Chapter 14
Sustainable Maternal and Newborn Care in India: A Case Study from Ladakh

Kim Gutschow, Padma Dolma, and Spalchen Gonbo

14.1 Excellent Maternal and Newborn Outcomes at Sonam Norboo Memorial Hospital

This chapter describes 40 years of remarkable obstetric and newborn care at Sonam Norboo Memorial Hospital (SNMH) in the Union Territory of Ladakh, which was newly established in October 2019. The Ladakh Union Territory—roughly the size of Croatia or the US state of West Virginia—is made up of Leh and Kargil districts, which each have only one public hospital that together serve a combined population of roughly 275,000 (Fig. 14.1). Its high quality of care and excellent standards are evident nation-wide. SNMH has twice won the nationwide Kayakalp Award, given to a district hospital in India in recognition of its excellence in promoting cleanliness, hygiene, and infection control and contributing to improved quality of care in India—first in 2016 and again in 2019. Given its reputation across India and the region, the SNMH maternity ward attracts women not only from Leh district, but also neighboring Kargil districts whose hospital has far lower standards than SNMH (Gutschow 2016, 2011; Gutschow and Dolma 2012).

Because of the high quality of care at the SNMH, there are no private maternity clinics in either Leh and Kargil districts, which is nearly unheard of among India’s 700+ districts—most of which have multiple private maternity clinics or hospitals. By 2008, when the all-India rate of institutional delivery was only 49%, SNMH could already boast of a 90% institutional delivery rate (ICCR 2008; Gutschow and Dolma 2012). Even more notably, SNM hospital recorded an MMR of 37 over the
last two decades, which is one-sixth the all-India MMR of 238 during that same period.\textsuperscript{1} Put differently, SNMH had an MMR of 117 over the past 40 years (47 maternal deaths and 40,047 live births from 1979 to 2019) (Fig. 14.2).

In 2001, Leh district tied with the Chennai district in having the lowest total fertility rate in India (Guilmoto and Rajan 2002), while Leh and Kargil districts reported the first and second highest contraceptive prevalence rates (CPRs) across all Indian districts in 2003–2004.\textsuperscript{2} In Ladakh, the prevalence of Himalayan socio-cultural norms that reduce fertility and promote female reproductive agency and authority, along with a culture of declining polyandry and primogeniture, has resulted in nearly universal household land ownership. The relatively egalitarian wealth distribution, lack of caste distinctions, and broad prevalence of an affirmative action category known as ST (Scheduled Tribe) status have produced a relative lack of communal violence between the Buddhist and Muslim communities, in contrast to neighboring Kashmir Valley (Van Beek 2006; Gutschow 2004, 2006; Aggarwal 2004).

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{ladakh_map.png}
\caption{Map showing Ladakh Union Territory (UT), Jammu & Kashmir UT, Leh hospital (SNMH), Kargil hospital, as well as both Leh District and Kargil District that together form Ladakh UT. (Published with kind permission of © Kai Gutschow 2020. All Rights Reserved)}
\end{figure}

\textsuperscript{1} Gutschow calculated the MMR for Leh hospital between 2000 and 2020 using data from SNMH (10 maternal deaths and 27, 318 live births). She calculated the average MMR for India in a similar period using the fibe estimates for India’s MMR—in 2000, 2005, 2010, 2015, and 2017—provided by the WHO (2019) and its partners.

\textsuperscript{2} Guilmoto and Rajan (2002: 668) report Leh district’s TFR as 1.3 and Kargil district’s TFR as 3.4 in 2001. Contraceptive prevalence rates (CPRs) across India in 2003–2004 were reported by the Indian Institute for Population Sciences at http://www.iipsindia.org/pdf/05_b_13atab13.pdf
Methods

This chapter is based partly on Gutschow’s three decades of fieldwork in Ladakh from 1989 to 2019, including participant observations and interviews with key interlocutors in the maternity unit of SNMH between 1990–1996, 2006–2007, 2011–2012, and 2019. Gutschow collected data and interviewed roughly 200 women and providers at SNM hospital during these periods, including a few dozen obstetricians, pediatricians, nurses, auxiliary nurse midwives (ANM), other doctors, and Chief Medical Officers (Gutschow 2011, 2016; Gutschow and Dolma 2012). The chapter also draws on observations and data collected by Dr. Padma Dolma and Dr. Spalchen Gonbo, conducted during their service at SNMH and summarized in their reflections below. Gutschow and Dr. Padma have worked closely together since 2006, collaborating on project design, data collection, and several international projects; the results were published and presented in Rome, Heidelberg, and India (Gutschow and Dolma 2012).

