Coming Up Short without Sanitation
A Community Sanitation Program by the Indian Government Helped Children Grow Taller and Healthier in the State of Maharashtra

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BACKGROUND
Most people living in rural Indian villages defecate openly outside, without using a toilet or latrine. In 2004, as a supplement to its ongoing Total Sanitation Campaign (TSC), the government of Maharashtra conducted a randomized, controlled experiment to study the effect of a sanitation intervention.

In Ahmednagar district of Maharashtra, 30 villages were randomly assigned to a community-level sanitation motivation treatment group and 30 villages to a control group. Eighteen months later, surveyors measured how much the average height of children in the treatment and control groups had changed.

OPEN DEFECATION IN INDIA
According to the Indian government’s 2011 census, 53.1 percent of all Indian households and 69.3 percent of rural households do not use any kind of toilet or latrine. This corroborates 2010 estimates from the WHO/UNICEF Joint Monitoring Programme, which found that 1.1 billion people in the world were not using a toilet or latrine, nearly 60 percent of whom live in India.

Such widespread open defecation has a broad range of negative consequences. Young children frequently encounter germs from other people’s feces, and many die from diarrheal disease. For those who survive, chronic early-life

KEY FINDINGS

- **Children living in villages that received sanitation motivation treatment grew taller on average.** Research done by Vogl (2011) suggests that taller children are more likely to lead healthy and economically productive lives and to develop closer to their cognitive potentials. The village-level sanitation intervention caused an important improvement in the height of children under five.

- **The program caused a modest increase in sanitation coverage.** After the experimental intervention, villages in the treatment group achieved more latrine use than villages in the control group, but open defecation remained a practice in almost every village. These results suggest that even incremental improvements in sanitation can lead to better health for children.

- **The TSC program was not implemented everywhere and much work remains to be done.** The government originally had planned to conduct the experiment in three districts, but ultimately only implemented the experiment in a single district. However, as the 30 control and 30 treatment villages were randomly selected within Ahmednagar district, the largest district in Maharashtra with a population of 4.5 million, this change does not materially detract from the usefulness of the findings.

The findings of the study highlight the importance of improving sanitation as part of a multisectoral approach to addressing India’s malnutrition crisis. Since improved sanitation has considerable effects on children’s health, and because open defecation involves negative externalities for other people, the task of improving sanitation deserves the attention of health policy makers. However, sanitation is not just a health issue. Given that it improves children’s growth, sanitation is also an important nutritional intervention as part of the triad of food, care, and environmental health identified as critical to achieving improved nutritional outcomes.
disease may consume resources that the body needs and change the course of their development. In the same way that the consequences of open defecation can hinder a child’s growth, they may also impede brain development, resulting in a negative impact on Indian children’s health and cognitive achievement. Therefore, learning about and implementing strategies to end open defecation are policy priorities.

**CONTEXT: INDIA’S TOTAL SANITATION CAMPAIGN**

From 1999 to 2012, the Indian government’s flagship program to end rural open defecation was called the Total Sanitation Campaign, or TSC. The TSC was implemented after the Centrally Sponsored Rural Sanitation Programme of the 1990s, which invested in latrine construction, but did not specifically promote latrine use. However, by contrast, the TSC aimed to effect change in sanitation behavior, and focused on motivating and incentivizing rural communities to stop open defecation. In 2012, the TSC was replaced with the Nirmal Bharat Abhiyan, or NBA, which returns the emphasis to subsidies.

The TSC was partially inspired by the Community-Led Total Sanitation Movement (CLTS), which uses social forces and emotional reactions to feces to motivate or trigger a community-wide commitment to end open defecation. Since CLTS emphasizes latrine use, not construction, its practitioners advocate against subsidizing the building of latrines. Similarly, although the TSC offered small, partial subsidies for latrine construction, it retained this emphasis on behavior change and on targeting rural communities as a whole (see Box 1).

