

**URBANIZATION**

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Toilets and Sanitation at the Kumbh Mela

Dr. Richard Cash looked up from his chair in the dining hall tent at the Kumbh Mela festival, where he had been reading a murder mystery, *The Case of the Deadly Butter Chicken*. At the long tables nearby, the Indian hotel staff was busy preparing for the evening meal. Outside, in the cold of the January evening in 2013, loudspeakers vibrated with a constant stream of loud music, Hindu religious teachings, and announcements about lost and missing persons. But inside the tent, in an enclosed encampment at the top of a hill a mile west of the city of Allahabad, in northeastern India, it was still warm and bright.

Putting aside the curious adventure of chubby private detective Vish Puri, Dr. Cash began to reflect on the past few days, and to plan for the discussion he had scheduled that evening with several students to reflect on lessons they were learning from the Kumbh Mela. He and his students had spent the day walking around the fairgrounds—which were just outside the camp and down the hill (see **Exhibit 1**)—to learn how toilet and sanitation facilities were organized at this event and what the pilgrims who came to the festival thought about them. They had all been up since 5 AM, when they joined the crowds who gathered along the small sacred beach area—called the *sangam*—where, it was said, up to 120 million people during this year’s 55-day festival would “take a dip,” practicing a sacred bathing ritual that, according to Hindu beliefs, would release them from their sins and the endless cycles of reincarnation; it was estimated that 30 million people would visit on one day alone, February 10, the most auspicious day for bathing.¹ The Kumbh Mela festival, the largest mass gathering in the world, took place once every 12 years in a temporary “tent city” which the Government of India funded and built on the sand flats in the annual dry season at the meeting point of three rivers sacred to Hindus around the world—the Ganges, Yamuna, and (historical but now mythic) Saraswati.²

What effect, Dr. Cash wondered, would so many million visitors have on the water and toilet sanitation resources at this year’s festival? And what effect would these resources have on the visitors? What might the facilities and conversations that he and his students had experienced today teach others about the use of toilets and water purity in other public health contexts? How might a religious event in Allahabad—an event so rare it occurred only once every 12 years—help address the chronic global challenges around water and sanitation in public health? How might cultural beliefs about water purity—for both body and soul—foster multidisciplinary opportunities in a world marked by increasing urbanization? These were some of the questions he planned to bring up for discussion in the evening’s student discussion session.

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As an expert in infectious diseases who had spent much of his life in India, Dr. Cash had been known since the 1960s for his work on water-borne illness, particularly cholera and its effective treatment with oral rehydration therapy (ORT). The link between water and the diarrhea of cholera that could be fatal if left untreated had led him, over the years, to research on toilet facilities in India. One of his graduate students at Harvard School of Public Health, James Potter, had recently mapped the toilet facilities in Cheeta Camp, an urban settlement of 117,000 people in Mumbai that lacked both running water and private bathrooms.³ Potter's work had revealed some of the common challenges involved in attempts to provide camp residents with safe and functional sanitation resources, including corruption, lack of accountability for officials, lack of sewage infrastructure resulting in open sewage drains, chronically unfinished or non-functioning toilet facilities, lack of electricity, and perceived safety for women and children.⁴ Several other students from Harvard School of Public Health had come out to India in early 2013 to explore the health-related implications of the toilet facilities at the Kumbh Mela festival.

Dr. Cash lived in India most of the year. Over many years, he had seen that health improvements have the highest chance of success when local communities could choose, own, and apply the ideas and practices that worked best within their particular culture and belief system. He knew that the sanitation problems across India and in much of South Asia were typical of many communities around the world where human need outstripped available resources. Were the toilet facilities at the Kumbh Mela appropriate to the cultural beliefs of those who attended the festival? Were there enough toilets for everyone? Did people need to be educated to use them, and what happened when people chose *not* to use them? Did the Indian government, who was funding the event, offer the different types of toilets as an educational opportunity (and if so, how, and what behaviors were intended to change)? How was the sewage handled, and did these sewage practices promote health or increase the health risks at the festival? What more broad-scale environmental risks did the toilet facilities at the festival present during the event and after the event was over?

Why Do Toilets Matter?

According to the United Nations and the World Health Organization, it was estimated that by 2030 the developing world would have more urban than rural dwellers.⁵ By 2050, it was estimated, the world's urban population would almost double, from 3.3 billion in 2007 to 6.3 billion.⁶ While urbanization could bring advances in social, political, and economic prospects, its pace often outstrips the development of basic public health services and infrastructure, compounding health threats that disproportionately affect the poor. Safe water and human waste disposal, basic health-related needs in any community, are known to be particular challenges for the urban poor. Driven to the least developed urban areas, the poor become most exposed to the consequences of dilapidated environments: pollution, health hazards that accompany insufficient hygiene and sanitation, and accelerated infectious disease transmission rates.⁷

The United Nations (UN) and the World Health Organization (WHO) consider sanitation essential to health. In 2010, the United Nations General Assembly recognized access to sanitation and drinking water as a fundamental human right.⁸ Millennium Development Goal (MDG) 7 had as its target by 2015 reducing by half the proportion of the world's population that lacks access to safe drinking water and basic sanitation. It was announced that that the safe water goal had been met by 2010,⁹ but, as of 2013, over one-third of the world's inhabitants still did not have access to proper sanitation and water sources.¹⁰

Sanitation-related diseases might be divided into six broad categories, all with serious health consequences: waterborne (following the oral-fecal route, such as typhoid, cholera, dysentery), water-based (caused by parasites, such as schistosomiasis), water-related (caused by insects or vectors associated with water, like dengue, malaria, or yellow fever), excreta-related (caused by contact with excreta or vectors breeding in excreta, most notably trachoma), water collection and storage-related (caused by improper hygiene or handling of excreta containers), and toxin-related (caused by toxic bacteria in surface-water, such as hepatic illness).¹¹ Such conditions account for an enormous burden of disease, estimated at 82,196,000 disability-adjusted life years (DALYs³).¹² The same cost-effective analysis also

³ A DALY is generally understood to mean "one lost year of 'healthy' life," as a result of a health condition such as disease or disability. (World Health Organization, "Metrics: Disability-Adjusted Life Year [DALY]." Online at http://www.who.int/healthinfo/global_burden_disease/metrics_daly/en/. Accessed 1/29/14.

showed that the preventative provision of water and sanitation services is superior to post-illness medical treatment. The conditions most easily prevented by proper sanitation include intestinal worms, diarrhea, and trachoma.¹³ Diarrhea is the most common symptom of a water-borne illness, and diarrhea-related dehydration can quickly kill affected infants and children, especially when they are already underweight or malnourished, making diarrhea the second leading stated cause of death among young children throughout most of the twentieth century.¹⁴

Safe sewage at the Kumbh Mela, as elsewhere around the world, Dr. Cash knew, depended on safe sewers and containment areas that would keep waste away from contact with clean water. For many countries, however, such systems either have not existed or often lacked the governance support they needed for proper maintenance. Such deficiencies could spell disaster, especially in areas of rapid urbanization, dense urban settlements, and refugee camps, where people live in makeshift or temporary shelters, and often suffer from poverty, malnutrition, violent effects of sudden displacement, substandard clothing and shelter, and inadequate or high-risk employment. Low-cost improvements could yield high benefits: a joint World Health Organization/UNICEF 2010 study estimated that for every dollar spent on sanitation, one could expect a \$34 return in life quality and health.¹⁵

But this is India!

In 2012, India was one of the poorest countries in the world with a number of health-related risk indicators (see Exhibit 2). Roughly 42% of India's 1.2 billion people lived below the international poverty line, with 2006 data indicating high rates of chronic malnutrition for children under age five, measured by stunting (48%), underweight (43%) and wasting (20%).¹⁶ The poverty of India is accompanied by significant health risks associated with inadequate sanitation.