The region’s high altitude, remoteness, low population density, and lack of all-weather roads create numerous obstacles to access, especially for women in labor (Gutschow 2016). The average villager needs to travel 33–42 km, often on foot, to reach a health clinic in a district where altitudes range from 3500 to 7000 m above

Fig. 14.2 40 years of birth outcomes from Sonam Norboo Memorial Hospital in Leh, Ladakh, annually (April–March) from opening in 1979 to 2020. (Data from SNMH records)
sea level (ICCR 2008). Both Leh and Kargil districts are cut off from the rest of India by road from November to May each year due to snowfall, while roads are often blocked at other times due to landslides or road repairs (Gutschow 2011, 2016). Given this difficulty of transport, the steady rise in institutional deliveries and relative absence of maternal deaths—only 47 in the past 40 years and 6 in the last decade—is remarkable (Fig. 14.2).

14.3 Maternity Care at SNMH

The high quality of care and exceptional maternal and newborn outcomes at SNMH in the initial years were largely due to two obstetricians, Dr. Tsering Landol and her niece, Dr. Padma Dolma, who have been tireless promoters of safe birth, reproductive rights, and compassionate care over the past 40 years (Gutschow 2011, 2016; Wiley 2003, 2004). After rising for nearly 25 years, the number of institutional deliveries plummeted sharply after Dr. Landol retired in 2003, but rose again from 1001 in 2005 to 1451 in 2006 after Dr. Padma joined the staff in 2005 (Fig. 14.2). Deliveries under Dr. Padma’s tenure dipped briefly in 2009 and 2011 when she left for more advanced training in Delhi but rose again each time she returned.

Dr. Padma and Dr. Landol and their fellow obstetricians consistently emphasized safe birth and reproductive rights for women across the region, who came to see the hospital as a place for compassionate and timely care that empowered them. Dr. Landol, who never married, was the first Ladakhi to graduate from Srinagar Medical College. The Government of India (GOI) awarded her two of the highest civilian honors in the nation, the Padma Shri in 2006 and the Padma Bhusan in 2020, for her contributions to Indian medicine, making her one of the few female recipients and the first Ladakhi ever to receive both honors. She also appears on the award’s “Wall of Fame,” which features those who have exhibited “excellence and glory” throughout their careers. She had been known for her consistent promotion of reproductive health and rights in Ladakh—as indicated by the rising rates of live births, tubal ligations, abortions, and IUD insertions (not shown) during her 25-year career (Fig. 14.2).

Before Dr. Landol retired in 2003, she began to face increasing backlash from religious groups against family planning, including efforts to block or prevent her mobile tubal ligation units and other reproductive health camps from operating in the villages. The final blows were the anonymous destruction of tubal ligation

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3The names in this chapter have not been changed, and stories were used with permission of the interlocutors, unless otherwise specified.

4Dr. Landol once told me that her greatest influence was not her father—who was the Prime Minister or Kalon (bka’ blon) and served the King of Ladakh during Partition when he organized the defense of Leh from Pakistani invaders (Gutschow 2006) but her mother—who faithfully followed the ten Buddhist virtues (dge ba bcu) her entire life.
machines and when she received anonymous death threats due to rising pro-natalism in Ladakh (Gutschow and Dolma 2012; Gutschow 2006).

Both total ligations and abortions sharply plummeted following Dr. Landol’s retirement in 2003. Tubal ligations dropped by half in 1 year, from 545 in 2003 to 246 in 2004, and further to 56 in 2005 (Fig. 14.2). The combined number of abortions and miscarriages also dropped, from 432 in 2003 to 191 in 2004, largely driven by a precipitous decline in elective abortions. Yet miscarriages also declined slowly over the next years as prenatal care improved. Both tubal ligations and abortions/miscarriages have remained low since 2003 for a variety of reasons. Practically, the missing parts for the tubal ligation machine were never replaced, while some of the staff working in the operations theater opposed tubal ligations and voiced their concerns about the declining population of Ladakh. More importantly, the social stigma against abortions has risen during the recent trends toward pro-natalism, as both Buddhist and Muslim religious leaders have advocated against family planning and reproductive rights (Gutschow 2006; Aengst 2014; Smith 2009). The growing concern over India’s sex-selective abortions also contributes to facility-based scrutiny of all abortions, although sex selection is not a pattern in Ladakh, which is known for its promotion of female rights and agency (Gutschow 2004; Aggarwal 2004). The falling demand for tubal ligations may also relate to a generation of younger women who prefer reversible methods of contraception like IUDs, condoms, and pills (Fig. 14.2).

