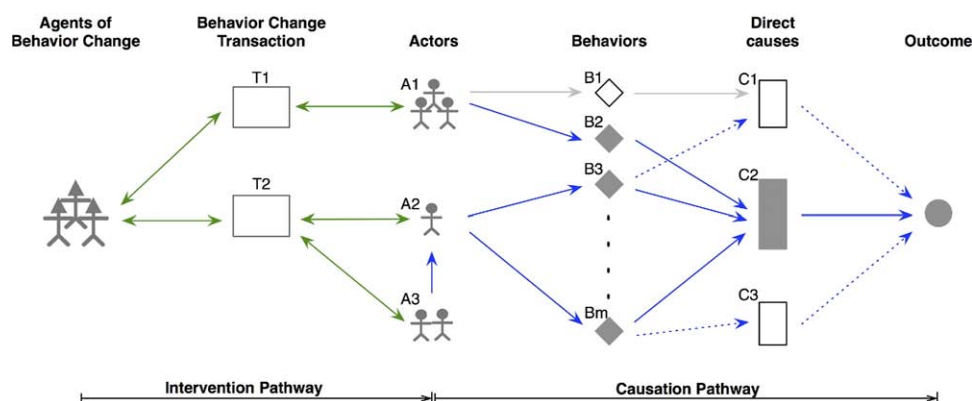


Figure 1 The intervention-causation pathway to improved newborn survival through behavior change. (Color version of figure is available online.)

we call the intervention-causation pathway. It consists of 6 interlinked layers segmented into an intervention pathway and a causation pathway.

The causation pathway begins from the set of various *actors* ($A_1 \dots A_l$) who practice a set of *behaviors* ($B_1 \dots B_m$), some of which increase and some of which decrease the risk for illness or death. These behaviors could be related to the behaviors listed in Table 1. A many-to-many relationship exists between the set of behaviors and the set of *direct causes* of newborn deaths ($C_1 \dots C_n$): each behavior may impact neonatal mortality through multiple direct causes, and each direct cause in turn, may be impacted by multiple behaviors. On the rightmost aspect of the causation pathway is the dichotomous *outcome*, which is either survival or death.

The intervention pathway may begin earlier, but for the sake of this discussion, we will focus on the *agents of behavior change* as the starting point. The agents of behavior change could be people, for example health workers, volunteers, women's groups, etc., who work directly with actors (ie, primary household care givers to the newborn) to change behaviors. Other kinds of agents of behavior change may also play a role, for example, mass media that can serve as a medium to channelize behavior change communication messages towards actors. We define the term behavior change transaction as the complete package of various components of a behavior change intervention arising from interactions between an actor and an agent of behavior change. It may include information, intrinsic and extrinsic motivation to change behaviors, a set of behavioral skills, social mobilization, social support, resource mobilization, etc.

Figure 1 uses an example to demonstrate the model. Suppose an intervention targets C_2 as a direct cause of newborn deaths. C_2 is modulated through behaviors B_2 , B_3 , and B_m . Actor A_1 practices behavior B_2 , and actor A_2 practices behaviors B_3 and B_m . Actor A_3 influences actor A_2 and has a role in determining whether B_3 and B_m are practiced. A behavior change transaction T_1 takes place between change agents and actor A_1 , and T_2 occurs with actors A_2 and A_3 . If T_1 is effective, B_2 will be altered, resulting in a reduction in the risk of C_2 . However, it may not be enough in itself, as B_3 and B_m also affect the risk of C_2 . If B_3 and B_m are altered, they will also impact the outcome through direct causes C_1 and C_3 , respectively (shown through dashed arrows).

Applying this model provides plausible reasons for the effect of the various intervention trials on neonatal mortality:

- In the Shivgarh, Makwanpur and West Singhbhum-Keonjhar trials, each of the links was sufficiently effective, leading to the impact on NMR.
- in the Mirzapur trial, there were elements of the behavior change transaction that were effective, yet the links in the causation pathway between targeted behaviors and direct causes, as well as the relative importance of the impacted direct causes in the NMR cause distribution may have been the weak links. In other words, hypothermia was effectively targeted through behavior change interventions; however, in this setting, hypothermia and infections were not key drivers of the mor-

tality rate. Instead, skilled care at birth to prevent birth asphyxia and management of the preterm infant were far more important causes of death, yet these were not effectively targeted.

