

## CASE STUDY

### NEPAL'S EXPERIENCE WITH TREATMENT OF POSSIBLE SEVERE BACTERIAL INFECTION IN NEWBORNS WHERE REFERRAL IS NOT POSSIBLE

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Credit: JSI 2005



**Save the Children**



**Government of Nepal**  
Ministry of Health  
Department of Health Services  
Child Health Division

# Case Study: Nepal PSBI

## Background

Of all newborn deaths globally, about one in five can be attributed to possible severe bacterial infection (presumed cases of pneumonia, sepsis, or meningitis). In Nepal, as in other settings with high newborn mortality rates, the proportion appears to be higher. From the verbal autopsy module used in the 2006 Nepal Demographic and Health Survey [MoHP 2007], 39 percent of newborn deaths were categorized as due to serious bacterial infections (not including tetanus).

Historically, the standard of care for treatment of possible severe bacterial infection (PSBI) has been inpatient care using parenteral antibiotics. In the late 1990s, the SEARCH project, in a remote tribal area in Maharashtra state, India, demonstrated that using a primary healthcare approach in which trained and supervised community health workers (CHWs) identified and treated cases of PSBI in the home could substantially reduce newborn mortality [Bang 1999]. Recently published trials [AFRINEST 2015, Baqui 2015, Mir 2017] further validate the role of simplified antibiotic regimens for outpatient use for those cases of PSBI for which referral is not possible.

## Why This Case Study?

In 2004, the Ministry of Health (MoH) and its partners—based on Nepal’s experience using community health workers to provide treatment services for infant and child acute respiratory infection (ARI) and diarrhea, along with the promising experience from SEARCH—began piloting an approach to PSBI that included treatment at peripheral-level primary healthcare facilities by non-physicians. This was subsequently scaled up nationally. The conditions in which this program has been delivered are similar to those in many other areas of South Asia.

## Objective

**To communicate key lessons from Nepal’s program experience with PSBI treatment—particularly in peripheral-level government primary healthcare facilities—to those developing similar programs in other settings.**

### Key messages

- 1) Prioritize getting and maintaining serious engagement by national-level leaders in the medical community.
- 2) Make services available and educate the population on the need for timely care-seeking. Active case detection through home visitation may not be necessary and in most settings won’t be feasible at scale anyway.
- 3) Scale-up is not enough. Give serious continuing effort to ensuring your program is actually performing. If it’s not, be prepared to change the strategy.
- 4) Be realistic about what your primary healthcare system can and cannot do.
- 5) No commodity, no program.
- 6) Give serious attention not only to health worker knowledge and skills, but also to motivation.
- 7) If private providers are the main source of care in your setting, find ways to effectively engage with them. You are unlikely to get population-level impact otherwise.

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## The Nepal Context

Nepal's population is close to 30 million, with a little over half living in hill and mountain regions and the rest in the terai (plains) area along the Indian border. The population is mainly rural, though it is becoming more urbanized. Remittances make an important contribution to the economy. Due to difficult geography, much of the population has had poor physical access to services, particularly in hill and mountain areas. In recent years, however, the road network has notably expanded mobile phone use is now close to universal.

As in essentially all low-income countries, health workers are in short supply, though the situation has been improving. The number of preservice training institutions has increased and their graduates are expanding the health workforce. Two categories of health auxiliary with 18 months of preservice training beyond their School Leaving Certificate—community medicine assistants (CMA) and auxiliary nurse midwives (ANM)—make up the largest number of graduates, together accounting for close to 4,000 new professionals per year [Gupta 2013]. Two other categories of health worker with three academic years of training—staff nurses (SN) and health assistants (HA)—account for about 2,000 more graduates per year. In addition, about 500 pharmacists, 1,300 physicians, and 600 BScN nurses graduate each year. Most find employment in the private sector. Physicians are largely concentrated in urban areas, particularly in the Kathmandu valley.

Approximately 13,000 medicine shops are registered with the national drug regulatory agency (the Department of Drug Administration [DDA]) and authorized to dispense allopathic products for human use. These registered shops are concentrated in urban areas. There is a similar (though not as readily quantifiable) number of unregistered shops, which are more heavily concentrated in rural areas. A large proportion of drug shops, particularly unregistered shops in rural areas, function as *de facto* outpatient clinics, with staff not merely dispensing drugs but also assessing patients and making treatment decisions.

