Culture and the health transition: Understanding sanitation behavior in rural north India

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Abstract

The factors that hasten and retard reductions in mortality and morbidity in developing countries are widely studied; this literature suggests that culture may play an important role in health transitions. India, which is home to one sixth of the world's population, has recently experienced slow declines in mortality and morbidity in part because of the country's uniquely poor sanitation. Despite relatively favorable development indicators in other domains, 70% of rural Indian households defecate in the open, with drastic consequences for population health. This paper draws on new qualitative and quantitative data to examine the cultural meanings of latrine use and open defecation. We find that beliefs, values, and norms about purity and pollution of private spaces and of bodies help explain widespread open defecation, and that renegotiation of caste and untouchability complicates the adoption of simple latrine technologies that are an important input into health transitions in other developing regions.

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Since the mid-twentieth century, developing country populations have experienced reductions in morbidity and mortality that constitute important improvements to human welfare. These health transitions have received significant attention from demographers, who debate the relative importance of income, access to medical care, public health interventions, and knowledge of the germ theory of disease to declines in mortality and morbidity in developing countries, as well as to the health transitions of developed countries that preceded them (McKeown and Record, 1962; Szreter, 1988; Preston and Haines, 1991; Pritchett and Summers, 1996; Deaton, 2013). Studies of health transitions have also emphasized roles of cultural, social and behavioral determinants of health (Caldwell, 1993; Caldwell et al., 1990).[1]

Literature at the intersection of demography and development has identified a number of cases where culture shapes population level health outcomes. For instance, a culture of strong son preference in many parts of Asia means that parents discriminate so severely against female children that mortality and abortion rates for girls are much higher than those for boys, leading to millions of "missing women" (Sen, 2003; DasGupta, 1987; Murphy, 2003; Arnold et al., 2002). Another important example of how culture shapes population health relates to the transmission of HIV/AIDS. There is now consensus among researchers that uniquely high rates of HIV/AIDS in eastern Africa are in large part due to culturally-specific ways of forming concurrent sexual partnerships (Mah and Halperin, 2010; Halperin and Epstein, 2004); other literature on HIV/AIDS in sub-Saharan Africa explores how responses to the epidemic should include analyses of culture (Cleland and Watkins, 2006). This article draws on extensive field research in rural north India, including qualitative interview data and a new quantitative survey, the Sanitation Quality, Access, Use and Trends (SQUAT) survey, to show how beliefs, values and norms about purity and pollution of private spaces

[1]Caldwell et al. (1990) provides examples of how culture influences health behavior, with a focus on cultural influences on child care practices and on women's education, both of which are widely recognized to play important roles in infant and child mortality and morbidity.

and of bodies help explain widespread open defecation, which importantly contributes to the region's high infectious disease burden.

Sanitation is widely recognized as an important part of a successful health transition, especially where population density is high (Preston, 1975; McGreevey et al., 2008; Cutler and Miller, 2005; Hathi et al., 2014). Poor sanitation spreads bacterial, viral and parasitic infections including diarrhea, polio, cholera and hookworm (Feachem et al., 1983). The negative externalities associated with poor human waste management mean that it is of public importance. Indeed, poor management of human waste in industrializing Western cities led to high morbidity and mortality until public officials made investments in sewage infrastructure and in behavior change campaigns to clean them up (Snow, 1855; Barnes, 2006; Dye, 2008). Recent research highlights the continuing importance of improving sanitation in developing countries for sustaining reductions in mortality and morbidity (Humphrey, 2009; Fink et al., 2011; Spears, 2013).

Today, much of the global burden of poor sanitation is concentrated in India, and particularly in rural India. According to the WHO-UNICEF Joint Monitoring Report, 60% of global open defecation, the practice of defecating outside without a toilet or latrine, occurs in India (UNICEF & WHO, 2012). According to the 2011 Census, about 70% of rural Indian households do not have a toilet or latrine. The health consequences of widespread open defecation in rural India are exacerbated because many regions have very high population densities. For instance, the primarily rural states of Uttar Pradesh and Bihar are home to about 300 million people, and have population densities that exceed 800 persons per square kilometer.[2] High rates of open defecation, combined with high population density, mean that the burden of diseases caused by open defecation in rural India is considerable, and that reducing open defecation is an important part of India's health transition.

[2]For comparison, a population density of 800 persons per square kilometer is about 170% of the population density of New Jersey, the United States' most density populated state at 467 persons per square kilometer.