Padma describes the difficulty of openly advocating for family planning in a close-knit community where she and other providers have been singled out for condemnation when they perform abortions. She concedes that government rules requiring a documented reason for every abortion, and consent by two providers during the second trimester, may have dampened access to and demand for abortions up until 2014. In 2012, the GOI amended the abortion laws by reducing the number of providers so that only one provider’s consent was needed to perform second-trimester abortions, and in 2020 the GOI amended the bill further to extend the time limit for abortions up to 24 weeks and drop gestational limits entirely in the case of congenital abnormalities. Padma believes that these amendments may help mitigate the dampening effect of government restrictions on abortion that she has seen.

Padma and her colleagues continue to do tubal ligations via mini Lap (a small abdominal incision) or during cesarean sections and ovarian surgeries for those who request them. Yet she must often delay clients who request tubal ligations for weeks, as her schedule is already filled with obstetric and gynecological surgeries including cesareans, hysterectomies, ovarian surgeries, and myomectomies, that are privileged over elective tubal ligations. To ameliorate this situation, Padma and her colleagues have asked the hospital administrators to allow the obstetrics and gynecology department to have not one but two full days a week for elective surgeries in one of the three operating theaters at the hospital.

In their hospital, Dr. Landol, Dr. Padma, other obstetricians, as well as a team of ancillary nurse-midwives have presided over a 40-year woman-centered model of care that has facilitated the normal physiology of labor while providing skilled
emergency obstetric care. This model constitutes the very essence of sustainable birth care (Introduction, this volume). The model has sustained a 40-year rise in deliveries, near absence of maternal deaths, and flexible adaptation to changing circumstances and technology using a minimum of technology and resources, given the remoteness and public status of SNMH. The lack of maternal deaths for 40 years—none at all between 2016 and 2020, and only 10 maternal deaths between 1999 and 2020—contributed to the hospital’s recognition across India. Its overall outcomes and lack of corruption are far better than other public hospitals in North India (Gutschow 2016; Iyer et al. 2016; Jeffery and Jeffery 2008, 2010). The low stillbirth rate and falling neonatal mortality ratio are related to its rising cesarean rate. While the cesarean rate ranged consistently between 3% and 9% until 2009, it rose to 27% in 2019 (Fig. 14.2). Padma attributes this rise to four main factors:

- Increasing rates of ART (Artificial Reproductive Technologies) that lead women to have twin pregnancies and more high-risk pregnancies that lead to elective cesareans after 37 weeks.
- More electronic fetal monitoring (EFM) after 2009 with the arrival of three EFM machines (two in labor room and one in antenatal ward) that allow for intermittent fetal monitoring and observation of fetal distress has likely led to an increase in cesareans, even as Padma recognizes that EMF records of fetal distress are often mistaken or ambiguous.
- High rates of gestational diabetes mellitus (GDM) and intrahepatic cholestasis of pregnancy (IHCP)—now better detected due to screening and laboratory facilities—lead women to opt for cesareans, given the higher rate of sudden stillbirths after 37 weeks. The cause for the high rates of IHCP in Ladakh is not known nor well-studied. Padma wonders if there may be a causal relation to the high altitude or genetic factors and suggests more research needs to be done on metabolic diseases in pregnancy in high altitude regions.
- The hospital protocol by which each attending obstetrician takes full charge of the labor and delivery wards for a week may lead providers to opt for cesareans in the absence of shared decision making. According to Padma, the system of individual provider attendance may lead to a lower decision threshold for conducting a cesarean, compared to a team-based decision making in case of suspected fetal distress resulting from an EFM reading. Padma suspects that having an individual obstetrician be solely responsible for all labor and delivery decisions leads to provider stress, given that providers face their peers during the monthly audits on maternal and neonatal deaths and stillbirths. The pressure of decision making and concerns about the impending audit if there is a neonatal death or stillbirth may contribute to a subtle bias toward cesarean delivery.

When Dr. Padma, her colleagues in the obstetrics department, and the Medical Superintendent Dr. Tsering Samphel came together to discuss the rising cesarean rate, they identified these four primary factors and contemplated possible changes. While they have little power to lower the rates of ART or pregnancy conditions like IHCP and GDM, they were aware that EFM and the monthly clinical audits could be driving providers to opt for cesareans. Yet rather than denying or ignoring the
troubling cesarean rise, they asked the Medical Superintendent to record their individual rates of cesarean, by provider, for several months. The result yielded few insights, as none of the four obstetricians was an outlier and all had months where their cesarean rates were slightly lower or higher than the average of other providers that month. The sample size is too small to tell if that was due to their patient risk profile or other factors. Yet their willingness to scrutinize each other and discussion with the Medical Superintendent shows their commitment to a sustainable model of accountability, patient-centered quality care, and the ability to adapt their obstetric practices as needed to improve care.