- In the community care arm of the Sylhet trial and the women's group trial in Bangladesh, minimal changes in behavior may be explained by weak links in the intervention pathway.

These insights foster the need for a suitable methodology for designing behavior change interventions that can impact neonatal mortality with greater precision and greater predictability. On the basis of the aforementioned discussion and the latest innovations in behavioral and management sciences, we propose that behavior change management (BCM) is one such theoretically and empirically sound framework to guide the rational design of behavioral interventions for impacting newborn survival in resource-poor settings. This framework has been used successfully for intervention development and implementation in the Shivgarh trial.¹¹

Shaping Behavioral Interventions for Newborn Survival

We begin by exploring the unique character of newborn care behaviors and their corresponding sociocultural context, which has important implications on intervention design.

What Characterizes Newborn Care Behaviors?

Behavioral research has typically been directed towards lifestyle-related or addictive behaviors, such as obesity, hypertension, smoking, sexual behavior, that have a well-established theoretical and empirical basis. However, newborn care behaviors are unique in multiple ways. Table 5 compares lifestyle-related or addictive behaviors with newborn care behaviors along multiple dimensions. In the design of newborn behavior change interventions, theories applicable to lifestyle behaviors should be adapted to the unique context of newborn care behaviors in light of the implications outlined in Table 5.

The implications of the uniqueness of newborn care behaviors on intervention design include:

- The target group for behavioral interventions should include household members along with other actors and influencers of behavioral decisions.
- As household-level behaviors are influenced by social norms, once the new behaviors are sanctioned and adopted by a critical mass of people, the barriers to behavior change are greatly reduced.
- As actors typically are unaware of the risks posed by existing risk-enhancing behaviors, they need to be taken through a process of contextualized reasoning that helps them realize and understand the risks associated with existing risk-enhancing behaviors and the benefits associated with recommended risk-reducing behaviors.

Table 5 Distinction Between Newborn Care Behaviors and Lifestyle/Addictive Behaviors and Its Implications on Behavior Change Intervention Design

	Lifestyle/Addictive Behaviors	Newborn Care Behaviors	Implications on Intervention Design
Locus of behavioral action	The locus of behavioral action is usually the individual who is practicing these behaviors	There is no single actor (eg, the mother). The locus of behavioral action is the household, with different members playing different roles in newborn care, and porous entry of traditional newborn care providers serving expert roles.	As the household is the locus of behavioral action, the target group for newborn care interventions should include the household as a unit, along with other actors and influencers
Behavioral context	Psychosocial: these behaviors usually take the form of habits rooted in individual experiences and psychological responses to social and environmental factors	Sociocultural: these behaviors are not habitual, and are rooted in cultural value systems embedded in social norms	Individuals and households cannot be isolated from the sociocultural context, and the intervention should address these behaviors at a normative level in order to be successful. Intervention delivery is easier and potentially more structured, as complex psychological processes and withdrawal symptoms need not be taken into account.
Perceived risk	The extent of perceived risk may vary, but actors are usually aware, however remotely, that these behaviors pose a greater risk for morbidity and mortality	Actors are often unaware of the risks posed by these behaviors; on the contrary, they usually attribute multiple benefits to them	An essential step of the intervention process should involve taking these actors through a process of contextualized reasoning that helps them realize and understand the risks associated with existing high-risk behaviors and the benefits associated with recommended behaviors.
Perceived barriers	Changing habit patterns, pleasure-pain choices, etc.	Cultural and spiritual factors enforced by social norms, belief that these behaviors are beneficial rather than high-risk	Motivation and negotiation for behavior change should address these barriers, including the risk that may be perceived in adopting a new behavior or modifying an existing behavior.
Mode of behavioral transmission	Generally, peer-to-peer	Transmitted along generations through familial hierarchy and by role-experts. Younger, inexperienced actors (eg, young/first-time mothers) acquire these behaviors from older, more experienced influencers whose knowledge and experience on these behaviors is valued	It is important to convince and motivate the more experienced actors who have influence over actors with lesser experience. Can the same mode of transmission be leveraged for the new recommended behaviors to institutionalize them and embed them within the socio-cultural context?
Social sanction	Usually the exception to the norm, and not valued by society as a whole	Usually the norm with an almost universal degree of social sanction	The intervention must reach a critical mass of people who can influence social norms

- Motivation and negotiation for behavior change should sufficiently address perceived barriers, for example cultural and spiritual factors, as well as financial barriers when applicable.
- As risk-enhancing behaviors are passed on from older, more experienced actors to younger, lesser experienced actors, the behavior change intervention should be directed along the same pathway.