According to a WHO/UNICEF monitoring progress report in 2012, southern Asia, of which India is a part, has the second worst sanitation coverage of any region in the world, with facilities providing for only 41% of the population (only sub-Saharan Africa is worse).¹⁷ Almost 60% of the world's open defecation occurs in India,¹⁸ and a 2003 study showed that only 50% of the urban population and less than 20% of those in rural areas could count on safe disposal of human feces.¹⁹ On average, less than one-third of the population was served by an "improved" toilet—that is, a toilet that hygienically separates human excreta from human contact. According to 2010 data from the WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation, only 66% of the Indian population used water that is treated or protected in some way, but not piped into their yard or dwelling.²⁰ Even though rivers in India are viewed as sacred, Dr. Cash knew, surface water was often severely polluted, with fecal coliform counts (FCC) that could fluctuate between 5,000 and 20,000 mpn per 100 ml (clean water would have a level of zero).²¹ Parameters of water quality are sometimes given in biochemical oxygen demands (BOD) per liter, indicating the amount of organic pollutants present.²²

The World Health Organization estimated in 2010 that India had the world's largest number (626 million) of people who practiced open defecation.²³ Students from the United States who had come to the Kumbh Mela frequently observed men and children urinating in public. Women, too, as they did at home in their rural villages, would typically squat together. Rather than use toilet paper, the common self-cleansing practice after defecation was to use water (with the left hand), available from a faucet or small bucket of water in the toilet area. Waste was often dumped into rivers and streams in the common belief, Dr. Cash's students were told, that "moving water" is pure and clean. Some villagers insisted that open defecation as is more sanitary than having a toilet inside the house, since, they say, "the sun burns up faeces."²⁴

Many of Dr. Cash's students had grown up in wealthy nations where sewage disappeared with a quick "flush" and was channeled away from home toilets to urban water treatment plants that helped prevent environmental contamination of the local ground water and drinking water supplies. But in many countries, including much of India, sewage treatment facilities were often inadequate or lacking, leaving the toxins and bacteria in human waste to drain directly into an open gutter and nearby river or lake. Sewage in public spaces and public toilets—including those at the Kumbh Mela—had to be removed by hand. Cleaning toilets in India, euphemistically called "manual scavenging," traditionally fell to people from the lowest caste. According to the Safai Karamchari Andolan (SKA), India's "Sanitary Workers Movement," in 2008 there were 1.3 million people, 90% of them women, who scoured dry latrines in India, and 95% of these workers were from the *dalit* or *Harijan* caste ("untouchables").²⁵

Doesn't Mother Ganga Purify?

Ritual purity is also associated with cleanliness in India. Pilgrims at the Kumbh Mela insisted that sacred rivers such as the Ganges—called “Mother Ganga”—and indeed many smaller “flowing” streams—were regarded as “pure” or “clean” no matter what went into them. This was explained in various ways: as a religious belief (as spiritual purity, that is, independent of biochemical measurements), as an ethical belief (that is, arguing spiritual purity as a justification for environmental interventions to make the river also biologically “clean”), and as hypothetical science (as for example the argument about the Ganges containing a high level of biophages²⁶). It was precisely this belief in the purity and purifying nature of the water that drew millions to crowd together into a small space during the Kumbh Mela festival. Pilgrims flocked to the *sangam*—the sacred bathing area at the festival—with one goal: a ritual purification bath. Ritual bathing at the festival also included drinking a small amount of the bathing water and offering small votive gifts to the river: flowers, flower garlands, candlelit paper boats, along with prayers as part of one’s worship or *puja*. (See **Exhibit 3** for the appearance of the water beside one of the pontoon bridges, with waste and residues from such votive offerings). The 2013 festival was marked by efforts to publicize information about literal pollution in the Ganges—that is, trash, bacteria, toxins, and other materials—and to advocate projects to clean it up.²⁷

Religious leaders and groups at the 2013 festival were also engaged in promoting health messages related to the purity of the water and environmental safety. Especially noticeable was the work of the Hindu non-governmental organization, Ganga Action Parivar.²⁸ The festival also included religious leaders who came to hold teaching sessions with their disciples and shared concerns about the river’s pollution levels, but did not participate in the bathing rituals.²⁹

As more and more people arrived at the 2013 Kumbh Mela during January and early February, the population density of the crowds would also increase significantly, with millions of pilgrims, tourists, religious leaders, government officials, and representatives of the international media squeezing into an area that in 2013 covered 1936.56 hectares³⁰ (or approximately half the size of Manhattan³¹). The highest human density at the festival is that in and around the one or two square miles of beach bordering the *sangam*. (See **Exhibit 4**)

Officials have long recognized the festival’s water-related health risks, particularly the risk of cholera.³² Indeed, some historians suggested that the 1817 Kumbh Mela in India may have been the original cause for the global Asiatic cholera pandemic of 1817–1824.³³ In 1954, the first Kumbh Mela festival after India’s national independence in 1948, official concern to prevent cholera was so great that officials mandated that “only people inoculated against cholera could enter the Allahabad district between January and February.”³⁴ Fear of both the vaccinations and the vaccinators, and the resulting long lines for vaccination before anyone could exit the train station, was reported to keep so many people away from the 1954 festival that “the UP Cabinet abruptly withdrew the inoculation requirement on January 28.”³⁵ Inoculation attempts that year were reportedly more successful at other Hindu festivals, in Pundarapur, Hyderabad, and Hardwar.³⁶ At the 2013 festival, there were no health requirements for anyone entering the fairgrounds, but the Kumbh Mela administration took a number of explicit public health measures to reduce common risks and ensure pilgrim safety during the festival.³⁷

Public Health at the Kumbh Mela

By the time Dr. Cash and his students arrived in Allahabad, official safety measures and health-related provisions were blending into the daily buzz of noise, music, and the ordinary rituals of daily life in an Indian religious setting. The loudspeakers, for example, broadcasting from 3 AM until 11 PM every day, included names and announcements intended to help lost pilgrims reconnect with their relatives. By 5 AM each morning, crowds of pilgrims were using the temporary public toilets in preparation for their daily sacred bath. By 8 AM, the sun was rising through a haze of campfires, as men and women flocked into the religious compounds (*akharas*) where volunteer groups served breakfast. Inside the tent compounds, altars burned with ritual sacrifices and groups of sadhus sat together in each tent, talking with interested disciples, pilgrims, and tourists, and smoked *chillum* pipes of cannabis. Along the metal plate and straw-strewn roads, children ran and begged, some of them dressed up to represent Hindu deities and other characters they played in nightly theatrical performances. Utility workers cleaned the toilets, sprinkled sanitizing bleach

powder at regular intervals; merchants set up carts with fresh fruits, vegetables, and small souvenirs; and naked ash-strewn holy men wandered around unpredictably. At regular intervals trucks drove through the fairgrounds spraying insecticide in blasts of blinding clouds intended to minimize the risks of mosquito-borne disease risks such as malaria and dengue. Across the site, approximately 8,000 cleaners kept everything tidy, chasing down plastic bags, litter, and collecting refuse into carts for removal (See **Exhibit 5**).³⁸

Based on past festival experiences, officials knew the situations that carried the most risk for crowd-related injuries. They were: (1) the directional flow (and press) of human bodies in a culture where people in public space were accustomed to pack together very tightly and were not accustomed to queuing or forming lines; (2) the ground surface and its capacity to safely support the human flow; and (3) the process of entering and submerging in the rapid currents of the merging waters for the purpose of holy bathing.³⁹ For 2013, these issues were addressed by proactive measures that related to: crowd flow control; ground safety; water, sanitation and bathing safety; a place for lost and missing persons; and provisions for onsite medical care.

Water safety measures included attempts to reduce the risk of waterborne diseases. Several religious groups at the 2013 festival led a publicity campaign to promote a “Green Kumbh” and sponsored efforts to emphasize the importance of keeping the Ganges clean.⁴⁰ The bacterial and contaminant potential of the bathing water was limited by controls on upstream discharge from factories during the festival, and by scheduled release of upstream dams to increase the flow and volume of fresh water into the bathing area.⁴¹ During the Kumbh, it was reported, “all the city sewers were directed downstream of the *sangam* to keep the bathing [areas] free of filth.”⁴² Drinking water was supplied from piped bore wells (40 were dug, according to the official website, connected by miles of piping⁴³ as shown in **Exhibit 6**). Specially marked UV-sanitized water was also available in special dispensing areas.⁴⁴ Runoff water and water deemed unsafe for drinking—called “grey water”—was diverted by piping the water into sandbag-lined open pools; signs clearly marked the pool as containing water that was not safe to drink. (See **Exhibit 7**.) Trucks were seen daily sprinkling this grey water on the straw-strewn and metal-plated roads; the trucks also included signs in Hindi to warn that the water used for this purpose was unsuitable for consumption.

Medical care was readily available to all, and records were monitored for any variations in intestinal or diarrheal complaints.⁴⁵ Medical facilities were organized according to geographical sectors. For administrative purposes, the festival site was divided into 14 geographical sectors; 13 of these sectors each had its own temporary allopathic medical clinic, and a fourteenth allopathic medical facility consisted of a hospital located in a permanent building that was located a short walk from the *sangam*. Each sector clinic was staffed by medical personnel who had been recruited (or appointed) from nearby hospitals and medical schools. The sector clinics contained pharmaceutical supplies for basic health complaints, two or three camp beds for patients who needed to lie down, and four types of disaster preparedness kits, large boxes clearly marked and equipped with all that a doctor would need to treat patients in case of: stampede, bomb blast, burn, and drowning.⁴⁶ All medical care within the administrative boundaries of the fairground was provided free of charge throughout the festival.

Toilets 2013

Dr. Cash and his students were at the festival for merely a few days in January, before the largest crowds of pilgrims were expected to arrive, in February, for the most sacred or auspicious bathing days. The team could hardly visit each of the 35,000 toilets across the fairgrounds. Nor did they have adequate resources to measure or study the water quality or bacterial content related to toilet facilities. Instead, they focused their time on visiting a few representative units located near the *sangam* and outside the *akharas* (the sadhu’s congregational compounds). They also interviewed selected officials, workers, holy men, and pilgrims, asking for their experiences and perceptions of the facilities and management. They observed four general types of designated toilet areas: roadside urinals, pit latrines, “Biodigester” toilets, and defecation fields.