14.4 Dr. Padma’s Story

When I was first appointed to SNMH in 2005, my main priorities were safe delivery and newborn care. I had just finished a 4-year residency and fellowship at the public Safdarjung Hospital in Delhi, where I regularly had 30–40 deliveries per day along with up to 13 cesareans on some night shifts. As such, I was hardly disturbed by a labor and delivery ward filled with women, but it was difficult to adjust to a remote district hospital whose facilities had been sorely neglected by the state government during the past 15 years of militant insurgency in the Kashmir Valley. By relying on networks with doctors I had met in Delhi and skills I had learned in my training, I was able to consult with my former colleagues in difficult cases to more accurately diagnose maternal and neonatal sepsis, for instance.

My colleague Dr. Kunzes and I implemented key changes in clinical protocols around maternal and neonatal care. By 2006, we convinced the Chief Medical Officer (CMO) in Leh to stock antenatal corticosteroids to improve fetal lung development for babies at risk for preterm delivery, 5 years before these drugs became standard protocol at hospitals across India.5 I asked that the hospital use betamethasone rather than dexamethasone because the former only requires 24 h (rather than 48) to be effective, and so there is a greater chance that the fetus will receive the benefits when a mother arrives in an advanced state of preterm labor. Given the difficulty of road access in our high-altitude region, mothers often arrive in preterm labor and the timely delivery of antenatal steroids is critical to hasten fetal lung maturity as well as stimulate the natural production of lung surfactant in both preterm or SGA (small for gestational age) newborns with vulnerable lungs.

Across India, antenatal corticosteroids have been proven to reduce the rate of necrotizing enterocolitis (NEC) by 54%, intraventricular hemorrhage (IVH or “brain bleeds”) by 46%, reduce an acute lung disorder known as respiratory distress syndrome (RDS) by 34%, and reduce overall neonatal mortality by 31% (MoHFW 2014b). They can also reduce the risk of systemic infections like meningitis and

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5 Padma’s protocols in 2006 were far ahead of her time. Even by 2014, only 41% of eligible mothers received antenatal corticosteroids in 75 developing Countdown countries (Bhutta et al. 2014).
congenital heart disorders like PDA (patent ductus arteriosus), for which there is no surgical capacity at SNMH. Most significantly, antenatal corticosteroids are known to decrease the need for respiratory support and other neonatal interventions, reduce the length of hospital stay, and thus reduce the risk of infections and costs associated with essential newborn care (ENC).

These and other advances have no doubt improved newborn outcomes in my time at SNMH. In 2008, Dr. Laurel Spooner from the UK donated our unit’s first Indian-made baby warmer, and in 2009 we began to develop our own Special Newborn Care Unit (SNCU), using funds from the Navjaat Shishu Suraksha Karyakram (NSSK) initiative that were distributed across India after 2009 to provide Essential Newborn Care (Paul et al. 2016; Mason et al. 2014). Although a district hospital was supposed to have 3000 deliveries per year to qualify for NSSK funds—and we only had half that number—we argued for an exception to be made, given the difficulties for mothers and newborns in accessing tertiary care in our region. Because there are no roads open between Ladakh and the rest of India between November and May every year, mothers and newborns can only reach tertiary level hospitals in Srinagar, Jammu, or Delhi by airplane. The closest Level III NICU (Newborn Intensive Care Unit) is in Srinagar and only accessible by one flight per week during the winter or a 2-day car journey during the summer. A plane flight carries its own risks for newborns suffering life-threatening complications, as their lungs may not adapt to the increased cabin pressure and lack of moisture on the airplane.

While a catastrophic flash flood destroyed much of our old hospital in 2010, this tragedy accelerated the construction of our new hospital with funds from the central government in Delhi. Since 2013, we have a new labor and delivery ward, with special labor rooms for women with eclampsia and infectious diseases, as well as post-op and preterm wards (Figs. 14.3, 14.4, 14.5, 14.6, 14.7 and 14.8). Our delivery room has 3 flexible tables that allow for upright or squatting delivery, with central oxygen supply for all three delivery tables (Fig. 14.3), a neonatal warmer and resuscitation equipment (Fig. 14.4), a newborn scale, and two EFM machines in the labor room for intermittent fetal and maternal monitoring (Fig. 14.5). We have equipment for vacuum and forceps deliveries, dilation and curettage (D&C) sets for abortions and post-miscarriage interventions, and an area for essential drugs such as injectable oxytocin, methergine, magnesium sulfate, carboprostone, and dinoprostone. To promote hygiene, we have a room with PPE, an autoclave for sterilizing our delivery sets, a septic labor table in a separate room for women with active infections (e.g., hepatitis) to avoid contamination, and a hand wash unit with foot pedals for improved hygiene (Fig. 14.6).