These form some of the bases of the BCM framework.

Sociocultural Context for Behavior Change: “The Cup Is Not Empty”

The most stubborn habits which resist change with the greatest tenacity are those which worked well for a space of time and led to the practitioner being rewarded for those behaviors. If you suddenly tell such persons that their recipe for success is no longer viable, their personal

experience belies your diagnosis. The road to convincing them is hard. It is the stuff of classic tragedy. (Hampden-Turner C, Arc L: The raveled knot: an examination of the time-to-market issue at analog's semi-conductor division, unpublished internal report).

The aforementioned quote alerts us to the folly of misunderstanding, misinterpreting, trivializing, or worse, ignoring altogether, the historical and sociocultural context while developing and implementing behavior change interventions, including the introduction of technological innovations. In the context of newborn health, the social norms of a community have been shaped over time, often centuries, as for Shivgarh, by communities' experience and empiric knowledge aimed at improving newborn survival. Concepts, such as ritual pollution, evil eye and evil spirit, postdelivery confinement, exist across geographies and can be seen as cultural innovations that emerged within the rational bounds of traditional knowledge.^{11,22-24}

The biomedical community frequently finds itself challenged because some of these culturally embedded rational frameworks are contradictory to conventional scientific thought. However, these paradigms are often grounded in a logical thought process layered on axiomatic cultural values and even deeper underlying assumptions in the social subconscious. For example, in India, the cow occupies a sacred space in the common Hindu consciousness; therefore, contrary to scientifically proven germ theory, cow dung is considered purifying and thus is applied to the umbilical stump in what is perceived to be a protective, purifying act. As another example, across cultures, mothers and newborns are quarantined in the postnatal period from evil spirits that have traditionally been perceived to carry the risk of newborn death, and in the process, access of the mother and newborn to curative care within the health system is stifled.

It is only logical that we attempt to understand the socio-cultural operating systems on which newborn care behaviors are layered if we intend to modify the behavioral risk factors or synergize existing practices to catalyze health gains. The cup of reason is not empty, but rather, has a rich history founded in family and community values and shared experiences, and replacing the contents of the cup may not be a pragmatic or desirable option in the near term. Instead, we need to look for ways to "dissolve" new knowledge into the existing pool of understanding. New knowledge can be made appealing to cultural sensibilities by embedding it within existing socioculturally appropriate reasoning pathways.

The BCM Framework for Designing Behavior Change Interventions for Newborn Survival

The BCM framework (Fig. 2) is based on the intervention-causation pathway to improved newborn survival through behavior change. Intervention design follows the reverse direction from the outcome layer (ie, the goal of the behavioral intervention) towards the agents of behavior change layer, whereas intervention implementation follows the forward direction along the intervention-causation pathway. Intervention design consists of the following steps:

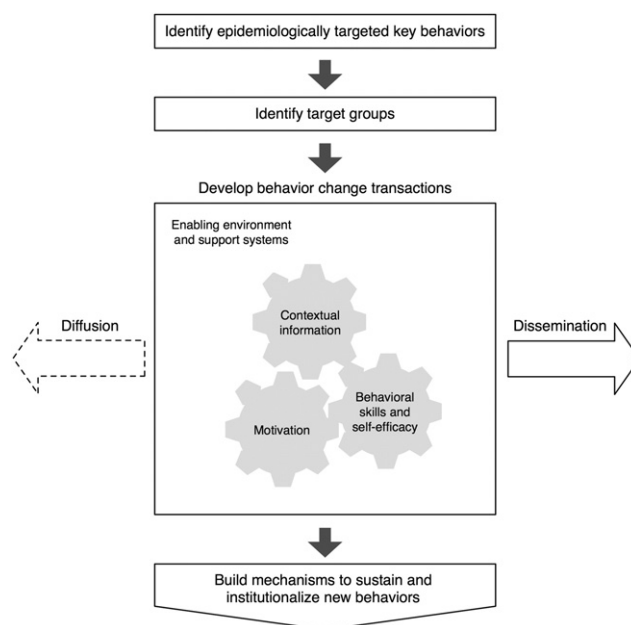


Figure 2 The behavior change management framework for designing behavior change interventions for newborn survival.