Roadside urinals

Roadside urinals were semi-contained units made of corrugated metal roughly five feet high, ensuring basic privacy but without a roof. (See **Exhibits 8, 9**) Each was clearly labeled with a large gender-specific logo visible from the road. Within each urinal, students found one or more pipes buried in the ground, many already full and overflowing

with human waste. Around each pipe a few clay bricks allow the user to stand or squat an inch or two above the surface soil. The pipes had no flushing mechanism and operate by gravity, drawing waste into a mounded area behind the unit. No water was provided in these units. The mound and the sand around the external walls were sprinkled liberally with white sanitizing powder. One of the sanitation workers proudly displayed the labeled sack of powder: Shaktiman, (calcium hypochlorite) a stable bleaching powder “using high-purity hydrated lime, chlorinated under a controlled temperature at high vacuum.”⁴⁷ The students had noticed that there seemed to be little or no sewage odor at any of the toilets they observed, and remarked on the apparent effectiveness of the disinfectant powder.

Pit latrines

A pit latrine was a toilet built over a pit. Two versions of pit latrines were common at the Kumbh, the “PRAI” type and the Sulabh complex. Originally designed in the late 1940s, the PRAI pit latrine was a hand-flush, water-sealed latrine with a ceramic toilet pan and a trap. Sewage channeled into the pit by users’ flushing it down with water. Each PRAI toilets unit contained several stalls, each stall a private space surrounded by canvas walls, ceiling, and entry flap, all placed on bamboo poles. Like the roadside urinals, the PRAI pit toilets also showed evidence of sanitizing powder sprinkled liberally around the area to keep odor to a minimum. According to the Kumbh administration, 7500 PRAI-type toilets were installed for 2013. (See Exhibits 10, 11.)

The Sulabh 10-seater toilet complexes were the brainchild of Dr. Bindeshwar Pathak, who in 1970 founded Sulabh International Social Service Organisation, a sanitation NGO based in India “dedicated to Gandhian ideology of emancipation of scavengers.”⁴⁸ Sulabh toilets took the users several steps up—literally. Each unit resembled a small trailer with ten doors, five on each side, with steps leading up to the narrow corridor outside each door. Users entered a traditional Indian (squat-style) toilet room with a door that shut. (See Exhibits 12, 13) The ceramic toilet pan was hooked up to a flush mechanism, and a small spigot by the door operated a functioning water tap for personal rinsing. The students noticed that one of these units near the *sangam* received heavy traffic before dawn each morning. A second Sulabh toilet a few feet away was still under construction; detached pipes and tubes lay in the open sand area underneath, and the students were told that parts were often stolen during construction. (See Exhibit 14.) A billboard attached to the outer walls of the completed toilet encouraged pilgrims to use the toilets as part of the 2013 focus on environmental health. (See Exhibit 15.)

Biodigester toilets

As they strolled across the fair on their first morning walk, Dr. Cash and his students had noticed a bright green and yellow caravan that looked rather like a small circus trailer. An official in charge of the unit quickly appeared and was eager to explain. It was, he said, the latest model of a “Biodigester” toilet. (See Exhibit 16.) Toilet rooms in the Biodigester were similar to those in the Sulabh toilets.

The unit’s biodigesting process depended on a special additive culture that needed to be replaced after every 200 users. However, the official told the students, on January 14, 2013, a thousand people had used this toilet complex, with a long line to it throughout the day. His workers could not stop the crowds from using the unit, since the people needed toilet facilities and a ladder had already been placed on the ground, so there was no way to stop them. Such heavy use was made worse by the fact that at that time, the biodigester tank was not yet outfitted with its essential bacteria culture for biodigesting human waste. Since then, the official said, his staff had guarded it carefully, as an experimental display open to limited use only.

The official described the biodigesting process to the students and a crowd of pilgrims and children who gathered around. As the fecal matter sinks into the tanks below, he said, the infusion of bacteria in the main tank dissolves the solid matter totally, “one hundred percent” into water, odorless and pathogen-free. This water, he said, then leached into the ground. Solar paneling provided lighting. A small sink and mirror outside each unit was accompanied by running water (see Exhibit 17) and, above the tap, a bar of soap and a towel (which, the students were told, was also frequently stolen). Because people in India do not commonly use hand-washing stations—the common way to wash hands and utensils is to rub with sand—many pilgrims who used the Biodigester toilet did not know how to press and use the soap dispensers, making it necessary for on-site staff to explain it. The official added that the biomethane and methane (CH₄), byproducts of the unit can be used in cooking, but in these toilets, it was simply released, into the air.

Dr. Cash's students asked the official how he felt about the pollution of the Ganges. "Running water is always holy," he answered. However, he added, he personally believed that "People drinking Gangajal [water from the Ganges] are blinded by religion and should not drink the water."

Defecation fields

Scattered throughout the site, Dr. Cash and his students noticed a number of small corral-like areas, apparently empty but fenced in with corrugated metal walls. (See **Exhibit 18**.) These, they learned, were defecation fields or "flag areas." Such fields provided toilet space for villagers accustomed to the traditional practices of open defecation. These areas were labeled with signs, gender-specific, and cleaned daily. Pilgrims who followed such practices, however, seemed to make no special effort to find these protected fields, since the students observed a widespread practice of open defecation across the festival grounds throughout their visit.

User Comments: What Did the Pilgrims Say?

It was estimated that as many as 80% of the pilgrims who attended the 2013 Kumbh Mela were villagers from rural areas across India and South Asia.⁴⁹ Dr. Cash's students wanted to know what this majority population at the festival thought about the toilet and sanitation facilities, and especially how they would compare to those the pilgrims' were familiar with in everyday life. With the help of several translators, they approached people and asked them for comments. One of the students recorded the following observations and comments in her field notes:^b

Woman at the sari racks at Sangam

She comes here every year for her dip. She says that this year, the Mela is much better organized than last year, that there are many more toilets. The facilities are cleaned much better, and they never had changing stalls before or racks for drying their clothes. She stays in Allahabad because she lives locally and comes in on her motorcycle as a day visitor at 9 AM, staying only for the morning. She says that all the tents where the people who visit for the Mela are living are on the other side of the river.

Tea-and-samosa merchants, selling beside a "grey water" pool

These six men make and sell tea and samosas at the pilgrimage site. We ask them what this large pit lined with sandbags is. They reply that it is an artificial lake, that they are expecting water to come through a well-hidden pipe into this area, water which they plan to use for washing themselves at the latrine. The water that comes out of the pipe is part of the disorganized system of runoff management, but once filled, the people will take it with buckets and bottles to do their daily toilet. They say that the cleanliness of this water is not of utmost importance because it will all be submerged under water during the rest of the year.

Observations of Open defecation

Driving from Sector 14 to Sector 13, one of the students reported seeing "many children wandering along the roads and children and women relieving themselves (squatting) on the ground by the roadside." Later that evening, the same student wrote,

On the way down the hill from Lakshmi Kutir (Sector 11), I see four individuals squatting on the side of the road simultaneously to relieve themselves, two women and two children fully clothed above the waist. I can't help but think that there must be some social component to going to the bathroom on the side of the road. First there is the protection of going in groups, but there is also a palpable sense of companionship that's hard to describe.

^bSource for translations of pilgrim and official comments in this and following section: Leila Shayegan, Field Notes, January 2013.

A “Porter”

A man who identified himself as a “porter” explained that he cleans the fecal material from the open defecation areas and puts it in tanks. He reported that there were 12 porters assigned per sector.

“Zero discharge” toilet user

About 7 AM, several of Dr. Cash’s female students and their female interpreter approached a woman they notice who was exiting a “Zero Discharge” toilet and asked her about her experience using it. “It’s very good. It’s clean and there’s water,” she said. She took sand, rubbed it in her hands, and then went to the water spigot and rinses with water. By 7:20 AM, they noted that “there is a good amount of traffic at the toilets. The same man who was staffing these toilets yesterday is there again.”

Two garbage workers at the *sangam*

They empty trash three times a day into pits, and the pits are cleaned daily by men in trucks who take it off site. The workers don’t know where the trash goes. They themselves work from 4 AM to 2 PM. They are only temporary workers and will go back to their village after the Mela is done. These men were recruited by an official sweeper sent to the villages to ask for a particular number of employees. In their case, the official asked for 12 workers from their village for this sector. When they started working on Dec 25, 2012, their starting pay was Rs. 125 per day, and now it has increased to Rs. 198 per day.^c They will continue to work here until March when the Mela ends. They are responsible for the area from the sari rack^d at the *sangam* to the border with Sector 1.

Manager of powder-spreading

He tells us that the white powder is a larvicide used against mosquitoes and flies. We are looking at a trash lorry, which we are told takes the day’s trash and dumps it in a “trash house.” The conversation takes place at the worker’s camp, a site erected by the Mela officials temporary workers employed for the duration of the Mela. Those we interview tell us that the Mela administration builds the tents, and then through the government, site workers can request and are assigned tent space. They are also provided private toilets (not to be used by pilgrims) and a water pump for cooling and bathing.

