



Protecting newborns: Fatima Yakubu, a Nigerian community health extension worker, holds tubes of chlorhexidine digluconate 7.1 percent gel. Yakubu's rural primary health care facility is one of about 120 clinics in the central Nigerian state of Kogi that are supported by USAID's Maternal and Child Survival Program.

By T. R. Goldman

REPORT FROM THE FIELD

To Reduce Neonatal Mortality, Nigeria Is Taking A Simple Treatment Nationwide

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At the Okene Zonal Hospital in Kogi State, Nigeria, an infant's tiny face—still flecked with a newborn patina because the boy had been born less than an hour earlier—was barely visible. The baby, wrapped in billows of Ankara cloth, lay on a small mattress inside a slatted metal basket whose graceful curves

evoked a Victorian-era birthing implement, a basket that had likely been in continuous use since the hospital opened in 1960, the year Nigeria became independent.

Despite the heat of the mid-July rainy season, the deputy ward matron dressed the child in a terrycloth jumpsuit, booties, and a large winter hat. Then she triple-gloved her hands and, hold-

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Photograph by T. R. Goldman

ing the baby's recently cut umbilical cord stump in her left hand, spread a thick layer of chlorhexidine gel along the length of the stump.

The infant was lucky on at least two counts. First, in a country where the minister of health tweets about Nigeria's "broken health system"¹ and the neonatal mortality rate is among the highest in the world, the child happened to be born in one of a handful of Nigerian states making a concerted effort to promote the use of chlorhexidine gel, a low-cost intervention that instantly reduced his chances of dying from the sort of massive infection that in Nigeria and other developing countries can all too easily take root in a newborn's umbilical cord stump.

Last year Nigeria's Federal Ministry of Health launched an ambitious plan aimed at making the immediate application of chlorhexidine to the stump the national standard of care. The five-year goal was to have the gel available and used on over half of the seven million Nigerian babies born each year.

Such a change would be a major challenge anywhere. In Nigeria—a roiling democracy of almost 200 million people that is Africa's most populous country—it's a daunting undertaking given ingrained cultural practices, a faltering infrastructure, health care workers who are often poorly trained, and a pervasive lack of money. The combination is frequently fatal for newborns.

But these factors did not conspire to take this infant boy's life, which was his second piece of good luck. The previous night, twelve hours before he was born, the baby suffered a cord prolapse—a rare condition that occurs when a loop of the umbilical cord moves out of the uterus and into the vagina before the baby does. Standard procedure is to immediately perform a cesarean section, to avoid the possibility that when the baby's head passes through the birth canal, it squeezes the cord and cuts off the baby's blood flow and oxygen.

"It's supposed to be an emergency," the ward matron, Sallu Bose, says. "But it was no longer an emergency because of financial constraints." Whose constraints? "The patient's," she explains.

Warm and candid, with rimless eyeglasses and a loud, infectious laugh, Bose has worked at the hospital for more than twenty-five years. On occasion, she will "stand in" for a patient who cannot find all of the money for a cesarean section, personally guaranteeing to provide the 30,000 Nigerian naira (roughly US\$100) that it costs. This is a massive sum in a country where half of the population lives on the equivalent of less than US\$2 a day. She is almost always paid back, Bose says, though it may take some time.

In this case, the mother and her family were able to collect the fee, although it took them twelve hours to do so. Bose says that after the cesarean was performed, the child needed oxygen because he had been born in fetal distress. Now, a short time later, he was dressed and lying in the newborn basket. But it was impossible to know exactly how he was faring, since there was no monitoring device in the maternity ward.

The state-run hospital and its four general practitioner physicians perform surgeries as well as deliver four to six babies a day. The hospital has one anesthesiologist and no obstetrician, explains Abdulraheem Sullayman, its medical director. Sometimes patients are operated on even when they cannot afford the fees, but not always. "We still have to pay for the equipment, the stitches, the gauze, the gloves, the drips, the blood bank," he says, almost apologetically.