Our SNCU (Fig. 14.7) includes eight to ten incubators in two separate rooms to prevent the spread of infection and isolate the most vulnerable newborns. There are rooms for Kangaroo Mother Care (KMC) as well as breastfeeding or pumping breast milk. There are staff rooms for NICU nurses, midwives, and labor and delivery nurses to rest. We have a total of 64 patient beds, including 13 beds in our labor wards—6 for women in active labor, 6 beds for post-partum observation, 1 bed for high-risk women with eclampsia. There are 27 beds in our antenatal ward, postnatal
ward, and septic labor room, besides the 24 beds in our high-risk ward for women at risk of preterm labor or miscarriage and post-op women who have had cesareans, hysterectomies, and other gynecological operations. These labor and delivery wards are all connected to our operation theater (Fig. 14.8) as well as linked to our outpatient antenatal clinic, where we see over 15,000 women and children every year for antenatal care, postpartum care, newborn care, vaccinations, and infant care.

Our skill sets have increased tremendously along with our technology, such as C-reactive protein analysis that can help determine neonatal and maternal sepsis. Our current team of consultant obstetricians—myself, Dr. Ayesha, Dr. Padma Ladol, and Dr. Khatisha—have initiated key clinical protocols that WHO recommends for maternal and neonatal care, such as vitamin K injections and KMC care for all newborns, prophylactic antibiotic treatment for pregnant women who present with vaginal discharge, antenatal steroids for all women who have preterm labor, and postnatal surfactant therapy for all vulnerable newborns.

By 2011, following an all-India government initiative promoting maternal death reviews, the Departments of Obstetrics and Neonatology jointly decided to hold regular maternal and neonatal death reviews or audits to improve our quality of care and be accountable to our community (Gutschow 2016). A team consisting of the clinical staff involved in the care preceding the death and the medical superintendent now meets once a month to audit every single neonatal death, maternal death,
and stillbirth. We freely discuss the care provided, what could have been done differently, and what protocols need to be changed or reviewed. These audits help avoid similar mistakes in the future and enable our hospital staff to make evidence-based recommendations around what essential skills or health commodities—drugs and equipment—are most needed to save lives at our hospital.

### 14.5 Dr. Spalchen’s Story

Padma and her team made many improvements in maternal and newborn care between 2005 and 2009. In 2009 pediatrician Rinchen Dolma and I, as well as several nurses from SNMH spent 3 months on a neonatology fellowship at New Delhi’s All-India Institute of Medical Science (AIIMS). As one of India’s leading public medical colleges, AIIMS has spearheaded newborn care in India since 1990, when it hosted a national conference on medical technology for newborn care under the auspices of the NNF (National Neonatal Forum). NNF had been charged with developing the first guidelines on newborn care in India. The entire fellowship team received specialized training in essential newborn care at AIIMS, while we roomed
with fellow Ladakhis who lived nearby to save costs. In 2010, I received more government-funded training in facility-based newborn care for 5 days in Srinagar and for 2 weeks at Kalwani Saran Children’s Hospital (KSCH) in Delhi.

My stints at AIIMS and KSCH were largely observational and did not constitute a formal residency. Like our SNMH in Leh, both AIIMS and KSCH operate with similar challenges because they have limited resources, serve a diverse demographic, have a high volume of patients, and must admit all patients who are referred there. KSCH continues to serve as a regional collaborative center that provides technical expertise, monitoring, and quality assessment for the SNCU in Ladakh and other districts across Northwest India (MoHFW 2011). After being trained in newborn fluid stabilization, resuscitation techniques, and management of newborn sepsis, Dr. Rinchen and I have moved far beyond the basic training we received while completing our MBBS (Bachelor of Medicine, Bachelor of Surgery) degrees.