Workers constructing toilet complex in Sector 8

In the afternoon, we come across some newly installed toilet complexes in Sector 8 and ask the workers about them. They tell us that these toilets are finished but there is still cleaning work to be done. The male and female stalls are not yet labeled, so the seats are essentially unisex. There are no signboards, but this is a public toilet that was completed today. It took 4–6 days to complete, and there are four complexes of 20 toilets each for Sector 8. There are two kinds—these shed toilets and 35 typical, tent cloth PRAI toilets, that are individual and closer to a pond at the site. This facility has power from 5 PM to 8 AM, and there are water spigots outside but when cleaning is done, a bucket will be placed in each stall. These toilets are open 24 hours daily.

Workers at a completed PRAI Toilet complex in Sector 8

While driving through Sector 8, we see a huge toilet facility. We naturally alight to check it out. The workers explain to us what is going on. This is a complex of 250 PRAI toilets—100 of which are used regularly, and 150 of which are used only occasionally. They take 1–1½ hours to construct on average, and there are 150 for men and 100 for women. They are used primarily by laborers and women who mostly come in groups at dawn and dusk. There are street lights for lighting, but no

^c The exchange rate of Indian rupees at the end of December 2012 was approximately 54 rupees per US\$.

^d Bamboo fencing throughout the site that officials had intended to help guide pilgrims’ routes to the bathing areas was commonly used instead for hanging and drying clothes.

electricity. Open defecation is a problem here, as young children do not use the toilets but come here and defecate outside, between 10 and 20 coming each day. On major bathing days, there are between 50 and 60 who defecate openly daily.

A Sadhu Speaks

Wandering through the Juna Akhara (the compound of the largest religious group of sadhus present at the Kumbh Mela), the students were invited to sit and talk in the tent of one of the sadhus, who told them his story and his role at the festival.

He told them that he had joined the Juna Akhara as a child, at age five, and that he had attended every Kumbh Mela, coming by truck from his ashram in Haridwar. At the festival he was one of 100 appointed officials who managed trouble-shooting and logistics for the sadhus in the Juna Akhara campsite, including complaints related to sanitation. He said that this festival was organized no better and no worse than any other Kumbh, although, he noted, mobile phones had made things much easier here—especially calling ambulances and finding lost people. He explained that each tent had a kitchen and its own toilet and bathing area. Toilet facilities at previous festivals used to be “just a pitcher and a pot,” but now consisted of “a pot and a toilet.” There were two water taps per tent. In 2013, the government provided one, and the akhara had installed a second at its own expense. Land allotments to each akhara for the festival were provided without cost, but the akharas themselves were responsible to design and build everything they needed within the compound for the duration of the festival. The government provided them with a single light socket, toilet, pipe, and waterspout per tent, but the akharas had to procure their own light bulbs. These provisions were generally distributed by seniority, and sometimes by vote.

Typically between 5 and 10 people lived in each tent, he said, and the Juna Akhara compound contained a total of 2500 tents. He said that main encampment of the Juna Akhara, located in Sector 4, comprised 4,080 square meters of land. There were 400 tents here, 10–20 Mahatmas (holy persons, or sadhus), and 80 Mahatmas in the tent next door to him. In his own tent, he said, there were 7 Mahatmas, 2 disciples, 1 cook, 1 washer, and 1 singer of hymns. Workers for the sadhus were sometimes followers, and some (often the cooks) hired on contract. He reported no problems with the government, but said that it was sometimes a challenge to coordinate between the different branches of the Juna Akhara itself. He said he was happy with the bathroom facilities at the 2013 festival, adding that his disciples take care of the regular day-to-day maintenance of the toilet, but that the Mela administration did the more rigorous cleaning.

Three Officials Give Their Viewpoints

Dr. Cash’s students were also able to speak with several of the Kumbh Mela administration’s government officials to learn their views on how the toilets and their staff were managed.^c

A water department official speaks

What are the sanitation needs of the Kumbh?

We prepare for the Kumbh based on the previous records, based on the population density and based on a sense of who will stay in what sector. The officials know which areas will be very densely populated, and that is how they decide to allocate resources.

What numbers specifically were used for planning this year’s Kumbh?

On the first bathing day, there were 10 million people, and on February 10th, we are expecting 30 million. People who stay for the whole time are approximately 300,000–400,000 people.

In the past, what challenges have you experienced with regards to ensuring proper sanitation?

Open air defecation is a social problem that cannot be changed in a month; 80% of the pilgrims who attend the

^c The two interviews largely in English are given here as question-answer format; the interview with a medical official from the health department was reproduced from memory after the event and has been paraphrased.

Kumbh come from rural areas—the practice of open defecation must be addressed by the existing governments in the villages from which they come. It is not efficient to try to change these habits at the Mela.

What is the current plan for ensuring proper garbage disposal?

Garbage is collected every day, twice or three times a day. The garbage is thrown in “identified dumping sites,” where another agency picks up the trash and dumps it into “identified landfill sites.”

How many and what types of toilets are there at the Kumbh?

There are 35,000 toilet seats at the Kumbh. We aim to have 8–10 people per each toilet for a month. Most of the toilets are PRAI type, using a seat, a water seal, and a pipe to the trenches.

How do the toilets work?

Sewage goes into the pit behind the toilets and doesn't create any pollution. It all gets converted into manure in 3–4 months by anaerobic bacteria, and it is rich and good for the soil. The pits fill quickly, so we dig more pits and connect them “that way.” Sometimes we have to suction out the sewage.

Who checks the pits to make sure that they are not overflowing?

We don't have to check the pits—people will complain.

How is sanitation managed from an administrative standpoint?

There is a zonal officer in each particular area whose job it is to ensure proper sanitation. They are called “sanitation in charge” in each sector hospital, a doctor who also does sanitation work but does not see patients.

Are all restrooms equipped with soap?

People bring their own soap. This is common knowledge.

How is hand-washing being handled?

Soap is provided to the sanitation workers, but hygiene is the responsibility of the people themselves.

How is water provision managed?

The waterworks department takes care of that.

A physician in the health department speaks

A physician in the health department responsible for Sector 4 began by explaining how the PRAI toilets were constructed. He said they first dug up a 5-foot deep pit at a distance of 1½-to-2 feet behind the toilet, and then treated it with a mix of lime, bleach, and insecticides. The pit was then covered by two diagonally overlaid bamboo gratings (5 by 5 feet), nets, grasses, and polyurethane sacks and straw. Finally, it was covered by sand and more bleach. He explained that there was less sewage than water to deal with, but the water was absorbed by the sand, leaving only nightsoil (stool). Gradually, it became manure once the pits were closed, treated with powder, and covered so that no light or air could get in, fostering anaerobic conditions. This nitrogenous waste, converted to manure, he said, was rich for the soil and clean for manual handling.

The roadside urinals, he noted, were intended only for urination but were also used for defecation, mostly by small children who did not know any better. The people who maintained the toilets and the garbage were the sanitation workers, who worked in teams of 12 people. Each team has 1 woman on the team who stays at the base camp and cooks all day for the others, another member of the team who is the chief, and 10 sanitation workers. The recruiting of these workers was done by a supervisor who was responsible for all the workers he recruits, and who was liable if any “malactivities” were discovered. The Mela administration expected many *kalpvasis* (pilgrims who remain on the site throughout the entire 55-day festival) at this Mela, and based on the estimated number of attendees, the health department would decide on the number of gangs needed. The sectors themselves were divided up into “circles.” In Sector 4 where the akharas had their main camps; there were 5 circles, all of which obtained their materials from a central storehouse.

The physician confirmed the sadhu's information about government provisions to the akharas, saying that the toilets are free, given by the health department, but that the akharas have the right to install their own toilets under the careful observation of health officials.

In the defecation fields or flag areas, he said, the excrement was picked up by sweepers or porters and carried 20–30 feet away to a pit to be buried. When asked how villagers from rural areas were expected to locate the flag areas, he said there was a “natural instinct” that leads pilgrims to these areas. In addition, he added, they were also marked with signs, since “people from the village can read.”

He also explained the powders that are used at the Mela fairgrounds. White circles on the ground denote covered nightsoil pits, where spraying should occur daily. Lime and bleach were used as a septic treatment to disinfect. Neon and a 5% solution of malathion were also used as mosquito larvicide.

When asked how he decided where to put the toilets, the physician said that there is no exact demarcation, but there should be more urinals near the *sangam* or Ganges but not pit toilets, to avoid pollution. He said that in Sector 4, there were about 7 or 8 Biodigester complexes for general use.

A veteran of the Allahabad water department speaks

During a roadside conversation while walking back to the hillside camp, the students had an interview with a man who has worked for the Allahabad water department for 34 years:

What are you responsible for in terms of water and sanitation?