Currently there are about 600,000 births per year in Nepal with about 55% delivering in health facilities (mainly hospitals), with a marked urban-rural disparity (88% vs. 50%) [CBS 2015]. This is a notable change from 15 years ago; the 2001 DHS reported only 9% of births in health facilities. Similarly, over that period there has been a marked increase in the proportion of women of reproductive age who are educated and a large decline in fertility. There has also been a drop in newborn mortality; the most recent estimate is 23/1000 live births [CBS 2015].

Since about 1990, Nepal's primary healthcare system has included health facilities in each village development committee (VDC), a geopolitical unit with 5–10,000 population. A few of these, with more advanced services, are designated primary healthcare centers (PHC) and serve a wider catchment area. Most of the rest used to be designated sub-health posts (SHP) but all have now been officially upgraded to the status of health post (HP). So, in the past, there were three categories of primary healthcare facilities, the largest number being sub-health posts. There are now two categories, PHCs and HPs. Each normally has at least 5–6 clinical staff (with a mix of permanent and short-term contractual staff), mainly CMAs, ANMs, and HAs. In the past, there were two additional cadres of health auxiliary: village health workers (VHW) and maternal-child health workers (MCHW)—with only about three months training; they have been largely replaced by CMAs and ANMs.



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In addition to services at the health post, outreach is provided at more peripheral sites. This is the main modality for delivering immunization services. Also associated with each health post are at least nine female community health volunteers (FCHVs); in some VDCs there are 20 or more. As their title suggests, for most of their functions FCHVs are unpaid. Their role has evolved but is now mainly in health promotion and distributing program commodities (e.g., iron-folate supplements to pregnant women, ORS and zinc for cases of child diarrhea.). Almost all FCHVs report regularly giving health advice to pregnant women [APC 2015]. They are particularly known for the role they play in twice annual distribution of vitamin A and deworming tablets to young children, a program that rolled out over a period of about eight years beginning in the late 1990s and has consistently been reaching over 90% of children aged six months to five years. As described in more detail below, in the past FCHVs played a comparatively large role in treatment of childhood illness. Although this has declined, one-fourth of FCHVs are still actively providing antibiotic treatment for ARI [APC 2015], treating a total of about 250,000 cases per year. They treat close to one million cases of child diarrhea per year. Both for ARI and diarrhea, this is a larger volume of cases than are treated at the PHC and HP level. Based on national survey data [APC 2015], the average FCHV spends 6–7 hours per week on FCHV-related duties; most of them visit their local health post several times a month, mainly to restock commodities and submit reports on their activities. Attrition is very low: <5% per annum.

Government primary healthcare services at the VDC level—as described above—play a very important role in Nepal in delivering clinical preventive services (e.g., immunization, family planning, and vitamin A supplement distribution) and help account for Nepal’s notable progress on achieving MDGs 4 and 5. Although they also offer sickness care services, this is a comparatively smaller role, with most such services sourced from the private sector (clinics, medicine shops, etc.). This is due, in part, to the greater ease of access to private providers for such services, as they normally have more convenient opening hours. Furthermore, there are far more of them. As described above, there are over 20,000 medicine shops across Nepal offering allopathic products (vs. a little over three thousand PHCs and HPs). A national survey is underway to better characterize this sector (along with private clinics) and its role in treating sick young infants. Many of these shops in fact function as outpatient clinics and are staffed by health workers with the same credentials as those working in PHCs and HPs. However current regulations do not permit such workers the same scope of practice in the private sector as they are allowed working in a PHC or HP. Provision of clinical services by these health workers, though not formally recognized, is acknowledged by the government and the medical profession as accounting for a large proportion of sickness care in the country, particularly in rural areas. And most recognize that it would not be in the public interest to shut them down. The unregulated nature of this practice, nevertheless, presents a difficult challenge.