A lack of sufficient government funding is a constant problem in all sectors of the economy in Nigeria, which has a three-tier political structure: a federal government in the capital, Abuja, and thirty-six states plus the Federal Capital Territory. Each state is subdivided into local government areas (a total of 774 for the whole country), and each area is run by an elected council that administers primary health care clinics, among other things. But Nigeria's limited financial resources are stretched even thinner by systemic corruption, state governors who wield near-total control of their own budgets, and a public sector that relies overwhelmingly on oil revenue—so much so that last year's drop in oil prices sent Nigeria into its first full year of recession in a quarter-century.²

At the Okene Zonal Hospital in Kogi State, many of the staff members had gone for months without a paycheck. And doctors in the nearby Kogi State Specialist Hospital, in the state capital of Lokoja, were on strike because of the lack of pay.

"Everything has been politicized," says Bose, whose ward has an incubator donated by several civic organizations that can't be used because it runs too hot and because there's no money, technician, or both (it's not clear which) to fix it. Politicians, she says, "forget that this particular profession has to do with life and death."

The infant, who had been moved from the basket and placed on the vinyl covering of one of the mattresses in the maternity ward, finally lets out a faint cry. "You are welcome," says a doctor, using the ubiquitous phrase that Nigerians employ more as a greeting than a reply.

Evidence

There are no silver bullets in global health care.

But chlorhexidine—cheap, safe, and simple to use—comes close.

The math is not complicated. Neonatal deaths (that is, deaths of infants in their first twenty-eight days of life) occur almost exclusively in low- and middle-income countries, where some 2.7 million neonates die each year.^{3,4} Infections are one of the top three killers of neonates. Luke Mullany, an early chlorhexidine researcher and a professor at the Johns Hopkins Bloomberg School of Public Health, notes that the rule of thumb is that countries with the highest neonatal mortality rates have the highest proportions of infection-related deaths, a figure that in some cases exceeds 40 percent.

Exposure to bacteria through the freshly cut umbilical cord is a common source of infection. As bacteria colonize the cord stump, it often develops a foul smell, and the bacteria can pass into the baby's bloodstream. There, they become systemic, and all too often fatal neonatal sepsis is the result.

A coating of chlorhexidine gel every twenty-four hours until the stump falls off is the recommended protocol in Nigeria. Chlorhexidine, a topical antiseptic long used as an all-purpose skin cleansing agent in hospitals around the world, not only kills surface bacteria but also seals off bacterial entryways from the still partially open blood vessels in the stump.

A landmark cluster-randomized trial led by Mullany of more than 15,000 infants in 413 communities in Nepal found that applying chlorhexidine to the umbilical cord reduced neonatal mortality by 24 percent overall, and by 34 percent for those infants who had chlorhexidine applied within twenty-four hours of being born.⁵

Nigeria's demographic characteristics mirror Nepal's in two key areas: a very high neonatal mortality rate and a high share (estimated to be 63 percent) of home births—including some one million cases in 2013 in which women gave birth alone, with no one in attendance.^{6,7}

With some 276,000 neonatal deaths annually in Nigeria (the country has the second-highest neonatal mortality rate in the world),⁸ it's no wonder that the Federal Ministry of Health's 2016 "National Strategy for Scale-Up of Chlorhexidine in Nigeria," the government's meticulously drafted road map, notes that "progress in reducing neonatal deaths globally is closely linked to results in Nigeria."⁹

"A highly preventable mortality," says Stephen Hodgins, a longtime chlorhexidine evangelist, referring to umbilical cord infections. "And in a high-mortality setting if you can knock off one out of five deaths, that's a pretty big chunk to take out. If you can knock out what was causing 10 percent, you've accomplished something

meaningful," adds Hodgins, an associate professor at the University of Alberta's School of Public Health.

Obstacles

The ministry's national strategy was officially launched on November 17, 2016. Its ambitious goal is to use chlorhexidine on 52 percent of Nigerian newborns by 2021, a target that if reached will avert an estimated 55,000 newborn deaths in the five-year period.⁹ A year into the program, however, the enormity of the obstacles that must be overcome to reach that goal is becoming clear.