We are primarily in charge of the water supply and the sprinkling of the ground. All of the water and health officials have a meeting at 4 PM every day to discuss the problems that have arisen and to give updates on how things are going. We provide clean water and remove the dirty water, laying pipe and using ponds as collecting pits for wastewater.

What kind of problems do you encounter?

This is a temporary city—5 million people stay here, and there are more than 50 million on the big bathing days. Our problems have to do with overflow of the toilets and leakage of the pipelines. What happens often is that people drop balls in the toilet holes, blocking the pipe and causing an overflow. This can happen at any time, 24 hours a day.

How do you deal with these overflows?

We have a team of more than 1,000 repair people. Within 15 minutes of a problem occurring, the Babas [Hindu holy men] complain, and loudly. We have no option but to fix their problems.

How do you deal with the overflows on the main bathing days?

It's true that there can be up to 50 million on the big bathing days, but we have fewer problems in the akharas on the main bathing days than on other days. The Babas are out and about, not staying in and using their toilets. The problem is getting people enough water—on such days, we have trouble with water shortages. We shut down all the sprinkling of the roads and divert that water for the people.

You've been working at the Kumbh since 1982—what changes have you seen over the last 30 years? Has anything improved?

There are still 13 akharas, but there are so many more branches now. In Juna Akhara alone, there are more than 400 toilets. There's been a 40% increase in toilets in the Mela area since 2001. One improvement has been the bolts and clamps put on the roads, which are above the pipes and protect them better.

What are the big sandbagged water pits that we have seen along the roads?

Those are Jal Nigam's water reservoirs. Suppose a stampede or a fire occurs—it is not clean water, in fact it is “rotten water” but it is an emergency water supply. It should not be drunk, as it is really leakage water. The sandbags are to stop soil erosion and to keep it from sinking back into the groundwater.

Conclusion: After the Rains, or, Is There a Problem?

The Kumbh Mela bathing festival took place on straw-reinforced sand that was located literally *in* the Ganges riverbed, and used by millions of pilgrims during what is India's dry, or winter, season. Toilets had been constructed as soon as the ground dried out enough for workers to begin. Over the 55 days of the 2013 festival, it was estimated that somewhere between 70 and 120 million visitors would attend, some staying for all 55 days, others coming only for a single day; 30 million were expected on one day alone, February 10, 2013, traditionally the most auspicious day of the Kumbh Mela for bathing. Each pilgrim was likely to use the festival grounds for toileting purposes, either in the designated toilets, in the flag areas, or following the cultural practices of open defecation. By early March, the pilgrims would pack up and leave, and workers would take everything apart, collect remaining garbage, and return home to their villages. By early April the area would revert to agricultural marshland as the rainy season returned. The rivers would rise, submerging for another year whatever detritus and waste remained on the sands. The officials would remove regulations in place during the festival that banned upstream cremation. Waste from the city of Allahabad would resume emptying into the river, and the dams that had been opened during the festival to ensure a plentiful flow of clean water would be closed again to contain the water force where it was needed far upstream.

Dr. Cash concluded his pre-dinner musings by wondering about the festival's natural after-effects. The waters of the Kumbh Mela are rivers, not lakes; they flow, with fast and heavy currents in some places. And the detritus from millions of pilgrims and tourists was not just a matter of every twelve years; indeed, some variant of sacred bathing at the site took place, on a smaller scale, in the dry season of every year, without the international media that focused on safety during the 2013 event. What would be the effect of large quantities of human waste on the water quality as it reclaimed the area and carried the flow on across 500 miles of rural India toward the sea? What would be the effect of the accumulated chemicals and toxins used to sanitize and deodorize the area for the fair, on those who worshipped and washed with the water during the rest of the year? What would be the hidden disease cost, after the tourists went home and the holy men returned to their ashrams and their wanderings? Were the toilets at the Kumbh Mela in 2013 contributing to a health or sanitation problem—or did they offer a positive lesson for other settings around the world?

Web Resources to learn more about the Kumbh Mela:

Official Government of India Kumbh Mela Website:
<http://kumbhmelaallahabad.gov.in/english/>

Harvard University "Mapping the Kumbh Mela" Project

(co-sponsored by the South Asia Institute and the Harvard Global Health Institute):
<http://southasiainstitute.harvard.edu/kumbh-mela/>

Short film about the "Mapping the Kumbh Mela" project:
<http://southasiainstitute.harvard.edu/kumbh-mela/post/mapping-the-kumbh-mela-movie/>

FXB Health Team Blog on "Public Health at the Kumbh Mela"
<http://fxbkumbh.wordpress.com/>

FXB Health Team Video Presentation (HSPH, March 28, 2013)
http://webapps.sph.harvard.edu/accordentG1/kumbhmela_20130328/index.htm

Mapping Toilets in Mumbai

Harvard School of Public Health Seminar co-sponsored by the South Asia Institute (story & video):
<http://southasiainstitute.harvard.edu/2012/09/mapping-toilets-in-mumbai/>

Samuel Loewenberg, "Mapping Toilets in a Mumbai Slum Yields Unexpected Results," *International New York Times*
July 22, 2012

<http://india.blogs.nytimes.com/2012/07/22/mapping-toilets-in-a-mumbai-slum-yields-unexpected-results/>

From the Public Media:

"River of Faith: A Film about the Kumbh Mela 2013" by Namit Arora

<http://www.youtube.com/watch?v=cQNoimABjMQ>

Omar Rashid, "Post-Kumbh Mela, the Sangam presents an unholy sight," online at

<http://www.thehindu.com/news/national/other-states/postkumbh-mela-the-sangam-presents-an-unholy-sight/article4661217.ece>

World Health Organization, "Water sanitation health: Fast facts"

http://www.who.int/water_sanitation_health/monitoring/jmp2012/fast_facts/en/

WHO/UNICEF *Progress on drinking water and sanitation*. Geneva: WHO, 2012

http://www.who.int/water_sanitation_health/publications/2012/jmp_report/en/index.html

Exhibits

All photos are by S.R. Holman unless noted otherwise.

Exhibit 1 View of the Kumbh Mela fairgrounds, looking southwest, January 2013. Note the sandbagged “grey water” pool under construction in the lower left.

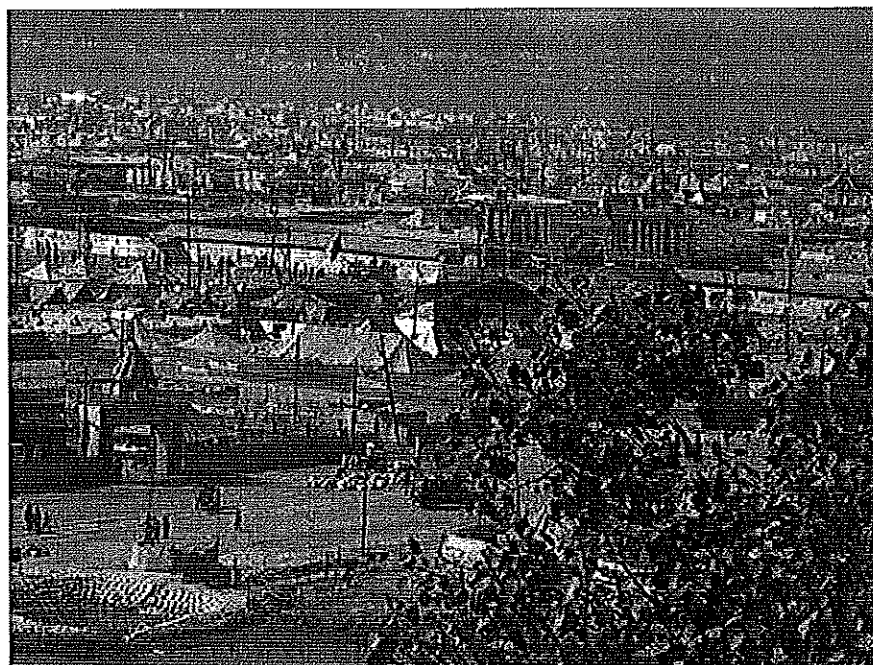


Exhibit 2 India: A Brief Health Profile.

Total population (thousands):	1,224,614
Population living on <\$1 per day (%)	41.6
GDP spent on health (%)	4.2
Total health expenditure per capita (\$US)	44
Population without access to improved drinking water-sources (%)	8
Population without access to improved sanitation (%)	66
Maternal mortality (per 100,000 live births)	200
Low birthweight newborns (%)	28
Stunting, children under age 5 (%)	47.9
Underweight, children under age 5 (%)	43.5
Under-five mortality rate (per 1000 live births)	63
Poorest 20% of population	116
Wealthiest 20% of population	39

Source: World Health Organization, *World Health Statistics 2012*

Exhibit 3 River water with festival detritus, as seen from a pontoon bridge.



Exhibit 4. Crowds at the *sangam*. Photo courtesy of Satchit Balsari



Exhibit 5. Garbage collection cart.