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## History of Nepal's Programmatic Response to PSBI

Nepal has been a pioneer in what is now known globally as *Integrated Community Case Management* of childhood illness (iCCM), having first done proof-of-concept piloting of community case management of ARI/pneumonia in the late 1980s [Pandey 1989]. In the early 1990s, Nepal introduced community case management for ARI and diarrhea within the government's peripheral primary healthcare systems on a pilot basis, with treatment by FCHVs and by health auxiliaries at the HP and SHP level (using cotrimoxazole [cotrim] for treating ARI). In the late 1990s, this program was consolidated with IMCI and progressively expanded [Dawson 2008], designated as *Community-Based Integrated Management of Childhood Illness* (CBIMCI). By the mid-2000s, the program had reached about half the districts in the country. At that time, in program districts 16% of ARI cases were treated by FCHVs, 37% in government health facilities, and 68% by private providers (mainly medicine shops), including those seeking care from multiple sources [Quinley 2007]. The same pattern was seen for diarrhea treatment.

The scaling up process used for CBIMCI (as well as for CBNCP, and IMNCI, discussed below) has varied somewhat over the years but there have been certain common features. Consistently, the content and approach have been determined under the leadership of the Child Health Division of the Ministry of Health and, regardless of which development partner has supported scale-up in a particular district, it has been done in a fairly standardized way. Nepal has a long history of training for such interventions, and the methodologies used normally adhere to sound adult education principles. For example, they use primarily hands-on, competency-focused, participatory approaches and limit use of didactic, lecture-style sessions. Training approaches are appropriately adapted to the level of worker or volunteer. Although less so now, in the past a large proportion of FCHVs were illiterate; training materials and approaches used were appropriately tailored for such groups. Typically, training has been delivered on a group-based, off-site basis. Generally, these trainings have been delivered in blocks of time not exceeding five days.

Initial introduction in a district begins with district-level orientation. Training of higher level health workers has sometimes been done by the Nepal Pediatric Society. In some instances, partner organizations supporting expansion in a district have used their own staff as trainers, together with technical staff from the district public health office. In other instances, local organizations specializing in training health auxiliaries and community health volunteers have been used. In most instances, the number of simultaneous batches of training has been kept limited, to ensure at least one expert trainer is involved in all trainings. But for various reasons this standard has not always been maintained. In some instances, when there was pressure to more rapidly implement rollout, it has been clear afterwards that the quality and effectiveness of the training suffered.

As training is completed, there are generally associated community sensitization activities, publicizing the new services. Also, with few exceptions, arrangements have been made to ensure that all needed equipment (e.g., respiratory rate timers) and program commodities are available from the time health workers and FCHVs are trained on new functions.

It has been evident, as this program was rolled out, that to effectively introduce new services or clinical practices even good quality training, on its own, is insufficient. So, as CBIMCI was scaled up, the effort also included:

- Modifications to the routine *health information system*, with reporting from community level. This system included auditable individual case records used by FCHVs and health auxiliaries, which were systematically reviewed during meetings at the health facility and supervisory visits to the field, for quality assurance/improvement purposes. How functional this system has been has varied by setting and over time, in part related to the quality of partner support.
- Continued attention to *logistics*, including:
  - Procurement of key program commodities by government
  - Development and continued use of a logistics management information system for tracking stock-outs of key program commodities
  - Active work with staff at health facility and district levels on logistics management
- Regular *review meetings*, during which monitoring data were reviewed and needed actions identified to address performance issues. These meetings happened at all levels: health facility, district, and regional/national.
- Continued *partner support* particularly for rollout but also limited support for “maintenance,” e.g., support of periodic review meetings. Generally the highest performing districts have been those with at least some modest maintenance support from partners.

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In 2004, Nepal was the first low-income country to develop a National Newborn Health Strategy (NNHS) and from that time key players (MoH, leaders in the pediatric community, USAID, UNICEF, Save the Children's Saving Newborn Lives [SNL] program, and others) have helped ensure that newborn health is prioritized. Safe motherhood was also prioritized by government and partners through this period, beginning a little earlier. Under the NNHS—recognizing the scale of the mortality burden attributed to serious infection in newborns—there was explicit provision for piloting PSBI care at the most peripheral level, building on the CBIMCI program experience and drawing lessons from SEARCH. This marked a permissive stance by MoH and leaders of the pediatric community on task-shifting for this clinical function, in circumstances where successful referral was unlikely.

As specified in the NNHS, the government—with support from SNL, John Snow Inc., and USAID—began piloting the Morang Innovative Newborn Intervention (MINI) beginning in 2004, first within selected VDCs in a terai district in eastern Nepal (with a total population of a little less than 1 million) and then district-wide [Khanal 2011]. Under this model, FCHVs were to make home visits during pregnancy, within two days of birth, and again at seven days. They were to counsel on danger sign recognition and the importance of timely treatment. FCHVs were also empowered to assess for PSBI (using an algorithm adapted from that used in SEARCH), initiate treatment using oral cotrim, and facilitate referral to the SHP/HP level.

