



Innovation of the Mundane: Better Stoves, Better Toilets, Better Lives

GLOBAL IMPACT ARTICLE SERIES

Every day, we hear about international health crises, from HIV to Ebola. But underlying contributors to serious health and environmental challenges often don't receive the attention they deserve. Two examples are toilets and cookstoves, which may not readily come to mind when contemplating global health issues. Yet these two household amenities, which many of us take for granted, facilitate the spread of disease, cause countless preventable and premature deaths, endanger the lives of women and children, pollute waterways, contribute to deforestation, and degrade quality of life for billions of people.

These are important issues to the people of Dolatpura, a village in the Indian state of Gujarat. In May, 2014, a team of U-M students traveled to India to assess the needs in several villages in partnership with the Setco Foundation, an Indian non-profit organization focused on healthcare, education, and empowerment. In Dolatpura, the team identified two families and a Setco-funded community center that wanted to work closely with them. The goal was simple: build a better cookstove and a toilet people actually want to use. Two years later the team is working closely with members of the Dolatpura community to perfect cooperatively-designed technologies to do just that.

A SAFE PLACE TO GO

According to the World Health Organization (WHO), 2.4 billion people lack access to sanitation facilities. Of these, 946 million defecate in the open. People use fields, roadsides, bushes, and water bodies as their toilet. Not only does this pollute the environment, but exposure to fecal matter has been linked to a dizzying array of illnesses. The short list includes growth stunting in children due to bacterial exposure, and the spread of cholera, dysentery, hepatitis A, typhoid, polio, and diarrhea. The BBC reported that the practice is particularly unsafe for women, who report verbal, physical, and sexual harassment and violence when they venture outside to defecate.

India is home to 59% of the world's open defecators, according to a joint report by WHO and the United Nations International Children's Emergency Fund (UNICEF). It's a problem that India's current Prime Minister, Narendra Modi, has pledged to eradicate by 2019 as part of his "Swachh Bharat Abhiyan" effort, known in English as the "Clean India" campaign. Most of the government's efforts toward this goal have centered around building toilets. However, just because a toilet is built doesn't mean people will use it. Sue Coates, the Chief of Water, Sanitation, and Hygiene at UNICEF, told the BBC that there are several possible reasons for this, including personal preference or longstanding habit. According to Sai Bolla, one of the U-M team members, another possibility is that government-built toilets are of poor quality, and no one wants to use a small, dark, smelly toilet.

To address this complex issue, the team spent a year researching toilet technology, eventually settling on a composting toilet as the best design for this particular application. According to Rachel Ross, one of the

team members, the design was chosen due to water efficiency, ease of user upkeep, and comparatively low cost. In two years it will also have an output the family can use: free fertilizer. This is a valuable commodity in an agricultural village, and was a key factor in convincing the family that having a toilet, using it, and maintaining it would be financially beneficial to them.

The fertilizer "was a very material benefit we could recognize and emphasize in discussion with them," says Ross. "We've noticed that it's very important to be clear about what the benefits of an intended technology are in order for them to have any interest in not just building it, but using it and maintaining it," adds Bolla.



DESIGNING A SAFER COOKING STOVE

Women and their families around the world inhale carbon monoxide, carbon dioxide, and lung-harming particulates from the simple act of cooking. The culprit? Traditional cookstoves, often situated atop open fires, and without ventilation or protection from toxic fumes.

In 2012, WHO reported that exposure to cooking smoke generated from solid-fuel (e.g., wood, animal dung, or coal) burning stoves resulted in 4.3 million premature deaths—more than either malaria or tuberculosis. According to the Global Alliance for Clean Cookstoves (GACC), it is the fourth-leading risk factor for disease in developing countries, and has been linked to child pneumonia, lung cancer, chronic obstructive pulmonary disease, heart disease, and low birth weights.