By 2012, I was chosen to be a “trainer of trainers” in neonatal resuscitation and I trained over 300 doctors, nurses, and paramedics in neonatal resuscitation across Leh district. In 2013, I began collaborating with Dr. Nirupama Laroia, from the University of Rochester in New York, in order to improve neonatal resuscitation in the Leh hospital with funding from the American Association of Pediatrics (AAP) and the Helping Babies Breathe (HBB) program, which advanced basic neonatal resuscitation across India (Aneji and Little, this volume). Another pediatrician, Dr. Tsering Norbu, began to pursue a long-term study that will follow babies from birth through 5 years of age to better understand the sequelae of perinatal complications.
By 2016, we had completed a 12-bed SNCU where all treatment to newborns is provided free of cost, including drugs and procedures. Government funding and private donations provided critical neonatal technologies including: bubble CPAP (continuous positive airway pressure)—a non-invasive method of delivering supplemental oxygen or room air into newborn lungs; a photospectrometric bilimeter to accurately measure neonatal bilirubin in order to administer appropriate phototherapy for newborn jaundice; an oxygen blender to mix oxygen and room air for compromised neonates; T-piece resuscitators that make it easier to control and deliver positive pressure ventilation; LED phototherapy units for newborns with jaundice; apnea monitors to record newborn breathing rates or cessation of breathing; and advanced warmers/monitors that can measure newborn heart rates, breathing rates, blood pressure, and oxygen levels. Future plans for the SNCU include a milk bank and the ability to provide total parenteral nutrition (TNP), a liquid nutrient via IV lines to newborns whose stomachs are too weak to handle breastmilk or formula.

Perhaps one day SNMH will venture into newborn intubation with ventilators rather than using only CPAP. Yet at this time, Padma and I believe that essential newborn care is most important and cost-effective in a remote region like Ladakh. Even during these past 9 months of Covid 19, our hospital staff used CPAP, high flow oxygen, and dexamethosone, instead of ventilation for our most critically ill patients. We have learned much about how to save newborns at this remote, district-level hospital in the last 6 years. We know that a majority of the babies born
in Leh after 32 weeks can be saved with KMC, expressed breastmilk, a high degree of cleanliness to avoid infection, and baby warmers. While the first three interventions cost almost nothing, the fourth is an expensive medical technology the government is providing across India. While some sick newborns will need this advanced care, all newborns need loving care from a trained staff who listen to the mothers and observe the minute changes in their baby’s condition. As I like to say, “A smart mother is better than a poor doctor!”

14.6 Two Newborn Outcomes in the Special Newborn Care Unit (SNCU)

Dr. Spalchen recalls one of his early manual resuscitations in 2011 with a simple bag and mask device using techniques he had learned in Delhi called Helping Babies Breathe (HBB) (Aneji and Little this volume, Lawn et al. 2014). For 20 days after his birth, we gave the baby continuous ventilation with the correct air pressure of less than 40 cm/liter using a self-inflating bag and skills learned in our neonatal resuscitation training (Zodpey and Paul 2014). The baby’s main complications were...
jaundice and apnea (breathing disruption), so we performed an exchange transfusion in which the baby’s blood was exchanged with donor blood products to reduce excess bilirubin. Because it was the first exchange transfusion at SNMH, they had great difficulty placing the neonatal catheters to deliver the donor blood. Although the tiny baby stopped breathing twice during the procedure—causing everyone great distress—he survived, avoided infection, and the procedure cured his apnea and decreased his bilirubin levels. Given the boy’s extreme prematurity, it was clear he needed an incubator, unavailable at that time in SNMH. The boy’s father, an engineer, purchased an incubator in Delhi and had it flown to Leh, where it was donated to the SNCU after the boy’s discharge.

**Fig. 14.8** Dr. Padma with her team in the operating theater for obstetric and gynecological surgeries. (Published with kind permission of © Rinchen Dolma 2020. All Rights Reserved)
In 2012, a baby boy was born weighing only 890 grams, which made him one of the smallest newborns ever to survive at SNMH. While he had no other major complications at birth, his weight declined to 850 grams after a week in the SNCU and his situation looked dire as he needed so many calories just to stay warm. But with regular kangaroo care and expressed breastmilk that his mother dripped into his mouth using a gauze and then a spoon, this newborn survived during his 2-month stay in the SNCU, where he received room air and oxygen via bubble CPAP and IV fluids for hydration. He was discharged after 2 months weighing only 1800 g, and the doctors expected he would soon be readmitted to the newborn care unit given his vulnerable size. Yet when his mother brought him for a visit after 3 months, he weighed 4.5 kg and he had no developmental delays in the first 5 years of his life!

14.7 Neonatal Care in Ladakh Versus India: Scaling Up

The National Rural Health Mission (NRHM) was launched in 2005 to improve child and maternal health across India with help from the WHO, the World Bank, and other global NGOs. In 2009, the Indian government launched the Newborn Baby Safety Program (Navjaat Shishu Suraksha Karyakram or NSSK) to help train district-level pediatricians like Dr. Spalchen in basic neonatal care, including newborn resuscitation, prevention of hypothermia and infection, Kangaroo Mother Care (KMC), and early initiation of breastfeeding (MoHFW 2009). The government of India promoted access to care for mothers and newborns with the JSSK (Janani Shishu Suraksha Karyakram) initiative that provided free drugs, diagnostics, referral, and transport for mothers and newborns during the first postpartum month.