From that level, health auxiliaries (including VHVs) were authorized to give daily injectable gentamicin treatment for seven days, beginning in the home (with arrangements made between the health worker and the family on time and place for subsequent injections). In parallel with this effort to extend service delivery to the community level, leadership at the district health office actively raised awareness of PSBI care across the district. During early implementation, a large volume of cases were identified by FCHVs and managed at the SHP and HP level. However, as the program matured, FCHVs played a smaller role in case-finding, and caregivers sought treatment not only from peripheral government health facilities but also from hospitals and private providers, including drug shops. Having sensitized the population on the importance of timely treatment (both through health education by FCHVs during home visits and district-wide awareness raising) and made it clear that efficacious treatment was available, there was a significant improvement in timely care-seeking for newborn danger signs, but increasingly families bypassed the community outreach process designed for this intervention (with active case-detection by FCHVs and initial injection treatments given in the home by a visiting health auxiliary).

In parallel with the MINI pilot, the Child Health Division (Ministry of Health) modified the CBIMCI protocol in 2005, allowing task-shifting to health auxiliaries at the SHP and HP level to treat PSBI cases on an out-patient basis using cotrim and gentamicin. At that point, CBIMCI had been introduced in fewer than half of the 75 districts in Nepal but as it was expanded to further districts, PSBI treatment was included in the treatment protocol. PSBI treatment at HP and SHP levels was also incorporated into the routine health information system. From this time forward, gentamicin was purchased by the government and made available in HPs and PHCs. Gentamicin is manufactured in Nepal and currently retails for about US\$0.17 per ampule (80mg/2cc).

Building on the MINI experience, a more comprehensive community-based package of newborn services was developed (the *Community-Based Newborn Care Package*, CBNCP). It was piloted first in 2008/09 in one district, then subsequently scaled up, ultimately reaching about 42 districts. This contributed directly to rollout of the modified CBIMCI protocol at HP/SHP level, which by about 2014 had reached all districts in the country. Through this period, however, the focus of primary healthcare-level newborn efforts by government and its development partners was mainly on the role of the FCHV, not health-facility-based health auxiliaries. So, although there was further program expansion at the PHC and HP level, PSBI care at this level received comparatively little ongoing program oversight and attention.

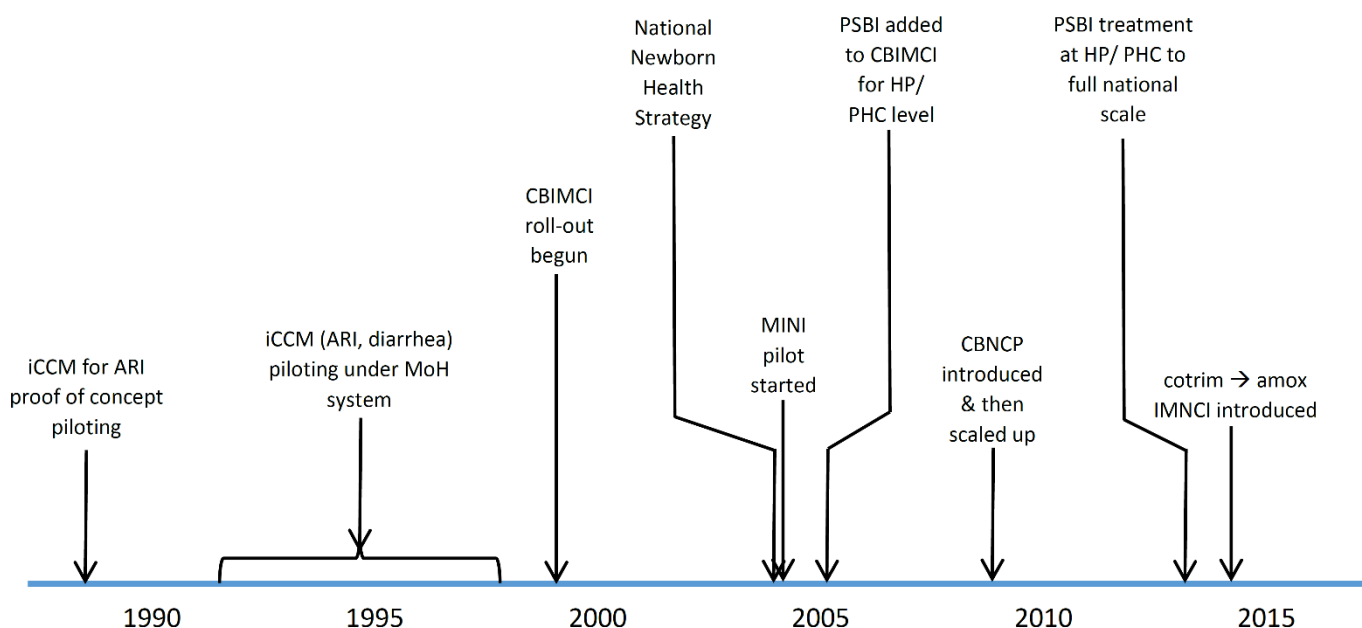
Through the period 2011-2013, a large scale evaluation of CBNCP was conducted [McPherson 2013]. It found that only a small proportion of newborns received early postnatal visits from FCHVs and that FCHVs had difficulty performing the new quasi-clinical functions they'd be assigned. It also found that levels of care-seeking were high, but that families generally bypassed FCHVs and took their sick newborns directly to health facilities or medicine shops, as was seen in the later phase of the MINI project described earlier.