1. Identify epidemiologically targeted key behaviors.
2. Identify suitable target groups for a behavioral intervention.
3. Develop appropriate behavior change transaction(s) for each target group.
4. Leverage the influence of social networks to expedite behavior change.
5. Build mechanisms to sustain and institutionalize new behaviors.

Step 1: Identify Epidemiologically Targeted Key Behaviors

The population cause structure of neonatal mortality is foundational to designing an evidence-based behavior change intervention.¹¹ Tools like verbal and social autopsies can be useful in tandem in mapping the relationship between the bio-medical cause structure of mortality and associated behavioral risk factors. Some behaviors may be desirable and beneficial, and may need to be re-enforced; some may be undesirable and harmful, and will need to be targeted for change; and others may not exist and thus will need to be acquired. Identifying a priori the set of risk-enhancing and risk-reducing behaviors that affect the predominant direct causes of mortality and morbidity based on the NMR and illness profiles of the population is a logical prerequisite for expecting predictable outcomes of behavior change interventions.

Step 2: Identify Suitable Target Groups for a Behavioral Intervention

Actors are the end points on the intervention pathway as well as the starting points in the causation pathway, and therefore have a very important role in the overall pathway to improved newborn survival. Once target behaviors are identified, the next step involves identifying groups of actors that

practice or influence the practice of target behaviors. As highlighted earlier, it is important to not only include the actors who acquire the target behaviors (eg, mothers), but also those who “transmit” or directly propagate and influence these behaviors (eg, mothers-in-law, traditional newborn care providers). Ecological models of health behavior assert that health behavior has multiple levels of influences and reinforce the rationale for multilevel targeting of interventions at the individual, family, subgroup, community and societal levels to increase the likelihood of behavior change.^{18,25,26} A multilevel approach may be adopted to identify the various target groups at the household, subgroup (for example caste or clan-based), community and societal levels, identifying first the various actors or practitioners, then the “transmitters” and finally expanding on the set of influencers.¹¹

Step 3: Develop Appropriate Behavior Change Transaction(s) for Each Target Group

As defined earlier, a behavior change transaction is the entire set of the various components of a behavior change intervention arising from interactions between a target group and an agent of behavior change. What should an ideal behavior change transaction consist of, to effectively change an actor's behavior? We combine our earlier observations on newborn care behaviors and their socio-cultural context with a theoretically and empirically sound model for individual-level behavior change to arrive at a minimal set of factors, which when addressed, will increase the likelihood of behavior change at a household level.

The information motivation behavioral skills model, initially developed for constructing theoretically and empirically sound interventions for changing HIV risk behavior at an individual level and later extended as a general model for health behavior change, asserts that information, motivation, and behavioral skills are the fundamental determinants of individual-level behavior change.^{27,28} We further assert that in the context of newborn care behaviors in community settings, the fundamental determinants of household-level behavior change include contextualized information, motivation (intrinsic, extrinsic or in combination), behavioral skills and self-efficacy, and of particular importance, an enabling environment and support systems.

It has been widely observed that precise information about risk and memory capacity for verbatim background facts does not translate into reasoning accuracy and behavior change.²⁹ This has been explained by fuzzy trace theory, which posits that judgment and decision-making, and therefore behavior, are driven preferentially by gist representations of information, which is a subjective and, to some degree, subconscious interpretation of information based on emotion, education, culture, experience, worldview, and level of development, rather than verbatim information, which is literal, precise, and quantitative and captures the exact surface form of information. The preference to operate on the crudest gist—the fuzzy-processing preference—increases with age, experience or expertise.³⁰ We therefore refer to contextualized information as information that is pre-

sented in a way that resonates with the existing sociocultural paradigm¹¹ and appeals to gist-based intuitive representation, thereby improving retrieval and decision-making.

Motivation can be intrinsic or extrinsic³¹ and involves negotiation of perceived barriers to behavior change, including perceived risks associated with changes in behavior, and reinforcement of perceived opportunities and benefits of recommended behaviors. Early movers will typically require a considerably greater degree of negotiation than followers who will change behaviors once these have already earned social approval by a critical mass of influencers.

Behavioral skills and self-efficacy refer to the provision of essential skills for moving from existing behaviors to recommended ones, including those that help in specifically practicing the new behaviors as well as those that help in negotiating the new behaviors with other influencers and transmitters.

Enabling environment and support systems include social support³² for acquiring, maintaining, and reinforcing recommended behaviors as well as structural or institutional supporting systems and mechanisms that can help in overcoming perceived barriers. Social support is extremely important in communities with high levels of social cohesion and normative influences on behaviors, which is often the case in low resource settings where social cohesion is a highly valued and highly developed aspect of social capital that aids in collective community function and survival.