First, there is the task of establishing a reliable supply chain. While there are five certified domestic manufacturers of chlorhexidine gel, unregulated open-air drug markets that can compromise quality are rampant. And in a country twice the size of California, how do you move the chlorhexidine to thousands of clinics and hospitals in addition to the 200,000 private patent and proprietary medicine vendors—drug retail outlets—where the majority of Nigerians buy their medical supplies? The nation's poorly developed infrastructure further complicates matters: Only 15 percent of Nigeria's roads are paved, yet 90 percent of all freight travels by road.^{10,11}

A second problem is creating demand. Most mothers (and their husbands and mothers-in-law), traditional birth attendants, and clinicians are still not aware of chlorhexidine and its benefits. And patent and proprietary medicine vendors are reluctant to stock products that nobody asks for. "You need strong demand generation, so shop owners know about it, and women and family members know about it, so the husband goes into [a] shop and they know to ask for it," says Nikki Tyler, Market Access Advisor at the Center for Accelerating Innovation and Impact of the US Agency for International Development (USAID), who worked on the national strategy document. The vendors "are profit-oriented, so they need to know people will buy drugs in order for them to stock them."

A third challenge is storage and handling. Chlorhexidine gel has a shelf life of three years in a normal temperature range. But Nigeria's spotty electricity supply makes that impossible to guarantee. "In some places in Borno and Yobe States, the room temperature can be 40 degrees [104 degrees Fahrenheit]," says Ibrahim Ali, the genial but steely-eyed director of pharmacovigilance at the Nigerian Agency for Food and Drug Administration and Control (NAFDAC). "Even if you see power lines, there [may be] no electricity."

Fourth, doctors can be stubborn when it comes to changing standard practices, insisting on a higher level of proof than community health workers do. It has long been a common practice for Nigerian doctors to wipe the umbilical cord stump with methylated spirits, a rubbing alcohol that evaporates quickly and doesn't have the same bacteria-killing capacity as chlorhexidine. Jaiyeola Oyetunji—a doctor and a project manager at Jhpiego, the global health nonprofit associated with Johns Hopkins University—notes that the Nepal studies “showed that chlorhexidine was good, that it was beautiful. But it didn't condemn methylated spirits.”

Just as difficult is overcoming families' cultural practices that have solidified over generations. Traditionally, Nigerians have coated umbilical cord stumps with everything from olive oil to engine oil, using red toothpaste and Mentholatum in the south and herbs, salt, and even cow dung in the north in the hope of protecting the stump and, in many cases, helping it fall off more quickly.

It is not easy to convince families that such approaches do nothing to protect against infection, especially “when the mother-in-law comes and says: ‘This is what I used for your husband, and he's still alive,’” explains Joshua Olorunfemi, Kogi State's director of public health.

In fact, matters could be even worse, say health care workers, because at least there's a tradition of applying something to the stump. This means that chlorhexidine is being promoted as a substitute for something else, not as a conceptually new intervention.

The final challenge is simply paying for everything. The national strategy estimates that it will cost US\$32 million to reach its five-year goal of 52 percent chlorhexidine uptake. That means squeezing strapped state budgets and seeking money and expertise from a host of different domestic and international NGOs to conduct media campaigns, train health care workers to use chlorhexidine, and purchase and distribute hundreds of thousands of tubes of chlorhexidine to jump-start interest in the product until people are willing to pay for it themselves.

“Who's organizing this program?” Matthew Durowaye, a consulting pediatrician in Lokoja's Federal Medical Center, asks rhetorically. He is one of seven pediatricians in a state with an estimated population of 4.3 million.¹² “It's not the Kogi State government,” says Durowaye, referring to the July 2017 conference on chlorhexidine use he was attending that was paid for by USAID's Maternal and Child Survival Program.

Yet even when a program is initially funded, organizers cannot be ensured of sustainable

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financing—that is, having resources available year after year after year. Indeed, in two states (Sokoto and Bauchi) that served as a model for successfully introducing the use of chlorhexidine in Nigeria, state purchases of the gel were halted after the election of new governors. The problem, says Olorunfemi, is that the “ability to get approval and release [of funds] depends on the relationship between the [state] commissioner [of health] and the governor. The funding of any government activity is based on having budget ownership, [and the budget] comes out every year.”