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In response to these evaluation findings and other developments, from 2014 the Ministry of Health undertook a refocusing of program efforts on care of sick infants and children. Consistent with global guidance and more recent evidence, amoxicillin was adopted for PSBI treatment in place of cotrim. The 7-day regimen of gentamicin was retained. Also, based on the CBNCP evaluation, there was a rebalancing of strategy with clinical functions for PSBI care shifting largely to health workers at the HP and PHC level with the FCHV's role confined primarily to counseling and health education. With revisions to the approach, it was expected that FCHVs continue to provide counseling during pregnancy home visits, including on newborn danger signs and care-seeking, but it was no longer expected that they systematically make postnatal home visits. With this realignment, the package was rebranded as *Integrated Management of Newborn and Child Illness* (IMNCI). The IMNCI package is now being rolled out (and is currently being reviewed, supported by WHO).

In addition to efforts to address treatment of PSBI, Nepal has pioneered the use of chlorhexidine for umbilical cord stump care for prevention of such infections. The first large-scale community-based trial was conducted in Nepal [Mullany 2006]. Over the period 2009 through 2016 chlorhexidine use was first piloted and then progressively scaled-up nationwide. Currently approximately 70 percent of newborns across Nepal are reached with the intervention [Guenther 2016].

## Timeline



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## Exploratory Work with Private Sector Providers

A series of qualitative studies have been done in rural areas in Nepal on care-seeking for sick infants and children, with studies completed in 1994 and 2005 [Shrestha], a yet-to-be-published study in Sarlahi district looking at factors contributing to delays in care-seeking [Lama 2017] and a study underway in early 2017, using the same methodology as the 1994 and 2005 studies. These studies have documented that in these settings generally there is a preference for treatment from private sector providers, mainly medicine shops. This preference is due to convenient opening hours, availability of drugs, and perceived better quality of care. A later study of medicine shop clinical service providers [Miller 2008] documented problems with appropriateness of care for treatment of sick infants and children, and suggested possible avenues for influencing practice of such providers. A more recent study [SPMER 2016] investigated treatment of PSBI in medicine shops and government primary healthcare facilities in six districts. As with the Miller study, it documented problems of appropriateness of care in the private sector, including:

- failure to use the MoH-approved treatment protocol (and overuse of second- and third-line antibiotics)
- use of injectable steroids for treating PSBI
- inaccurate weighing and dosing

However, it also found promising signs. Credentials of service providers in these medicine shops were equivalent to those working in PHCs and HPs. And these health workers expressed interest in using government treatment protocols and participating in a formalized social-franchising network for treatment of sick young infants. Note that a national survey of such providers is expected to be completed by the second quarter of 2017.