Panel 1 presents hypothetical questions from the perspective of the target group that can serve as a guide to the development of behavior change transactions. The objective of the intervention developer should be to effectively integrate these components into a behavior change transaction such that it maximizes the likelihood of behavior change in a target group.

Step 4: Leverage the Influence of Social Networks to Expedite Behavior Change

Social networks refer to the web of social relationships that surround individuals. Diffusion is the process by which new ideas and practices passively spread within and between communities over time, and dissemination includes active and planned efforts to persuade target groups to adopt an innovation.³³⁻³⁵ Because individuals exist in social networks, when illness in one person is treated or prevented, others to whom that person is connected also benefit; the better connected that people are, the larger the effect.³⁶ It may be argued that the cumulative impact of an intervention is the sum of the direct health outcomes in an intervened group plus the collateral health outcomes in others with whom they interact in their social network; therefore, intervening on well-connected people is more cost-effective.³⁶

Malcolm Gladwell's bestseller *The Tipping Point: How Little Things Can Make a Big Difference*, identifies 3 key factors that usually determine whether a trend will “tip” into wide-scale popularity: (1) the presence of influential early adopters or champions; (2) the “stickiness” factor, which refers to quali-

Panel 1 The Behavior Change Transaction Should be Designed to Address the Fundamental Determinants of Behavior Change. The following hypothetical questions from the perspective of a target group can guide the development of a behavior change transaction.

I/we UNDERSTAND (contextualized information
for assimilation, gist-based intuitive representation
and retrieval)

- Am I able to understand and assimilate the new information?
- Am I able to link my current behaviors and attitudes to the proposed ones, and understand the basis for adopting the proposed behaviors based on my rational paradigm?
- Can this information resonate with already existing subconscious thinking patterns so that it supports gist-based intuitive decision-making (ie, does this sound and feel right)?
- Are there any cues that can help me retain this new information better and retrieve it from memory when it is needed?

I am/we are CONVINCED and MOTIVATED
(motivation)

Intrinsic Factors

- *Below critical mass threshold (tipping point):*
 - Am I convinced that it will not have any adverse impact on the baby or mother?
 - Am I able to perceive any tangible benefits in the near term?
 - Does the intervention attack my cultural values or strengthen them?
 - Are my psychological, social, physical, economic, spiritual and efficacy barriers sufficiently addressed?
 - Perceived social consequences: Am I convinced that adopting these behaviors will not make me a subject of social ridicule? OR Can I become a role model for the community/will the intervention increase my influence and social status?
- *Above tipping point:*
 - Does adopting these new behaviors expand my social influence and network? OR cannot adopting these behaviors potentially make me a subject of social ridicule?
 - Are my psychological, social, physical, economic, spiritual and efficacy barriers sufficiently addressed?

Extrinsic Factors

- Are there financial or other incentives?
- Are health services more accessible?
- Do I perceive the quality of care to be good?

I am/we are CAPABLE (behavioral skills and self-efficacy)

- Do I have the behavioral skills to effectively practice these behaviors? Can I see myself practicing this behavior?
- Do the people who will be present and assisting at the time of delivery and newborn care possess the necessary behavioral skills?
- Do I have access to people who can help me negotiate behaviors with family/friends in case I have problems?
- Do I have access to people who can help me practice recommended behaviors in case I have problems?

I am/we are SUPPORTED (enabling environment and support systems)

- Are people who have decision-making roles supportive of the new behaviors?
- Are people who will be present and assisting at the time of delivery and newborn care supportive of the new behaviors?
- Are my peers and influencers supportive of the new behaviors?
- Is there a larger social support system accessible to me?
- Are there any structural/institutional supporting systems/mechanisms that can help me overcome perceived barriers? (for, eg, availability of emergency transport)

ties or attributes that people find compelling; and (3) the power of the context, which refers to the physical and broader social environment.³⁷ Appropriate design of behavior change transactions tailored to each target group can address the second and third factors. The first factor underscores the importance and influence of social networks. Specifically in health promotion and public health, Orlandi et al³⁸ have identified the need to address the gap between innovation development and planning for diffusion and dissemination.