This paper aims to understand why sanitation in rural north India is so poor. We begin by presenting a puzzle: open defecation is much more common than in India than in other countries where people are poorer, literacy rates are lower, and drinking water is more scarce. We then present findings from new qualitative and quantitative research on open defecation in rural India. We find that beliefs, values, and norms about purity and pollution of private spaces and of bodies help explain low demand for latrine use, and that rural India's unique history of caste complicates the adoption of the simple latrine technologies that provide an alternative to open defecation in other parts of the developing world. This paper constitutes an important contribution to the literature on India's health transition because it explains the slow adoption of sanitation by examining the cultural meanings of latrines, latrine use and open defecation. Much of the existing literature on improvements in basic sanitation in other parts of the world describes investments in physical infrastructure (Preston and Van de Walle, 1978; Cain and Rotella, 2001; Cutler and Miller, 2005). Yet, as we will illustrate, the problem of widespread open defecation in rural India has little to do with lack of infrastructure *per se*.[3]

In the first section of the paper, we present our question: why do so many rural Indians defecate in the open, despite relatively favorable outcomes in other domains of development? Second, we introduce our data and methods; we describe our fieldwork and present a methodological framework for examining relationships between culture and health behavior. Third, we explain key cultural concepts relating to life in north Indian villages; we draw upon these to describe the cultural meanings of latrine use and open defecation among the

[3]Although we are aware of no other studies that focus specifically on the cultural meanings of latrine use and open defecation in rural north India, there are cases from other parts of the world that illustrate the importance of culture for sanitation behavior. For instance, Barnes (2006) describes how cultural attitudes toward hygiene and excreta disposal in rural France during the mid to late 1800s interacted with messages spread by the government about infectious disease. Cairncross (2003) notes that public health researchers working to reduce parasite infections in the American South in the early 1900s argued that racial differences in parasite burdens between poor blacks and poor whites could in part be explained by the fact that black families had more control over their children, and were therefore better able to enforce latrine use.

households we study. Fourth, we present our findings: we find that having a simple latrine at home is considered by many to be ritually impure, and that latrine pit emptying presents special challenges in a society that is renegotiating caste and untouchability. We find that open defecation is seen as promoting purity and strength, particularly of male bodies, which is important because men typically decide which large financial investments a household makes. Fifth, we consider how the cases of latrine construction and latrine use that do occur in rural India reflect and reinforce the cultural interpretations that perpetuate open defecation among the majority of the rural population.

We conclude with a discussion of these findings for public policy. For decades, Indian sanitation policy has focused on the construction of pit latrines, with little consideration of how to transform the cultural meanings of open defecation and latrine use. These cultural meanings, we contend, are far more important for explaining rural north India's high rates of open defecation, and the resulting disease burden, than has previously been understood.

The Indian sanitation puzzle

Despite decades of rapid economic growth in India, improvements in health and the disease environment have been remarkably poor (Drèze and Sen, 2013). One reason for India's slow improvement in the burden of disease, and perhaps also for its exceptionally high rates of malnutrition, is its uniquely poor sanitation and public hygiene (Deaton and Drèze, 2009; Spears, 2013). India, which is home to one sixth of the world's population, has 60% of the world's open defecation (UNICEF & WHO, 2012). Open defecation is a particularly important threat to health in rural India, where 70% of households defecate in the open, and where 90% of Indian open defecation takes place (Government of India, 2012b).

What sorts of technologies would reduce the burden of disease caused by open defecation? Because constructing sewers and sewage treatment facilities in rural areas is very costly, rural

households in most other developing countries build and use simple, inexpensive latrines to contain feces underground. The World Health Organization (WHO) publishes guidelines on how to make simple pit latrines[4] that reduce the transmission of fecal pathogens (WHO, 1996).[5] These guidelines recommend using an underground soak pit with a volume of around 60 cubic feet; such a latrine pit is expected fill up after approximately five years if used regularly by two adults and four children. When a latrine pit fills up, households must either construct a new pit or empty the old one.[6] The Indian government endorses this, and similar types of inexpensive pit latrines for use in rural India (Government of India, 2007).

Table 1 presents summary statistics about sanitation, GDP, poverty, literacy, and drinking water access for several poor countries and developing regions. The regions shown – south Asia, sub-Saharan Africa, and south east Asia – are the three poorest regions in the world. Within those regions, we show summary statistics for countries that have populations of at least 100 million people. The summary statistics in table 1 suggest that India's high rates of open defecation cannot be explained by its GDP per capita or by its poverty rates. Sub-saharan Africa, for example, had only 65% of the GDP per capita of India, but only 35% of rural people defecate in the open. In particularly sharp contrast, Bangladesh, which borders India, has less than half of the GDP per capita, and yet only 3.5% of rural Bangladeshis defecate in the open.