Credit: Save the Children



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## Current Program Performance

CBIMCI reached all districts in Nepal by 2009 and, with CBNCP expansion, provision for PSBI treatment at PHC and HP level reached full national coverage shortly thereafter. Over the last three years, from the MoH's health management information system (HMIS), there have been approximately 8,000 PSBI cases per year documented to have received treatment in PHCs and HPs (and a similar volume treated as hospital inpatients). Given that the expected total number of cases with symptoms compatible with PSBI in Nepal is about 45–50,000/year, this means that PHCs and HPs are treating a volume of cases equivalent to just under 20 percent of what is expected. Note, however, that these 8,000 cases are reported from only about 800 of the 3000 PHCs and HPs. According to HMIS data, the other three-fourths appear not to be offering this service. As with all HMIS systems, though this gives useful information, there are important limitations with regard to data quality and completeness and—at best—this data only gives information on case volume, not quality of care. For example, it provides no information on what proportion of cases are lost to follow-up without completing treatment, or what proportion of cases referred from PHC or HP level to hospital receive a pre-referral dose of antibiotics. Further study is also needed to determine what is happening at health facilities not reporting treating any cases. In some instances it may be that cases are being treated but not adequately documented and therefore not captured in HMIS data.

Secondary analysis of DHS 2011 and MICS 2014 surveys on care-seeking for symptoms of childhood illness, restricting to infants below 1 year of age, indicates that for 75–80 percent of such cases care is sought outside the home. Disaggregating these cases by source of care, about 40 percent seek care from private clinics or hospitals and a similar proportion from private medicine shops. Seven percent report seeking care from a government hospital and just over 10 percent from PHCs and HPs. Although data are not available specifically for young infants (<2 months) or newborns (<28 days), one would expect a similar pattern of care-seeking. For very young newborns, one may expect that proximity of the service provider would be especially important. This would tend to favor medicine shops, given how widespread they are.

From a recently released national health facility survey [MoH 2017], 85 percent of PHCs and 75 percent of HPs were found to have gentamicin in stock. Likewise, 93 percent of PHCs and 89 percent of HPs had amoxicillin. However only about a quarter had amoxicillin as suspension or dispersible tablets, the preferred formulations for use with young infants.

Note that until recently, no special program efforts have been made addressing quality of in-patient PSBI care or referral linkages between primary and hospital levels for sick newborn care. In-service training of health workers based in district hospital has been initiated and is expected to reach close to 1/3 of such hospitals by the end of 2017.

As reported earlier, the most recent estimate of NMR for Nepal is 23/1000, from the 2014 MICS survey [CBS 2015]. This estimate covers the five-year period 2009–2014. This was a reduction from the preceding five-year period (29/1000). This is encouraging; however, there are no current data available on what, if any, change there may have been in the contribution of PSBI to overall newborn mortality. This information is expected over the coming year, as a verbal autopsy module was included in the Demographic and Health Survey conducted in 2016. Once these cause-specific mortality data become available, it will be possible to establish to what extent the burden of mortality attributable to PSBI has declined since 2006, when cause-specific mortality was last determined in a national survey.