As observed earlier, for newborn care behaviors in com-

munity settings, the knowledge and experience of older, more experienced people is valued by people on whom they exert their influence, and behaviors are transmitted along these lines. Behavior change can be expedited if these people, who are at the center of their social networks, are approached earlier, and their social influence is leveraged. Passive diffusion of the intervention can be augmented by an active process of dissemination by including influential target groups as agents of behavior change. Community-based volunteers and early adopters can play a critical role in diffusion and dissemination of the inter-

vention, introducing positive feedback loops that can rapidly modify social norms.¹¹

Step 5: Build Mechanisms to Sustain and Institutionalize New Behaviors

Behavioral interventions have an inherent advantage over therapeutic interventions, in that once behaviors are changed at a population level, ie, they attain the status of a social norm, it is possible to maintain the new status quo with minimal intervention and investment; thus, behavioral interventions can potentially become increasingly cost-effective over time. The key to institutionalizing the new behaviors is to embed them within the socio-cultural framework while leveraging existing modes of behavioral transmission, including folklore, rituals and traditions. Other individual, social and structural mechanisms for reinforcement of new behaviors through various agents, including the formal health care system, mass media, etc. can also be introduced.

Making Behavior Change Interventions Work

Designing a theoretically and empirically sound behavior change intervention is the first essential step towards ensuring a predictable impact on newborn survival. In this section, we touch upon certain key overarching principles that should guide execution.

The Central Role of Equity

Risk-enhancing behaviors may be universally prevalent, but the factors of equity and access ultimately lead to differential outcomes in different settings. Poverty increases exposure and reduces resistance to disease.³⁹ In rural and far-flung areas, newborns are universally at risk because of poor access to good quality health care.

Intervention implementation should, therefore, systematically ensure the inclusion of the most marginalized and highest at-risk groups; otherwise, gains in intervention coverage, and even changes in practices, may not translate into NMR reduction.

Reviewing the Role of Community Participation in Behavior Change

As observed in our analysis of the different community-based trials, community participation plays a critical role in newborn survival, but by itself may not be sufficient to reduce mortality. Community participation contributes to the success of behavior change interventions by ensuring ownership, enhancing credibility, driving accountability, expediting diffusion, facilitating dissemination, and creating an enabling environment and support systems.

Notwithstanding these necessary benefits and multiple other emergent properties embedded in their social networks,³⁶ there are limitations to what community participation can achieve on its own. While community participation or mobilization provides a foundation for change, in and of itself, it does not ensure that specific, life-saving behaviors

will be adopted and institutionalized preferentially over any other behaviors. Communities may not have the skills for an epidemiologically relevant selection of targeted risk-enhancing behaviors and limited knowledge of suitable risk-reducing behaviors, which are essential prerequisites for a predictable NMR impact via behavior change. Though community participation is critical to social support, championing of innovations and resource mobilization; in the absence of an external perspective, a community's deeply entrenched cultural notions and beliefs may limit their ability to recognize the risk associated with their existing practices, and therefore to take corrective action. For communities that have themselves inadvertently perpetrated gender, caste, and class-based inequities over the course of decades or even centuries, they may not be in the best position to implement newborn health solutions that address these inequities. Thus, behavioral interventions may be most successful when scientifically-sanctioned evidence is infused into communities that have mobilized for change; this creates both the energy needed for change and movement in the desired direction toward adoption of healthful behaviors.

Scaling-Up Behavior Change Interventions: A Challenge in Glocalization

Our current understanding of scale derives from the mass production paradigm, fuelling the search for standardized and replicable solutions. However, we may still be at a stage in which the automobile industry, an industry at the cutting-edge of mass production, was at the beginning of the 20th century.

In Henry Ford's autobiography, *My Life and Work*, he quotes himself as saying "Any customer can have a car painted any color he wants so long as it is black."⁴⁰ Although this attitude worked well earlier on in the industrial revolution in a sellers' market driven by consumers' basic need for transport, it would be a death knell for any company in modern times. During the past century, with increasing customer-centeredness, companies have evolved from a "one-size-fits-all" paradigm to increasing value enhancement and product differentiation by recognizing the uniqueness and unique needs of each customer. In their book, *The New Age of Innovation: Driving Cocreated Value through Global Networks*, management gurus C.K. Prahalad and M.S. Krishnan advocate the "n = 1" principle, which states that value is based on unique, personalized experiences of consumers while emphasizing that even companies serving 100 million consumers need to focus on individuals.⁴¹

A "one-size-fits-all" approach in public health may be even more problematic, as even the basic perceived need may not exist; for example, as we have come to realize, the "need" for newborn survival interventions from the perspective of policy makers and scientific experts does not always translate into demand by the community for health services. We need to recognize first that community health is not a "seller's market" because there is already a gap between what policy-makers and experts think is right for the community versus

what community members perceive to be in their best interest for survival.