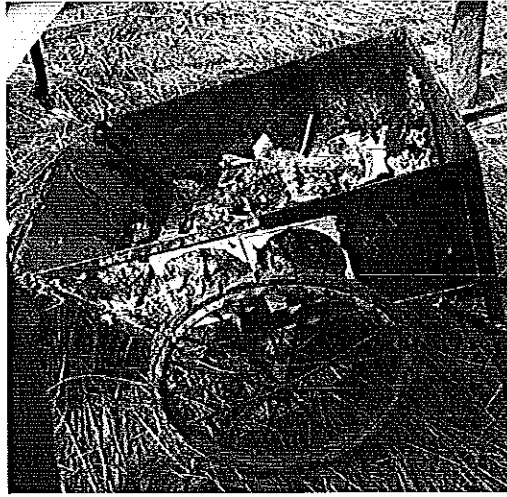


Exhibit 6. Women using water from a bore well pipe at the Kumbh Mela.



Exhibit 7. Pool of “greywater” with signage.



Exhibit 8. Roadside urinal.



Exhibit 9. Roadside urinal. Inside detail.

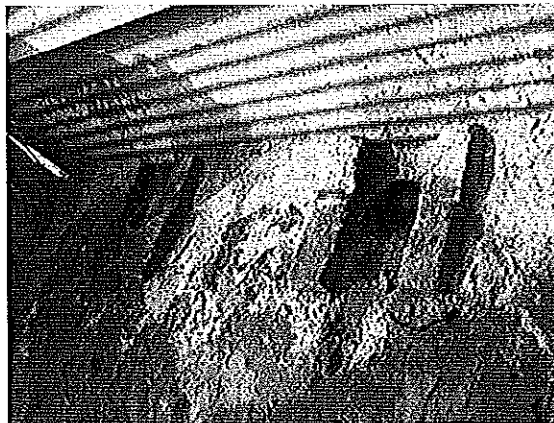


Exhibit 10. Large PRAI toilet complex in Sector 8. Photo by Jenny Bordo

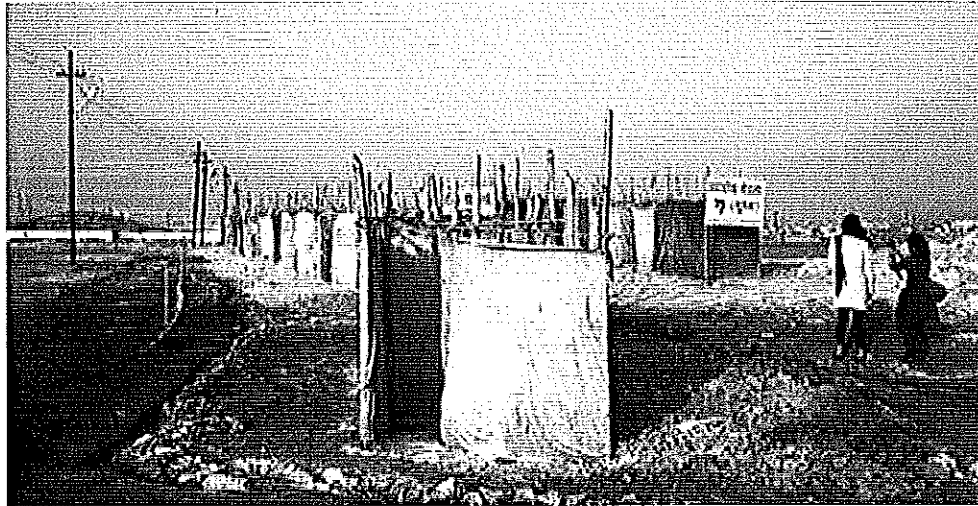


Exhibit 11. PRAI toilet, detail inside.

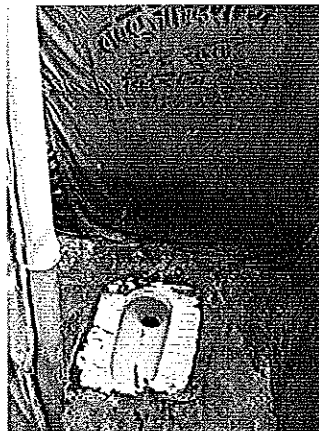


Exhibit 12. Sulabh complex, one under construction, one in regular use.



Exhibit 13. Sulabh or “zero-discharge” toilet, inside detail.

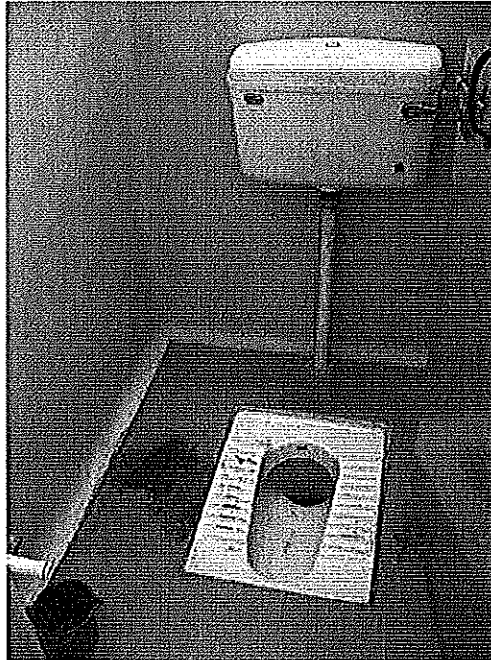


Exhibit 14. Loose parts underneath an unfinished Sulabh toilet.

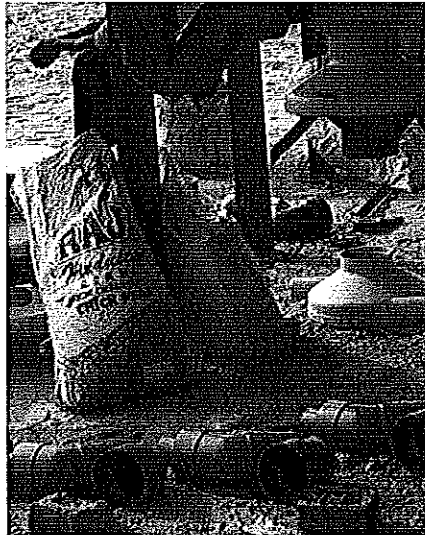


Exhibit 15. Signage on a Sulabh toilet unit encouraging Kumbh Mela pilgrims to think about the environment.

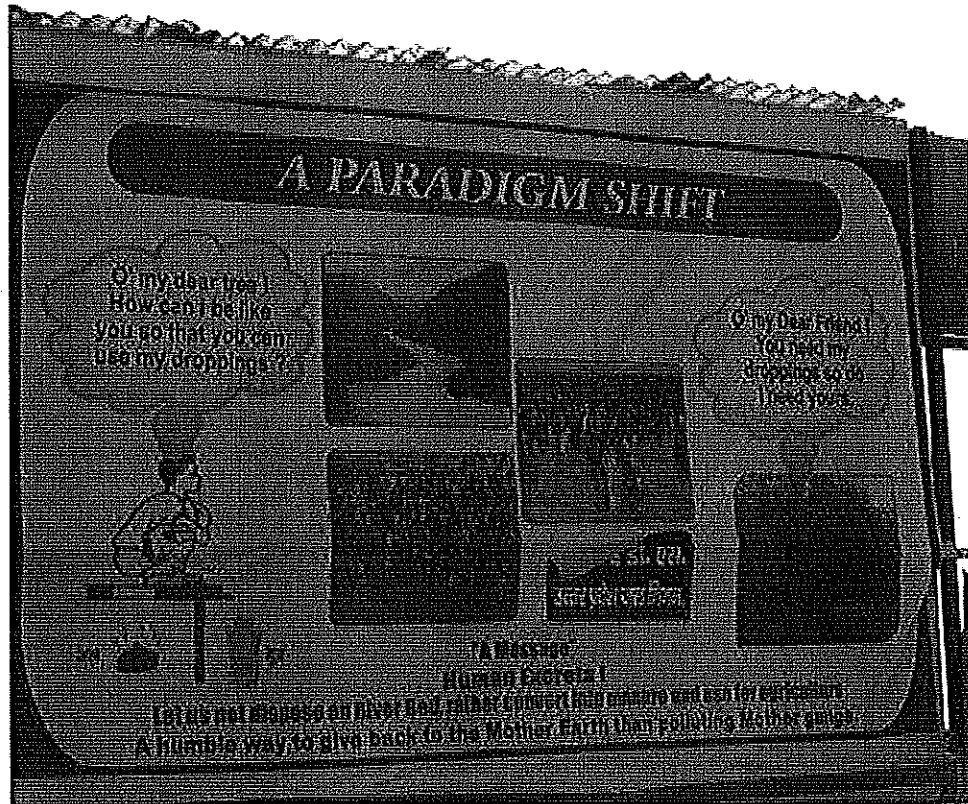


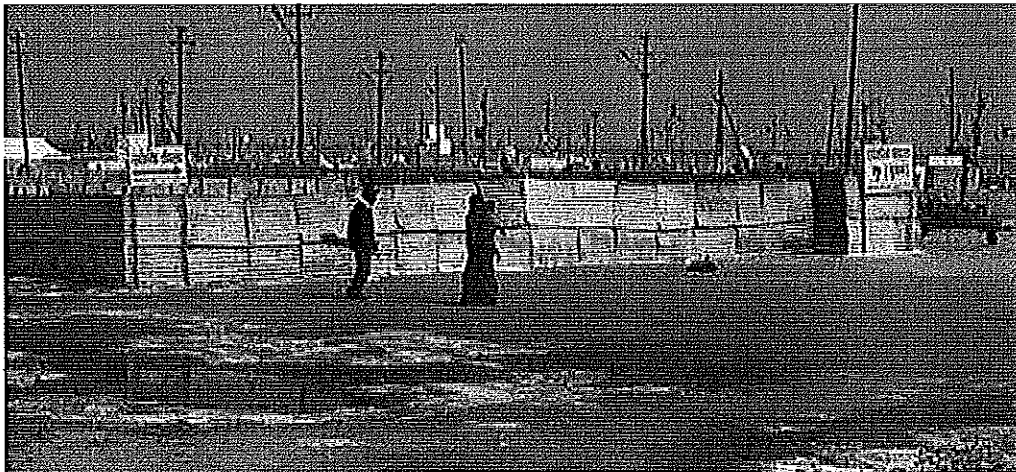
Exhibit 16. Biodigester Toilet.