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## Key Lessons

1. In many settings, it has been challenging to get ministries of health and leaders in the pediatric community to support provision of PSBI care on an outpatient basis, even for cases in which referral is not feasible. Nepal has had a more positive experience, for several reasons:
  - Norms and institutional culture have developed in the health sector in Nepal over the past several decades that value local evidence and problem-solving and have been more open to innovative strategies than what is generally seen in other country settings. Commonly, new interventions have been introduced with a strong evaluation component; careful, phased scale-up; and continued research and learning.
  - Throughout the 1990s, there was the progressive development and rollout of an iCCM program that empowered CHWs to treat ARI using antibiotics. Over time, as favorable evidence emerged from monitoring and evaluation data, government and pediatrician leaders became comfortable with such a task-shifting strategy.
  - Key government and professional leaders became acquainted with the SEARCH pilot experience, and acknowledged its potential relevance, particularly for less accessible populations.
  - Throughout the 1990s and 2000s, there has been effective engagement involving MoH, the academic pediatric community, and development partners on child and newborn health. Having pediatric leadership centrally involved has created a sense of ownership and has resulted in their support for innovative strategies.
2. The MINI pilot demonstrated that a significant shift in care-seeking for newborn danger signs was achievable under the government system with relatively modest inputs, by making such care available at the peripheral level and through a demand-side, community mobilization strategy involving FCHVs, local mass media, and other channels. Under MINI, FCHVs made home visits during pregnancy and postnatally. However, although initially a large proportion of PSBI cases were identified by FCHVs in the home and initiated on treatment, over time most treated cases resulted from spontaneous care-seeking by caregivers, bypassing the FCHV. As the intervention matured, the FCHVs' main contribution appears to have been to educate families about danger signs and encourage timely care-seeking. In Nepal FCHVs are generally an effective link between health services and the community; most other countries do not have a cadre of CHWs that are as widespread and well connected to the community. Community outreach strategies need to be tailored to the local context, working with what is actually available.
3. Community health volunteers can play an important role in making families aware of essential newborn care practices and danger signs that require timely care-seeking. From the Nepal experience, however, it is evident that it can be quite difficult to achieve high coverage for early postnatal home visitation at scale under routine program conditions. Nevertheless, even without active case-detection through postnatal home visits, raising community awareness and making PSBI treatment more readily available can lead to high rates of timely care-seeking.
4. Later rollout of the CBNCP package contributed to expanding availability of PSBI care at PHC and HP levels (along with CBIMCI rollout), but this aspect was given comparatively little attention, with most of the focus on home visitation by FCHVs (in line with a global emphasis on postnatal home visitation over this period). Likewise, although the CBIMCI rollout—from 2005—did include PSBI treatment this aspect of the package received considerably less attention than ARI and diarrhea. So rollout of PSBI treatment at PHC and HP levels did proceed but ongoing programmatic attention to this service was quite limited. More serious continuing programmatic attention to PSBI care at this level could have resulted in better performance.
5. Large-scale program efforts tend to have lots of built-in momentum, making it difficult to change direction in response to changing conditions and what is learned about actual program performance. In Nepal, over time, the MoH and partners have made such adjustments in strategy, for example in the realignment of the FCHV role to focus more on counseling and health education rather than PSBI case detection and initiating treatment, which was found not to be contributing much. Such serious attention to monitoring and evaluation and openness to make changes in strategy in response to evidence can be expected to contribute to population-level improvements in effective coverage for PSBI treatment and corresponding impact on health outcomes.
6. The peripheral primary healthcare system in Nepal, as it functions at the VDC level, has been effective for certain clinical preventive services. For example, it has succeeded in delivering immunization services at high coverage. But for sickness

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care for infants and children it cannot be expected to play as important a role as it does for schedulable preventive services (in part because its services have less convenient opening hours than the private sector). Similarly, in other country settings there needs to be a realistic determination of what role the existing government primary healthcare system can and can't be expected to play.

7. In Nepal, over the past 15 years for primary healthcare services there has generally been fairly serious attention to ensuring that program commodities are available at service delivery points, though certainly performance can be improved. At times, there have been problems at the central level with procurement, resulting in stockouts across the system. For most program commodities (including injectable gentamicin), government has assumed responsibility for procurement. Nepal has had a logistics management information system which has aided reliability of supply. In Nepal amoxicillin suspension and dispersible tablets are newer program commodities, and supply is not yet reliable. Note that previous experience in Nepal and elsewhere in South Asia suggests that care-givers prefer suspensions to dispersible tablet formulations for administering to infants.
8. Health worker motivation—not only knowledge and skills—is an important determinant of actual practice. In Nepal and other country settings, there may be motivation-related barriers to health workers assuming responsibility for PSBI treatment in peripheral government health facilities. There are indications that health workers may be reluctant to take responsibility for potentially serious cases, worrying about being blamed in the event of bad outcomes. Another issue potentially linked to health worker motivation is that a treatment regimen involving daily injections may be a barrier to taking on such a function in government health facilities, which only offer service six days a week (in contrast medicine shops are normally open seven days a week). Furthermore, since many government health workers also operate private medicine shops, they may prefer to treat cases such as these in their private medicine shops rather than in the HPs or PHCs where they work.
9. In country settings like Nepal where private providers are the main source of treatment for sick infants, to achieve reductions in deaths due to infection among newborns and young infants at population scale, it is necessary to find ways to effectively engage private sector providers (even if it is not immediately evident how to do so).
10. In Nepal, until recently inpatient care and effective referral linkages between primary and hospital levels have not received programmatic attention (though in-service training is now being provided to hospital-based health workers). For population impact to reduce PSBI deaths, this needs more attention than it has received. If significant program efforts do move forward in Nepal with private providers, it will be important to ensure sound, functional linkages between peripheral providers and hospitals.

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