Early Uptake

Olakunle Ekundayo, the founder and managing director of Drugfield Pharmaceuticals Ltd., employs 700 people and has two pristine manufacturing plants an hour north of Lagos that can produce up to twenty-seven million tubes a year of Chlorxy-G Gel, as his brand is known. “It's a simple product that has such a profound effect,” he says.

Seated at a small table in his spacious office, filled with photos and filing cabinets, Ekundayo says that domestic demand is far short of supply, and he has been selling his product elsewhere on the continent. “Yes,” he says, if one takes into account his “huge” initial investment, “we're losing money. In absolute terms, yes.”

When Ekundayo began manufacturing chlorhexidine gel three years ago, his was the first company in Africa to do so. He says that the federal government's imprimatur for nationwide implementation, combined with the fact that Nigeria had thirty-five million women of childbearing age, gave him hope that domestic demand was about to surge. “We thought the government says ‘that's it' and that's it,” he says. “The thinking was, ‘This will be a volume spinner.’ But it didn't happen that way. Uptake is still very slow.”

It is no coincidence that the swift climb of chlorhexidine coincides with neonatal mortality's rise as a hot topic in global health.

An August 2017 draft of the latest Multiple Indicator Cluster Survey of Nigeria, an international household survey developed by UNICEF to provide comparable global health data, puts chlorhexidine use at 3.9 percent nationally.¹³ A July 13, 2017, article in Devex, the global development website, by U.S. Pharmacoepia, a US nonprofit that helps countries modernize their drug manufacturing and that worked extensively with Drugfield, estimated the figure at 5 percent.¹⁴ However, no one really knows, because the government's official *Health Facility Daily Labour and Delivery Register*, last updated in 2013, contains no column on chlorhexidine application. There are plans to update the register with a revised set of metrics, but there's no guarantee that the new version will document chlorhexidine use—which is competing with a host of other indicators for the attention of public health officials. There are only so many columns available per page.

Shifting Focus

In the complex and competitive world of global public health, chlorhexidine has moved with enormous speed to a favored spot in the neonatal toolbox.

For decades, there was little agreement and conflicting evidence on the most effective umbilical cord stump care. Until the early 2000s, almost all studies on cord stump care were done in developed countries, evaluating dry cord care along with the use of antimicrobials such as chlorhexidine, triple dye, and alcohol. Radically different hygiene practices made it problematic to translate those results to the developing world.

Then came Mullany's Nepal study in 2006, which was followed by two more (in Bangladesh and Pakistan) that also showed that chlorhexi-

dine had a significant impact on mortality.^{15,16} In 2008 chlorhexidine was submitted for addition to the global essential medicines list of the World Health Organization (WHO); it was formally added in 2013.

In 2012 the UN Commission on Life-Saving Commodities for Women and Children—whose cochair was Goodluck Jonathan, then president of Nigeria—published a list of thirteen “overlooked” life-saving products for mothers, newborns, and older children.¹⁷ Chlorhexidine was one of the four commodities listed for newborns, and the commission estimated that its use worldwide could save 422,000 lives over the next five years.

In 2014 the WHO issued a formal recommendation—the ultimate accolade for a global health intervention—that chlorhexidine be used for cord stump care in home births in countries with a neonatal mortality rate of thirty or more deaths per thousand live births.¹⁸ (The Nigerian policy makes no distinction between home or facility births, calling for the application of chlorhexidine in both situations.)

Currently, twenty-seven countries in Asia and Africa either have a pilot program for the use of chlorhexidine or an aligned policy or are scaling up the use to a national level.¹⁹

It is no coincidence that the swift climb of chlorhexidine coincides with neonatal mortality's rise as a hot topic in global health. For decades NGOs and public health officials had focused more broadly on child health, defined as health in the first five years of life, rather than on neonatal mortality. That began to change significantly in the early 2000s—sparked in part by the United Nations' eight global Millennium Development Goals (MDGs). The fourth goal called for cutting the under-five mortality rate by two-thirds between 1990 and 2015.