The government also committed to building a tiered set of newborn care units across all of India’s districts: (1) Newborn Care Corners (NCCs) at primary health centers to provide essential newborn care and referral of sick or at-risk newborns; (2) Newborn Stabilization Units (NBSUs) to manage low birthweight or sick newborns at first referral units or Community Health Centers (CHCs); (3) Special Newborn Care Units (SNCUs) at district hospitals or medical colleges to handle all specialized newborn care except intubation and surgery; and (4) Level III Neonatal Intensive Care Units (NICUs) that provide the most advanced levels of neonatal care (MoHFW 2014a). Each SNCU was supposed to be equipped with radiant warmers, phototherapy units, oxygen concentrators, fetal pulse oximeters (which measure how much oxygen the baby’s blood is carrying), IV pumps, and bag and masks for newborn resuscitation (Neogi et al. 2011).

By 2015, the Indian government had made great progress in developing newborn care facilities across most of its districts, with 565 SNCUs, 1904 NBSUs, and 14,163 NCCs completed (Paul et al. 2016). Indian companies promoted newborn care facilities...
care by developing cost-effective and high-quality technology including baby warmers, phototherapy units, and resuscitation bags that met international quality standards and could be distributed across India (Kumar et al. 2016). Yet despite this success, coverage of low-tech interventions immediately before, during, and after labor and delivery remains scant in many facilities, due to poor quality of care, lack of training, and corruption in the healthcare system. Nationwide, only 45% of all newborns had three postnatal visits within 10 days of birth, roughly a third were exclusively breastfed at 6 months, and only 61% had full immunization after 1 year (Zodpey and Paul 2014; Sankar et al. 2016).

There are considerable disparities among states, between urban/rural settings, and for marginalized populations in India. The state of Kerala had the lowest NMR (7/1000) in the country, while Madhya Pradesh and Odisha’s NMR of 39/1000 was six times as high in 2014 (Zodpey and Paul 2014). Four northern states—Uttar Pradesh, Madhya Pradesh, Bihar, and Rajasthan—account for roughly 55% of all neonatal deaths in India (Zodpey and Paul 2014). There is a dramatic difference between rural and urban newborn death rates: India’s rural NMR of 33 is double its urban NMR of 16 (MoHFW 2014a). The gender breakdown of newborn deaths and care is also a cause for concern.

There is no breakdown for male and female NMR, but India’s IMR (infant mortality rate) indicates a clear preference for boys, with an IMR of 39 for male infants and 42 for females. Additionally, many district level SNCUs admit around one-third fewer female newborns than male newborns, suggesting that families are more likely to treat a sick male newborn than a sick female newborn (Sankar et al. 2016; Zodpey and Paul 2014). Death rates after discharge are also higher for female newborns (Zodpey and Paul 2014). We know that SC (Scheduled Caste), ST (Scheduled Tribe), and Dalit groups are the most disadvantaged in India, yet more research is needed to quantify the effect of discrimination on newborn mortality. A recent India-wide rural study looking at district level household surveys indicated that community-based participatory programs can help reduce NMR among SC or OBC (Other Backward Classes) communities (Houweling et al. 2013).

14.8 Neonatal Survival: India and the World

The leading causes of neonatal mortality in India today are: preterm birth complications (44%), intrapartum related events (19%), sepsis (13%), and congenital abnormalities (11%) (HNN 2020). In India, neonatal mortality still accounts for 62% of total infant deaths and more than half of the nation’s under-five deaths (HNN 2020). Three-fourths of India’s neonatal deaths occur in the early neonatal period, and more than a third of these deaths occur in the first 24 h of life (Zodpey and Paul 2014).

7 Other states and union territories with low NMRs include Tamil Nadu (15), Delhi (16), Punjab (17), and West Bengal. There were no NMR data for India’s most remote northern states (Arunachal Pradesh, Manipur, Nagaland, Mizoram, Tripura, Jammu & Kashmir, and Sikkim) in 2014.
In 2018, India was home to 17% of the world’s population, 20% of its live births, 21% of under-five deaths, 15% of its maternal deaths, but 27% of its neonatal deaths—an outsized fraction of the world’s newborn deaths (UNICEF 2019). With 549,000 newborn deaths in 2018, India ranks first among nations, and India’s NMR of 23 is five times China’s NMR (4) and is worse than Nepal’s—a remote Himalayan country with far lower GDP and less infrastructure than India (UNICEF 2019). India’s 7.5 million low birthweight (LBW <2500 grams) newborns are 11–13 times more likely to die than normal birthweight newborns and 10% of all LBW babies have neurodevelopmental disorders at 3 years of age (Zodpey and Paul 2014). Being low birthweight or preterm in India increases the odds of being stunted in the first 5 years of life and the risk of severe lifelong disabilities.