Like the automobile industry, we need to find ways to “glocalize,” that is, actively seek the right mix of global standardization and local adaptation to effectively scale these interventions. Castro et al refer to this as a dynamic tension between fidelity and fit: fidelity refers to the implementation of universal interventions retaining the intervention core as prescribed by the program developer, and fit refers to adaptation of program content to accommodate the needs of a specific consumer group. This challenge highlights the need to develop culturally informed and responsive programs that deliver the best in science while also addressing the practical concerns and realities of local communities.⁴²

Conclusions

Behavior change is a critical and fundamental determinant of newborn survival. It is not only the primary component of preventive interventions but a necessary complement of more downstream therapeutic interventions, thus providing the “last mile connectivity” between the existing evidence base and impact on newborn survival at a community level. It is time that we begin to address the gap between “what works” and “how to make it work.” Behavior change can contribute substantially towards minimizing this gap, and, therefore, it is critical to systematically understand the determinants of newborn care behaviors, their underlying socio-cultural context, and leverage this knowledge to develop mechanisms for effectively changing behaviors at a population level.

There is sufficient evidence to show that sociobehavioral science is a more exact science than previously thought. A number of systematic reviews have shown that using theory in crafting interventions can lead to more powerful effects than empirically untargeted “shoot-in-the-dark” interventions.¹⁵ As Reyna³⁰ succinctly conveys “practical questions about what works in medicine and public health are best pursued by answering questions about causal mechanisms, which is the province of theory. Scientific theory provides a blueprint for practical applications and allows for cumulative progress in these applications, in contrast to fads and trial and error approaches that currently characterize some decision aids and interventions.”

This work is an attempt to demystify behavior change at a community level and integrate available evidence from behavioral, social and management sciences into a theoretically and empirically sound framework for guiding the design of behavior change interventions towards *precision, predictability and pace* for impact on newborn survival. The behavior change management framework presented here was used successfully in the development and implementation of the behavior change intervention in Shivgarh, leading to a 54% reduction in NMR in a short span of 16 months.¹¹

Although we have discussed using the BCM framework for intervention design, we do not touch upon facets of implementation that are crucial for the success of behavior change interventions, as well as integration of behavior change inter-

ventions within existing health systems at scale. These will be dealt with separately. Besides newborn survival, the BCM framework is well poised to guide the design and implementation of other interventions along the continuum of care in community settings, while ensuring integration with other vertical interventions at the community level.

There are many potential avenues for research that can improve the effectiveness and predictability of BCM. What are the most vital, gateway behaviors that are closely correlated with direct causes of mortality and have synergistic effects on other important behaviors? How are behaviors clustered—can intervention on one behavior impact the uptake of other behaviors? Which is easier—acquiring new behaviors or modifying existing ones? How can we improve the way we use social networks for diffusion and dissemination of behavior change interventions? These and others will help in charting the most cost-effective and optimal pathway to newborn survival through behavior change.

Post Alma-Ata, the global public health community has tended to veer between one-sided technical expert participation on one extreme, to the other extreme of one-sided community participation. Neither is the most optimal: the former “culturally blind” interventions are likely to erode program outcome effects by failing to prompt community participation and adoption of innovations, whereas the latter culturally focused interventions, although culturally appealing, may lack scientific precision and predictability.⁴² We need to find ways to integrate these 2 ends of the spectrum: game-changing innovation lies in the synergy created when science and community perspectives come together. Partnerships across disciplines (for example, medicine, behavioral science, public health, management) and across roles (for example, policy makers, technical experts, community members) for developing effective and sustainable health behavior change interventions are a new frontier in behavioral science, and one of the most promising approaches to advancing health behavior change.⁴³⁻⁴⁶

The world is witnessing interconnectedness and change at a pace never experienced before in human history. Never before has the global view been so deeply affected by local issues and contexts. The stage seems set for a fundamental shift from a predominantly “globally directed locally-implemented” approach towards a networked codevelopment model that is “globally informed locally-developed.” Perhaps it is time for us to introspect on the reasons why we are falling short in our efforts towards improved newborn survival and change our behavior?

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