By then, while it was clear that the neonatal mortality rate was falling, the child mortality rate was dropping faster. The United Nations called its decline of 53 percent between 1990 and 2015²⁰ “one of the most significant achievements in human history.”²¹ As a result, deaths in the first twenty-eight days of life now account for almost 45 percent of all deaths that occur in a child's first five years—up from 37 percent in 1990, according to data from the WHO and UNICEF.^{20,22}

“We used to say ‘mother and child,’ and the ‘newborn’ was forgotten—it had dropped into the cracks,” notes Chinyere Ezeaka, the president of the Nigerian Society of Neonatal Medicine and a professor of pediatrics at the Lagos University Teaching Hospital, better known as LUTH. “The whole focus has shifted to the newborn, especially when we realized that reducing newborn mortality was the only way to achieve

MDG 4.”

Indeed, one of chlorhexidine’s main attractions is that it goes well beyond preventing umbilical cord infections (no small thing, of course): It’s also a powerful catalyst for improving neonatal care in general.

“There’s a convening power to chlorhexidine,” says Nosa Orobato, deputy director of the Maternal, Newborn and Child Health Program at the Bill & Melinda Gates Foundation in Seattle, Washington, who was the lead author of a seminal study in 2015 on chlorhexidine uptake in the two Nigerian states of Sokoto and Bauchi.²³ Orobato explains that as local communities and health care providers focus on chlorhexidine, they quickly become attuned to “a suite of things that really ought to be done anyway—antenatal care, misoprostol [used to treat postpartum hemorrhaging], delay [cord] clamping, washing your hands with soap and water, cutting the cord with a clean razor, putting the baby on the chest, not washing the baby.”

The twenty-five-gram tube of 7.1 percent chlorhexidine digluconate gel, the standard size that Nigeria has chosen to use to promote its national chlorhexidine strategy, is also small, discrete, and identifiable—an easy symbol for a politician to grasp.

In Nigeria, where state and local politics play an outsized role in even the most mundane health policy decisions, Orobato says that chlorhexidine “can help a governor visualize an intervention and serve as a proxy for understanding primary health care. That’s part of what we were able to do in Sokoto and Bauchi.”

That’s apparently what happened in the central Nigerian state of Kogi over the summer of 2017, where Gov. Ahmad Bello, a wealthy forty-two-year-old businessman, decided to capitalize on his state’s introduction of chlorhexidine by paying for 24,000 tubes and providing them free to hospitals and pharmacies.

He replaced the original packaging of the Nigerian manufacturer, Drugfield Pharmaceuticals, with a new box that was identical in every way to the old one with two exceptions: the new box featured an image of the governor’s smiling face and had an infelicitous misspelling of the word *umbilical* printed in bold black letters noting the gel’s purpose: “FOR UNBLICAL CORD CARE.”

Scaling Up

The brown concrete building that houses Nigeria’s Federal Ministry of Health rises like a squat sand castle amid the ever-expanding cityscape of Abuja. It is here that the momentum—or

The most powerful motivator to change could be the most obvious: Fewer infants will die.

inertia—for Nigeria’s national strategy for scaling up the use of chlorhexidine will be determined.

Bose Adeniran—a doctor and career civil servant who is now the ministry’s director of child health and a key player in the scale-up—works out of a tenth-floor office. She is peering into her smartphone when asked about the challenges of the chlorhexidine launch. “You don’t start with the challenges,” she responds sharply, implying that the question was too fraught to begin a conversation. A few seconds later she relents. “The cost of implementation is where we have challenges,” she says.

Indeed, although a dozen or more states have purchased chlorhexidine either with their own funds or donor monies, the procurement process so far is continuing only in a few states (including the most populous, Lagos) that have focused on the sustainability and institutionalization of chlorhexidine’s use, says Olayinka Umar-Farouk, the project’s official “uptake coordinator” and its unofficial chief lobbyist. A public health physician, Umar-Farouk is responsible for running interference, setting up training sessions, and cajoling and prodding the entire Nigerian health care establishment to make chlorhexidine use the country’s new standard for cord care.