**AN EXPERIMENT IN RURAL VILLAGES**

In 2004, the Indian state of Maharashtra began the large-scale implementation of the Total Sanitation Campaign. As the TSC was new at the time, there was an opportunity to learn from the implementation experience given that it would be launched in some districts and villages before others. Since districts are administrative areas smaller than states, typically with a few million residents, the TSC was implemented in villages within districts by the district governments. The Maharashtra government selected three districts in which to conduct an experimental evaluation of a special supplement to the TSC (Ahmednagar, Nanded, and Nandurbar). This research brief analyzes only the effects of that supplementary experimental program, and not the overall TSC.

A randomized experiment would allow for a simple estimate of the average effect of the supplementary program on children in the villages studied (see Figure 1); so, the government selected 60 villages in each of the three districts. Within in each district, 30 of the villages were randomly assigned to a treatment group and 30 to a control group. The treatment villages would receive a TSC-style visit from a sanitation motivator, intended to promote community latrine use. The control villages would continue with whatever sanitation practices they would typically follow. Surveyors would measure the health of children immediately before the intervention and again 18 months after the first survey. The experiment would reveal if children in villages randomly assigned to the TSC treatment grew taller.

Sanitation promotion makes use of social forces and emotions such as disgust to motivate communities to encourage one another to eliminate open defecation (for more details on the CLTS approach to sanitation triggering, please see Bongartz and Chambers, 2009, *IDS in Focus* #10). As part of the TSC, and unlike traditional CLTS, the Indian government made funding available to village leaders for partially subsidized latrine construction. In general, these resources were not yet being widely used in Maharashtra at the time of the experiment. Therefore, the experiment evaluates the government’s special effort at village-level sanitation promotion in the context of generally available funding for latrine construction.

The experiment did not proceed quite as originally planned. The randomized, controlled experimental program indeed was implemented in Ahmednagar district. Analysis of baseline survey data suggests that children and households were similar in the randomly assigned treatment and control groups. However, in Nanded and Nandurbar districts, the government never, in fact, carried out the planned experiment. Therefore, lessons can be drawn from the experiment.
BOX 1: IS YOUR TOILET SPILLING OVER?

When a program designed to help one person also helps other people, economists refer to this as the “spillover effect.” Open defecation hurts anyone living nearby who comes into contact with fecal germs. Therefore, latrine use would have positive spillovers: one person’s safe feces disposal can make another’s children healthier. Such spillovers are a central reason for government action in economic theory as left on their own, people may not sufficiently consider the effects of their behavior on others.

One statistical consequence of these positive spillovers is that merely comparing neighboring families who do and do not have latrines will not fully reveal the benefits of sanitation for children. Children in both families will be hurt by the household that openly defecates and helped by the household that does not. To document the full effect of sanitation, researchers must study the consequences of community-level sanitation, which is why the Maharashtra experiment was randomly allocated to villages, not to households.

It is sometimes claimed that sanitation spillovers suggest that reducing open defecation will not make anyone healthier until the practice is completely eliminated. However, this does not necessarily follow, in much the same way that claiming that reducing air pollution, a classic example of a negative spillover, does no good unless pollution is wholly eradicated.

The exact extent of sanitation spillovers depends on the context and situation. For example, open defecation is worse for neighbors in places where population density is greater and people live closer together. In Ahmednagar district, even relatively modest community-level sanitation improvements had a positive effect. We know that spillovers played an important role in this area because even in households that did not have a latrine in “endline” data after the program, children were taller after the program than before. In fact, the effect of the program on child height is statistically indistinguishable for households that had latrines and households that did not.

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**Figure 1: Design of a Randomized, Controlled Experiment**

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<tr>
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<th>Ahmednagar district</th>
<th>Nanded and Nandurbar districts</th>
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<tbody>
<tr>
<td>February 2004</td>
<td>60 villages</td>
<td>120 villages</td>
</tr>
<tr>
<td></td>
<td>baseline survey</td>
<td></td>
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<tr>
<td>August 2004</td>
<td>30 receive treatment</td>
<td>30 control villages</td>
</tr>
<tr>
<td>August 2005</td>
<td>midline survey</td>
<td>endline survey</td>
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BOX 2: WHAT CAN WE LEARN FROM ONE DISTRICT?