Exhibit 17. Sink outside biodigester tank.



Exhibit 18. Corrugated metal fencing around a large open defecation area.



Endnotes

¹ For estimate of 120 million during the entire 2013 festival, see Government of India, “Kumbh Mela 2013” [official government site, home page] online at <http://kumbhmelaallahabad.gov.in/english/index.html>, accessed January 2014. Reported total festival attendance varies widely in the media, estimated as 70 million in Laura Spinney, “Karma of the Crowd,” *National Geographic* 225/2 (February 2014): 120–135 at p. 129. For the estimate of 30 million on February 10, see Soutik Biswas, “India’s Kumbh Mela festival holds most auspicious day,” *BBC News India*, February 10, 2013, Online at <http://www.bbc.co.uk/news/world-asia-india-21395425>, accessed September 2013.

² On the Saraswati River, see D.P. Dubey, *Prayaga: The site of the Kumbh Mela*. New Delhi: Aryan Books International, 2001, esp. pp. 19–21.

³ See, e.g., Samuel Loewenberg, “Mapping Toilets in a Mumbai Slum Yields Unexpected Results,” *International New York Times* July 22, 2012, online at http://india.blogs.nytimes.com/2012/07/22/mapping-toilets-in-a-mumbai-slum-yields-unexpected-results/?_r=0. Accessed 1/10/14; See also Harvard School of Public Health Seminar co-sponsored by the South Asia Institute (story & video): <http://southasiainstitute.harvard.edu/2012/09/mapping-toilets-in-mumbai/>. Accessed 1/9/14.

⁴ Samuel Loewenberg, “Mapping Toilets in a Mumbai Slum Yields Unexpected Results,” *New York Times*, July 22, 2012. Online at http://india.blogs.nytimes.com/2012/07/22/mapping-toilets-in-a-mumbai-slum-yields-unexpected-results/?_php=true&_type=blogs&_r=0. Accessed 1/29/14.

⁵ World Health Organization. Urban Population Growth. Online at http://www.who.int/gho/urban_health/situation_trends/urban_population_growth_text/en/. Accessed 1/10/14. See also United Nations, Department of Economic and Social Affairs, Population Division (2006). *World Urbanization Prospects: The 2005 Revision*. Working Paper No. ESA/P/WP/200. Summarized at http://www.un.org/esa/population/publications/WUP2005/2005WUP_FS4.pdf. Accessed 1/10/14.

⁶ United Nations, *World Urbanization Prospects: The 2011 Revision*. Economic & Social Affairs, Population Division, ESA/P/WP/224. New York: United Nations, March 2012. Online at http://esa.un.org/unup/pdf/WUP2011_Highlights.pdf. Accessed 1/10/14.

⁷ Summary in this paragraph is derived from “Urbanization and health,” *Bulletin of the World Health Organization* 88.4 (2010), online at <http://www.who.int/bulletin/volumes/88/4/10-010410/en/>. Accessed 1/10/14.

⁸ World Health Organization/United Nations Children’s Fund Joint Monitoring Program. *Progress on Drinking Water and Sanitation: 2012 Update* (NY: WHO/UNICEF, 2012), 36.

⁹ United Nations, “We can end poverty: Millennium Development Goals and Beyond 2015. Goal 7 Fact Sheet. Online at http://www.un.org/millenniumgoals/pdf/Goal_7_fs.pdf. Accessed 1/10/14.

¹⁰ Sandy Cairncross, “Sanitation in the developing world: Current status and future solutions,” *International Journal of Environmental Health Research* 13 (2003), S123.

¹¹ Maggie Montgomery and Menachem Elimelech, “Water and Sanitation in Developing Countries: Including Health in the Equation,” *Environmental Science and Technology* (2007), 16–24, at p. 18.

¹² Maggie Montgomery and Menachem Elimelech, “Water and Sanitation in Developing Countries: Including Health in the Equation,” *Environmental Science and Technology* (2007), 16–24, at p. 18.

¹³ Sandy Cairncross, “Sanitation in the developing world: Current status and future solutions,” *International Journal of Environmental Health Research* 13 (2003), S123.

¹⁴ MM Levine et al, “The Global Enteric Multicenter Study (GEMS): Impetus, Rationale, and Genesis,” *Clinical Infectious Disease* 55 S4 (2012), S215–224.

¹⁵ World Health Organization/UNICEF Joint Monitoring Programme for Water and Sanitation, *Water for Life: Making it Happen*. Geneva: WHO/UNICEF, 2005, p. 5. Online at http://www.unicef.org/media/files/JMP_05_text.pdf. Accessed 1/10/14.

¹⁶ Fred Arnold, Sulabha Parasuraman, P. Arokiasamy, and Monica Kothari. *Nutrition in India: National Family Health Survey (NFHS-3)*, India, 2005–06. Mumbai: International Institute for Population Sciences; Calverton, Maryland: ICF Macro, 2009, p. 6. Online at <http://www.measuredhs.com/pubs/pdf/OD56/OD56.pdf>. For the most recent profile related to health indicators, see World Health Organization, *World Health Statistics 2012*. Geneva: WHO, 2012. Online at http://www.who.int/gho/publications/world_health_statistics/EN_WHS2012_Full.pdf. Accessed 1/30/14. See also K.S. Varadharajan, T. Thomas, and A.v. Kurpad, “Poverty and the state of nutrition in India,” *Asia Pacific Journal of Clinical Nutrition* 22.3 (2013): 326–339, online at <http://apjcn.nhri.org.tw/server/APJCN/22/3/326.pdf>. Accessed 1/10/14.

¹⁷ WHO/UNICEF JMP 2012, at p. 18.

¹⁸ WHO/UNICEF JMP 2012, at p. 20.