Beyond the health implications, collecting and burning solid fuel has significant environmental impacts. According to the GACC, the fine particulate matter emitted by cookstoves contributes up to 25% of black carbon emissions to general air pollution. Because the underlying fuel is often wood, sourcing it contributes to deforestation and habitat degradation, and ultimately exacerbates climate change due to a loss of carbon sinks. Less than half of the wood is grown and harvested in a sustainable manner. New stove designs are an essential part of combatting these problems. Higher-efficiency models can decrease the amount of wood needed and reduce time spent gathering fuel and cooking food, which allows women and girls to pursue a broader range of activities. The team addressed ventilation issues by adding a ceramic chimney to traditional stoves. They also increased the temperature at which the stoves could cook, decreasing the cooking time for meals. A large part of a successful stove design was the input and engagement of their partner family and the community center, resulting in the co-design of the new cookstove.

The Dolatpura community center now houses one of the new stoves built by the team. A woman who works there and uses the new stove reported that she spends less time cooking for the children and more time interacting with them. Thus, children may be getting more attention and education just by changing the stove design. Because the team worked collaboratively with a local stove builder, their efforts also resulted in employment for a local woman who now has both the knowledge of how to build more efficient stoves, and a job at Setco Foundation building them for others.

BENEFITS OF COOPERATION

In May 2015, additional project support allowed some team members to return to India and continue their work on product design with partner families in Dolatpura. In addition to receiving feedback and building relationships in the community, the team took measurements on the moisture of wood, the weight of cooking pots, the weight of food in the pots, typical cooking times, and air quality near the stove. Variables like these are essential for creating the most efficient stove setup possible, allowing the team to create something truly useful to their partner families.

Members of the student team emphasized the importance of understanding what the family wants and what the technological intervention means for them.

The trips were a significant factor in being able to really understand and communicate with their Indian partners.

FUTURE GOALS

The team returned to Gujarat once more in May 2016 to install the first toilet prototype and gather feedback on the stoves. Due to the stove project's success, they plan to hand it over to the Setco Foundation so that it can be incorporated into the organization's community education programs. As for the toilet, it takes two years for the compost to form. The team plans to monitor the pilot toilet and install another, and hopefully conduct another needs-assessment trip to a Setco community soon. The Setco Foundation is working in approximately 25 communities, each with a unique set of challenges to address. U-M's BLUElab India Project team has 15 returning members and over 20 new ones, all ready to continue co-designing impactful technologies.

[Click here to see Full Project Report](#)

Project Team Members

- **Stove Sub-team:** Sarah Rogers (sub-team lead), Sai Bolla (project team lead), Div Shah, Estelle Feider-Blazer, Kaylla Cantilina, Shilpen Patel, Yen Jee Ooi, Matt Ferguson, David Mark, and Alby Thomas
- **Toilet Sub-team:** Garima Gupta (sub-team lead), Rachel Ross (project team lead), Natasha Desai, Mira Shah, Elena Stefanko, Naveen Jasti, Romaer Chopra, Rohil Hakim, Rushil Bakhshi, Yashmeet Gambhir, Natalia Jenuwine, Alexandra Price, Melyssa Wei, and Dennis Hu
- **Education:** Riya Ahuja (sub-team lead), Kabir Rastogi, Nisha Patel, Osman Zuberi, and Diksha Manglani
- **Finance:** Natasha Desai (sub-team lead), Rueshub Patel (grant lead), Romaer Chopra (budget lead), Colby Hanley, Stephanie Høglund, Kabir Rastogi, and Tom Veraart
- **Public Relations Chair:** Diksha Manglani; Membership Chair: Naveen Jasti
- **Graduate Student Advisors:** Brad Wintersteen, Haresh Patel

The BLUElab India Project is a multidisciplinary student organization at the University of Michigan. Students are dedicated to co-designing sustainable, appropriate technology with Dolatpura, a small agricultural community, near Kalol in Gujarat, India. While BLUElab India Project is affiliated with the College of Engineering, members from multiple schools, including Literature, Science and the Arts and Art and Design. BLUElab India Project is part of the umbrella organization, BLUElab which is dedicated to co-designing sustainable solutions worldwide.

Made possible by The Dow Chemical Company, the Dow Sustainability Fellows Program at the University of Michigan supports full-time graduate students and postdoctoral scholars at the university who are committed to finding interdisciplinary, actionable, and meaningful sustainability solutions on local-to-global scales. The program prepares future sustainability leaders to make a positive difference in organizations worldwide. We believe that diversity, equity, and inclusion are key to individual empowerment, and the advancement of sustainability knowledge, learning and leadership.