Orobato’s work, particularly in the far northern state of Sokoto in 2013, had proved that with enough community involvement, lots of publicity about the product, and the right message—that the use of chlorhexidine is consistent with the cultural tradition of applying something to the umbilical cord stump—a state could ramp up that use to a significant level.

“We wanted local evidence,” continues Adeniran, who says that thirty-four states sent health delegations to Sokoto to study the results. The key now, she adds, is the individual implementation in each state. This will vary depending on factors such as the frequency of antenatal care visits, whether a community’s key “influencers” can be convinced of chlorhexidine’s benefits, the

rate of home births versus facility births, the number of private facilities versus public, and how often a skilled birth attendant is available. “No one cap fits it all,” she says.

In July and September, two comprehensive, two-day-long zonal meetings—each convening representatives of about half of the states—were held in Lagos and Abuja. At these meetings, senior state health officials were briefed on such subjects as the role of jingles in creating demand, how to use money from the World Bank’s Saving One Million Lives program for chlorhexidine purchases, and avoiding confusion between chlorhexidine gel and erythromycin—an eye ointment that is also used on newborns. Adeniran was at both meetings. Ali, the federal drug regulator from NAFDAC, attended the Lagos meeting and sent a representative to the Abuja meeting. Their presence, notes Umar-Farouk, helped bolster the gel’s reputation as a high-quality product.

A year from now, Adeniran says, there should be enough feedback from most of the states to see how far the country has moved toward full implementation of chlorhexidine. It might even be possible to start formally tracking the substance’s use nationwide. Now that is possible in only two states, including Kogi—where a chlorhexidine column has been manually added to the official copy of the *Health Facility Daily Labour and Delivery Register*.

Guarded Optimism

Progress lurches forward, and improvements in Nigerian health care are no exception. The country quelled a potentially disastrous Ebola outbreak in 2014 with an immediate and rapid response—a textbook example of infectious disease control that the WHO called a “piece of world-class epidemiological detective work.”²⁴

But reaching the national strategy’s five-year goal of just over 50 percent for chlorhexidine uptake, much less ever coming close to 100 percent, is more problematic and highly dependent on the vagaries of elected governors, whose states differ greatly on various health metrics. For example, in four northwestern states, more

than nine out of ten babies are delivered at home, while in Imo State in the southeast, that figure is fewer than one in ten.⁶

When resources are applied and efforts made, however, change does occur, and the idea that the use of chlorhexidine gel should be the normal standard of care can take hold.

That’s why Umar-Farouk, checking on the progress of implementation at the Federal Medical Center in Lokoja, is able to joke about an empty carton of Oral-B toothpaste she spots at the foot of a patient’s bed.

“I want to believe that’s for the teeth, not for the cord,” she shouts in mock horror to the head of the labor and maternity ward.

Christiana Ajileye, the nurse in charge of the ward, laughs. “They are using it,” she says of the chlorhexidine widely available in the ward. “They are testifying that it’s easier than methylated spirits,” she continues, noting that use of spirits requires cleaning the cord stump four to five times a day with a cotton ball, compared to the single daily application required with chlorhexidine.

“And they have been testifying that it [the stump] falls off in time,” she adds, with some emphasis, alluding to one of the thorniest issues in the world of chlorhexidine: the belief that its application delays the time when the umbilical cord stump breaks away.

That matters to many Nigerians, who want their baby’s cord stump to have fallen off before an all-important naming ceremony, which usually occurs 7–12 days after a child’s birth, depending on the ethnic group. The ceremony effectively ratifies a child’s existence and welcomes him or her into the community. There is evidence that chlorhexidine can delay the stump’s loss by a day or so, but it’s certainly not clear that other ointments will make it fall off any sooner.

Ultimately, the most powerful motivator to change could be the most obvious: Fewer infants will die. “That infected smelling of the cord, we don’t have that now,” says Fatima Yakubu, a community health extension worker at a primary health care facility surrounded by a rutted dirt road in rural Kogi State. “That’s what we’ve witnessed.” ■

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NOTES

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