The Maharashtra experiment was originally intended to be conducted in three districts, but ultimately was implemented in only one. How does this change what we can learn from this experiment? How does it change how we should think about policy experiments in general? Many randomized experiments in development are implemented by high-quality NGOs; does it matter that this one was overseen by a government instead?

The purpose of randomization in an experiment is to ensure that, on average, treatment and control groups are comparable so the difference noted can be interpreted as a causal effect. Within Ahmednagar district, the TSC experiment was, indeed, a randomized experiment and can be used to estimate the effect of the program. However, there is no guarantee that the effect found in Ahmednagar district would have been the same as if there had been an experiment in Nandurbar, a much poorer district. The District Magistrate of a district that differs from Ahmednagar might be justified in wondering whether this experiment’s results would be exactly replicated in her district.

What is true of this experiment is true of essentially every study or evaluation: some conclusions can be generalized while others are limited to the context studied. The Maharashtra experiment is special only because we happen to know that the government initially planned to experiment elsewhere and because we have data on all three districts, even though only one hosted an experiment. However, almost every study could have been conducted somewhere other than it was; too often, this decision is not analyzed. This means that it is difficult to know how the selection of partner organizations and research sites shapes the overall body of knowledge about what works.

Ultimately, a more complete picture requires comparisons of multiple studies and methods. Using non-experimental statistical methods, economist Dean Spears has estimated an average effect of the TSC on all of rural India, including places where the TSC was much less active than in Ahmednagar. He finds that the TSC had an average effect on height about half as large as the effect this experiment had in Ahmednagar. This makes sense: the program in Ahmednagar was a careful experiment, conducted in a district that was particularly disposed to implementation of the TSC. This difference in estimated impacts highlights the importance of the context from which evidence about a program’s effectiveness is taken.

in Ahmednagar (see Box 2), but sanitation practices in Nanded and Nandurbar remained unchanged. Nevertheless, we have some data about children in Nanded and Nandurbar and can compare improvements in Ahmednagar with developments in the other two districts. However, our experimental conclusions are based on Ahmednagar alone.

MODEST IMPROVEMENTS IN SANITATION

Before asking what improvements in sanitation were accomplished, we must ask whether sanitation improved. Did the TSC motivation lead to more latrine use?

Figure 2 summarizes evidence that the program caused latrine coverage in Ahmednagar to increase by 8.2 percentage points in the treatment group villages, relative to the control group. The data are from the final survey, in August 2005, 18 months after the initial survey and shortly before the experimental intervention.

The experimental program did not eliminate open defecation. Sanitation coverage increased, but not by a great deal, and not to levels near elimination of open defecation. However, given that the intervention increased children’s height significantly,
it is evident that—contrary to some claims by sanitation advocates—positive effects of improved sanitation are possible even without completely eradicating open defecation (see Box 1). The program was also intended to encourage people to use existing, constructed latrines that had not been in use.

Figure 2 plots the fraction of treatment and control villages that had won the Nirmal Gram Puraskar, or Clean Village Prize, by May 2012. The Clean Village Prize is a reward given by the Indian government to villages certified to have eliminated open defecation. Of the 30 villages in each group, nine treatment villages have won the prize, whereas only three control villages have. This provides additional confirmation—Independently of the experiment’s survey data—that the TSC intervention improved sanitation, albeit imperfectly.

IMPROVEMENTS IN HEIGHT
Did improvements in sanitation lead to healthier children? The experiment measured one important indicator of children’s health: the height of children under 5 years of age (see Box 3). Reducing open defecation was expected to reduce children’s exposure to germs from other people’s feces, allowing them to grow healthier and taller.