Globally, in 2018, there were 2.5 million neonatal deaths, 2.6 million stillbirths, and 15 million preterm births. The three leading global causes of neonatal mortality are similar to India: preterm birth complications (35%), intrapartum related complications (24%), and sepsis (15%) (UNICEF 2019). In the world, 85% of all preterm babies are born after 32 weeks and can survive with a minimum of high-quality, low-tech supportive care—yet this group contributes the majority of morbidities of preterm birth. Babies born at less than 28 weeks have a 95% chance of mortality without specialized newborn care, while babies born between 32 and 37 weeks have a seven-times increased risk of neonatal mortality than babies born at term (Lawn et al. 2014). However, due to advances in neonatal care in high-income countries, half of all newborns born at 24 weeks’ gestation in those settings survive, while nearly half of newborns born at less than 32 weeks die in low resource settings (WHO 2012).

Essential Newborn Care (ENC) costs little, but requires training, motivation, and knowledge transfer to be systematically and universally applied across the developing world. Yet coverage is often lacking in the high mortality settings where ENC is needed most. In South Asia, less than 5% of all facility-based births have access to neonatal intensive care. WHO defines ENC as: immediate drying and stimulation of newborns, warming or Kangaroo Mother Care (KMC), hygienic cord and skin care (hand washing, delayed cord cutting, and chlorhexidine for cord care), immediate breastfeeding, vitamin K prophylaxis, and neonatal resuscitation for babies not breathing at birth (Lawn et al. 2014; St. Clair et al. 2014). Within ENC, cleaning the cord stump and applying chlorhexidine can reduce neonatal mortality by 23% in low resource settings and delayed cord clamping is associated with a 41% reduction in intraventricular hemorrhage (IVH), a 39% reduction in need for blood transfusions, and a 38% reduction in necrotizing enterocolitis (NEC), a life-threatening intestinal pathology (Bhutta et al. 2014).

Thermal care practices such as KMC have been estimated to reduce 20% of all neonatal deaths caused by preterm complications and 10% of deaths in full-term or slightly preterm babies caused by infection (Bhutta et al. 2014). Early breastfeeding can reduce neonatal mortality by 44%, and there are proven benefits of Vitamin K prophylaxis to prevent bleeding, and of Vitamin KMC combined with breastfeeding support, early discharge from the hospital and supportive care for stable newborns is associated with a 51% reduction in neonatal mortality, 58% reduction in sepsis,
and 77% reduction in hypothermia (Bhutta et al. 2014). Finally, newborn resuscitation training has been shown to reduce intrapartum-related neonatal deaths by 30% and early neonatal deaths by 38% (Bhutta et al. 2014).

14.9 Conclusion: Sustainable Newborn and Maternal Care

The Ladakhi model suggests that the skills and equipment needed for essential neonatal and maternal care are not as costly nor as complex as once thought. Leh’s experiment could become scalable across India if public hospitals in other areas have staff as dedicated as Padma and Spalchen and their team and if hospitals and communities hold providers accountable for quality of care and review of mistakes made (Gutschow 2016). Our birth model makes clear that medical staff must be open to learning new clinical protocols, to changing outmoded or mistaken practices, and to welcoming marginalized communities or women. In short, Leh’s SNCU suggests that change and progress across India’s district-level facilities will require willpower and commitment to equal access regardless of gender, caste, and class.

In Ladakh, Dr. Landol, Dr. Padma, and Dr. Spalchen, along with their team of dedicated obstetricians and neonatologists, worked hard to improve the levels of care long before the central government intervened. The team’s commitment to transparency of care has proven itself sustainable over 40 years and sets SNMH apart from many district-level hospitals across India where corruption and staff morale are perennial problems (Gutschow 2016; Zodpey and Paul 2014; Iyer et al. 2016). Furthermore, their compassion and dedication to the people of Ladakh caused them to choose careers in Leh where they worked alongside their Ladakhi peers, instead of pursuing more lucrative medical careers elsewhere in India. The model has become sustainable because Drs. Landol, Padma, and Spalchen have collaborated with their peers in Leh to jointly develop a model of obstetric and newborn care that has received recognition in India and beyond for its excellent outcomes, dedicated staff, and compassionate care. While the revolution in newborn care in India has the potential to save millions of lives in the coming decades, it will only succeed if it includes well-trained and highly motivated staff who feel part of a functioning healthcare system that provides routine and emergency neonatal care. Hopefully and in time, more Indian hospitals will resemble the sustainable and high-quality model of care found in Ladakh.

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