- ¹⁹ KJ Nath, "Home hygiene and environmental sanitation: a country situation analysis for India," *International Journal of Environmental Health Research* 13 (2003), S19–28. (S21).
- ²⁰ <http://www.wssinfo.org/>
- ²¹ KJ Nath, "Home hygiene and environmental sanitation: a country situation analysis for India," *International Journal of Environmental Health Research* 13 (2003), S19–28. (S21).
- ²² Soma Basu, "Kumbh: Bane for farmers?" Blogpost, March 22, 2013, online at <http://deshlai.wordpress.com/tag/toilets/>. Accessed 12/16/13. The source for the author's claim that "water with a BOD measure above 3 mg/liter is not suitable for bathing" is not stated, but on the definition of BOD, see, e.g., http://www.un.org/esa/sustdev/natlinfo/indicators/methodology_sheets/freshwater/biochemical_oxygen_demand.pdf.
- ²³ World Health Organization, "Water sanitation health: Fast facts," online at http://www.who.int/water_sanitation_health/monitoring/jmp2012/fast_facts/en/, accessed September 2013. Data from WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation, *Progress on drinking water and sanitation*. Geneva: WHO, 2012, online at http://www.who.int/water_sanitation_health/publications/2012/jmp_report/en/index.html, accessed September 2013.
- ²⁴ Kalyan Banda et al, "Water handling, sanitation and defecation practices in rural southern India: a knowledge, attitudes and practices study," *Transactions of the Royal Society of Tropical Medicine and Hygiene* 101 (2007), 1124–1130, at p. 1127.
- ²⁵ Mari Marcel Thekaekara, "A lifetime in muck," *New Internationalist* (Aug 2008) 10–11 (10).
- ²⁶ On the biophage theory, see, e.g., "Chapter 5. 'The Mysterious Factor X'" in Julian Crandall Hollick, *Ganga: A Journey Down the Ganges River* (Washington: Island Press, 2008), pp. 131–149
- ²⁷ See, e.g., Anupma Jain, "Mighty river, breathe easy," *The Hindu*, December 9, 2012, online at <http://www.thehindu.com/sci-tech/energy-and-environment/mighty-river-breathe-easy/article4181144.ece>. Accessed 1/10/14; Ram Dutt Tripathi, "India Kumbh Mela dip 'raised Ganges river pollution,'" *BBC News: India*, January 24, 2013, online at <http://www.bbc.co.uk/news/world-asia-india-21175890>. Accessed 1/10/14; Katie Koch, "Saving the mother river: Divinity, College students explore 'sacred geography' at India's Kumbh Mela," *Harvard Gazette*, February 14, 2013, online at <http://news.harvard.edu/gazette/story/2013/02/saving-the-mother-river/>, accessed 1/10/14; Basant Rai, "Pollution and conservation of Ganga River in modern India," *International Journal of Scientific and Research Publications* 3.4 (April 2013), online at <http://www.ijr.org/research-paper-0413/ijr-p1634.pdf>. Accessed 1/10/14; Dean Nelson, "Ganges hit by alarming pollution levels during Kumbh Mela," *The Telegraph*, February 24, 2012, online at <http://www.telegraph.co.uk/news/worldnews/asia/india/9891059/Ganges-hit-by-alarming-pollution-levels-during-Kumbh-Mela.html>. Accessed 1/10/14.
- ²⁸ See, e.g., Ganga Action Parivar, "The first-ever 'green' initiative Kumbh," *Kumbh Mela January-February 2013 Special*, online at <http://www.parmarth.com/updates/kumbhspecial.pdf>. Accessed 1/10/14.
- ²⁹ Hindu teacher Shrivatsa Goswami of Vrindavan, for example, stayed away from the *sangam* and spoke openly during a lecture with the Harvard University students about the river's health risks due to its environmental pollution (personal communication; all three of the authors were present at the Kumbh Mela for this lecture. Goswami's choice to stay away from the *sangam* is per personal communication with Diana Eck, January 2013).
- ³⁰ P. Gregg Greenough, "The Kumbh Mela stampede: Disaster preparedness must bridge jurisdictions," *BMJ* 2013; 346:f3254, online at <http://www.bmj.com/content/346/bmj.f3254>, Accessed September 2013.
- ³¹ Laura Spinney, "Karma of the Crowd," *National Geographic* 225/2 (February 2014): 131.
- ³² Cholera at the Kumbh Mela will not be discussed in this case, but see, e.g., A. Leslie Banks, "Religious fairs and festivals in India," *The Lancet* January 21, 1961, p. 162–163; Bagchi S.C. and Banerjee S.C., "The Kumbh Fair (1966): Aspects of environmental sanitation and other related measures," *Indian Journal of Public Health* 11(4) (1967), pp. 180–184; Bryceson A.D.M., "Cholera, the flickering flame," *Proceedings of the Royal Society of Medicine* 70 (1977), pp. 363–365; "Sanitary reform in India: IV. Sanitary Reports," *The Lancet*, March 21, 1908, pp. 883–884; and more generally, H. Herbert, "The natural history of Hardwar fair cholera outbreaks," *The Lancet*, July 27, 1895, pp. 201–202.
- ³³ Ziad A. Memish, Gwen M. Stephens, Robert Steffen, Qanta A. Ahmed, "Emergence of medicine for mass gatherings: lessons from the Hajj," article 1 in the Lancet's "Mass Gatherings Health" series, *The Lancet Infectious Diseases* 12.1 (2012): 56–65, at p. 57. Memish's source for this assertion is J.N. Hays, *Epidemics and Pandemics: Their Impacts on Human History* (Santa Barbara, California: ABC-CLIO, 2005), esp. pp. 193–200 (discussion of the "First Cholera Pandemic, 1817–1824") and p. 217 (discussion of the "Second Cholera Pandemic 1827–1835" where Hays notes that Hindu pilgrimages were blamed for spreading the disease).
- ³⁴ Kama Maclean, *Pilgrimage and Power: The Kumbh Mela in Allahabad, 1765–1954* (NY: Oxford University Press, 2008), p. 201.
- ³⁵ Kama Maclean, *Pilgrimage and Power: The Kumbh Mela in Allahabad, 1765–1954* (NY: Oxford University Press, 2008), p. 201.

³⁶ Leonard Rogers, "The Control of Cholera Epidemics in India by Compulsory Anti-Cholera Inoculation of Pilgrims before Travelling through infected Districts to Attend Fairs *Royal Society of Tropical Medicine and Hygiene* 48,1 (1954), 42.

³⁷ Michael Vortmann, "Preparing for an uneventful day," Harvard FXB Center, Public Health at the Kumbh Mela [blog]. Online at <http://fxbkumbh.wordpress.com/2013/02/09/preparing-for-an-uneventful-day/>. Accessed 1/30/14.

³⁸ The cleaners were called *safai karmacharis*, belonged to the Bhangi caste, and lived in nearby villages: Omar Rashid, "Post-Kumbh Mela, the sangam presents an unholy sight," *The Hindu*, April 28, 2013, online at <http://www.thehindu.com/news/national/other-states/postkumbh-mela-the-sangam-presents-an-unholy-sight/article4661217.ece>, accessed September 2013. See also Krista Mahr, "At the largest gathering of humanity, who takes out the trash?" *Time World*, February 12, 2013, online at <http://world.time.com/2013/02/12/at-the-largest-gathering-of-humanity-who-takes-out-the-trash/>. Accessed 1/10/14.

³⁹ The list here is the authors' construction based on the two-hour lecture at HSPH on March 28, 2013 by Drs. Gregg Greenough and Satchit Balsari and their medical colleagues reporting on first-person experience of the Kumbh and the stampede, at http://webapps.sph.harvard.edu/accordentG1/kumbhmela_20130328/index.htm, accessed November 2013.

⁴⁰ On the "Green Kumbh" movement, see Ganga Action Parivar (Online at <http://www.gangaaction.org/>); see also Omar Rashid, "A 'Green Kumbh Mela' initiative," *The Hindu*, January 28, 2013, online at <http://www.thehindu.com/todays-paper/tp-national/a-green-kumbh-mela-initiative/article4352026.ece>, accessed September 2013. On the disappointing results of this effort, see Omar Rashid, "Post-Kumbh Mela, the Sangam presents an unholy sight," *The Hindu*, April 28, 2013, online at <http://www.gsd.harvard.edu/#/academic-programs/urban-planning-design/urban-design/ud-work/faculty-work/kumbh-mela.html>, accessed November 2013.

⁴¹ "Kumbh Mela: PMO warns action against industries dirtying rivers," *The New Indian Express*, January 11, 2013, online at <http://newindianexpress.com/nation/article1417536.ece>, accessed November 2013.

⁴² Omar Rashid, "Post-Kumbh Mela, the Sangam presents an unholy sight," *The Hindu*, April 28, 2013, online at <http://www.gsd.harvard.edu/#/academic-programs/urban-planning-design/urban-design/ud-work/faculty-work/kumbh-mela.html>, accessed November 2013.

⁴³ For the figure of 40 tube wells, see Government of India, "Kumbh Mela 2013 at a glance," online at http://kumbhmelaallahabad.gov.in/english/kumbh_at_glance.html. Accessed 1/10/14.

⁴⁴ Michael Vortmann, "The Sangam of Three Waters: Clean, Grey, and River," Harvard University FXB Center blog, "Public health at the Kumbh Mela," 2/21/13, online at <http://fxbkumbh.wordpress.com/2013/02/21/the-sangam-of-three-waters-clean-grey-and-river/>. Accessed 1/10/14.

⁴⁵ Satchit Balsari, "EMcounting the Mela: From Chennai to Prayag," Harvard University FXB Center blog, "Public health at the Kumbh Mela," 2/20/13, online at <http://fxbkumbh.wordpress.com/2013/02/20/emcounting-the-mela-from-chennai-to-prayag/>. Accessed 1/10/14. See also Katie Koch, "Tracking disease in a tent city: Public health researchers follow outbreaks in real time at India's Kumbh Mela," *Harvard Gazette*, March 1, 2013, online at <http://news.harvard.edu/gazette/story/2013/03/tracking-disease/>. Accessed 1/10/14.

⁴⁶ To view a photo by one of the authors of the Kumbh Mela disaster preparedness kits seen stacked in one of the sector clinics in mid-January and clearly labeled with contents of each, see <http://globalhealth.harvard.edu/emergency-disaster-kits-kumbh-mela-sector-hospital-2013#overlay-context=harvard-kumbh-mela-photo-essay>, posted and accessed November 2013.

⁴⁷ <http://www.adityabirlachemicals.com/brands/shaktiman.html>.

⁴⁸ <http://sulabhinternational.org/?q=content/meet-sulabh>.

⁴⁹ On the view that most pilgrims are poor villagers, see e.g., comments by photographer Jean-Marc Giboux as cited in Savita Iyer, "The power of group devotion, 100 million strong," *Spirituality and Health*, January-February 2013, online at <http://spiritualityhealth.com/articles/power-group-devotion-100-million-strong>, accessed September 2013.