Figure 3 presents the main result of the experiment: although children in the treatment and control villages were no different, on average, before the program, 18 months after the intervention, children in villages in Ahmednagar district that were randomly assigned to achieve the treatment were taller, on average, than children in the control villages. Children in Nanded and Nandurbar, where there was no experimental intervention, showed no difference between treatment or control group averages.

How large of an effect did the program have on children’s height? On average, children exposed to the TSC intervention grew about 1.8 percent taller, computed by the method of difference-in-differences. The probability that such a
**BOX 3: WHY CARE ABOUT HEIGHT? THE LONG AND THE SHORT OF AN IMPORTANT INDICATOR**

Compared with healthy children around the world, Indian children are much too short. The difference is not due to Indian genetics: other studies show that healthy children in South Delhi grow as tall as children in rich countries, and that Indian children who move to Europe early in their lives substantially catch up with the growth of other children. Identifying the many factors that combine to make Indian children so short is an important puzzle open to further research.

Does height matter? For a population, it very much does. The difference in height between any two people has a large genetic component. In contrast, widespread stunting in India suggests that early-life disease and malnutrition keep many people from growing to the height potential that their genetics would allow.

This is problematic because the same health deficits that slow physical growth have other lasting and harmful consequences. On average, studies from around the world suggest that shorter children become shorter adults who earn less money, achieve less of their cognitive potential, suffer worse health, and may even die sooner. Height does not directly cause these problems; it is an indicator of early-life conditions that cause them. This means that stunting among Indian children is not merely a health issue, it is also an economic issue and that sanitation is as well.

**Figure 3: Important Improvements in Children's Height. . .**

![Chart showing mean difference in height between treatment and control villages](chart.png)
difference could have occurred by random chance alone is less than five percent.

This difference represents a noteworthy outcome. An average healthy four-year-old girl is about one meter tall, so this change would represent an average increase in her height of about one to two centimeters. Relative to other interventions than can improve children's height, this is a large but plausible effect. For example, Checkley, et al (2004) find that inadequate sanitation in Peru is associated with a similarly sized deficit in child height; Frankenburg, et al (2005) document a similar effect on the height of a village midwife after a health promotion program in Indonesia.

Another way to understand the size of this effect is to compare it with the World Health Organization’s international reference heights for children’s growth. These reference averages are computed based on a sample of healthy children worldwide, including in India. Average children in India, however, are much shorter than the healthy standard, in part because of early-life diseases caused by widespread open defecation.

Figure 4 plots the average heights of children in treatment and control villages, from ages 1 to 60 months. The smooth curve above them is the WHO reference standard height. It is clear that the program improved children’s height throughout the age distribution, but it is also evident that a large gap remains even for children in the treatment group. Of course, poor sanitation is not the only threat to Indian children’s growth, and the experimental program studied here did not fully eliminate open defecation.
MUCH MORE LEFT TO DO
Analysis of this experiment demonstrates that improving sanitation in these villages in Ahmednagar district allowed children to grow taller. However, one of the most important conclusions of this study required neither statistical analysis nor a randomized, controlled trial—in two of the three districts where the state government originally decided to experimentally implement the TSC, no action was taken, illustrating the constraints facing the Indian government, the importance of investing in the capacity of district governments, and the need to ensure that local governments are motivated to carry out programs that can reduce open defecation. In the 2011 census, seven years after the experiment reported here, approximately half of Indian households still reported open defecation without using a toilet or latrine. Reaching this remaining half of the population with sanitation coverage that is even a fraction as beneficial as the experimental program in Ahmednagar district could substantially improve the health, growth, and human capital of India’s children and future workers.

Related reading
This article is primarily based on “Effects of a village sanitation intervention on children’s human capital: Evidence from a randomized experiment by the Maharashtra government,” by Jeffrey Hammer and Dean Spears, 2012. For further information, please see “Policy Lessons from the Implementation of India’s Total Sanitation Campaign,” presented by Dean Spears at the 2012 India Policy Forum. These papers contain more citations to other studies in the literature.

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