Nor can India's high rates of open defecation be explained by illiteracy or lack of drinking water infrastructure, which is often assumed to be related infrastructure. Table 1 shows that

[4]Cairncross (1987) provides a further explanation of inexpensive latrine and toilet options that are appropriate for use in rural areas of developing countries.

[5]To prevent the transmission of disease, pits should be covered, and the latrine seat should have either a water seal that prevents flies from entering and leaving the pit, or a cover that remains in place while the latrine is not in use. The bottom of a latrine pit should be two meters above the ground water table in order to prevent contamination of drinking water. In most places in rural India, the ground water table is low enough that hygienic latrines can be built with no threat of contaminating the groundwater.

[6]Two-pit latrines reduce the health hazards of manual emptying of latrine pits. In a two-pit model, the feces in the full pit can be left to decompose for several months while the household defecates in the second pit. Feces that have been allowed to decompose will not transmit bacterial infections, but may still transmit parasites.

women's literacy in India is similar to women's literacy in other parts of south Asia and in sub-Saharan Africa, and that men's literacy is higher in Indian than in these other places. Among these regions and countries, access to improved drinking water is uniquely high in rural India; more than 90% of rural Indians have access to improved drinking water. Indeed, rural India has even better drinking water infrastructure than in rural Indonesia, where less than a third of the rural population defecates in the open. Table 1 suggests that explanations of rural India's exceptionally widespread open defecation based on its poverty, literacy rates, or water access are misguided.

Another piece of rural India's sanitation puzzle is that households are unlikely to use simple, inexpensive pit latrines. Professionals working in sanitation and international development describe a "sanitation ladder," on which the rungs closest to the bottom of the ladder represent inexpensive latrine options, and rungs higher up on the ladder represent more expensive options (Kvarnstrom et al., 2011).[7] Pit latrines are considered a middle option; they are more costly than defecating in the open, but not as costly as constructing a septic tank. However, India's NFHS-2005 found that only about 20% of rural Indian households that do not defecate in the open use a pit latrine. In Bangladesh, 94% of rural households that do not defecate in the open use a pit latrine (DHS-2012), and in Nigeria, this figure is 87% (DHS-2008). Rural Indian households that do not defecate in the open are, in contrast, far more likely to use expensive septic tanks.

The prevalence of open defecation in rural India despite relatively favorable poverty rates, literacy rates, and water access, as well as the absence of simple pit latrines suggests a puzzle: why do so many people in rural India defecate in the open, rather than adopt the affordable latrines that have played a major role in reducing the disease burden in other developing countries?

[7] In rural India, technology ladders exist in other domains, for instance, a transportation ladder might include feet, bicycles, motorcycles, and cars. For further discussion of the "missing middle" of the Indian sanitation ladder, see Coffey et al. (2014)

Data and methods

Field sites and fieldwork

Qualitative data. This paper primarily draws on data from 100 in-depth, semi-structured qualitative interviews carried out by several of the authors in Valsad district of Gujarat, Rewari district of Haryana, Fatehpur district of Uttar Pradesh, and Parsa district of southern Nepal[8] between November, 2013 and May, 2014. A map showing the location of these field sites is provided in the Appendix. The Appendix also discusses selection of the field sites and respondents, interview protocols, and analysis of the data. Two-thirds of interviews were carried out in households in which at least one member had switched from open defecation to regular latrine use in the 10 years prior to the survey. One third of the interviews were carried out in households in which every member defecates in the open. The authors also did extensive pre-testing of the interview guide in Sitapur district of Uttar Pradesh, and follow-up fieldwork in Jaipur, Rajasthan; Sitapur, Uttar Pradesh; and Muzaffarpur and Sheohar districts in Bihar.

Quantitative data. We supplement our analysis of the qualitative data by presenting results from a complementary quantitative survey that was designed by the authors and carried out between November, 2013 and April, 2014. Data for the Sanitation Quality, Use, Access and Trends (SQUAT) survey data was collected for approximately 23,000 individuals in about 3,200 households in the Indian states of Haryana, Uttar Pradesh, Bihar, Rajasthan, and Madhya Pradesh. Coffey et al. (2014) provide a description of this survey and its main findings.

[8]We originally decided to visit the terai region of southern Nepal, which borders the Indian states of Bihar and Uttar Pradesh, because open defecation rates there are lower than in rural India: the 2011 Nepal DHS reports an open defecation rate of about 50%, compared to the 2011 Indian census open defecation rate of about 70%. However, these differences in open defecation are not primarily due to the adoption of simple latrines, which according to the DHS, only about 7% of households in the Nepali terai use, but to higher rates of septic tank use. We found that attitudes and beliefs about open defecation and latrine use in this region are very similar to those we found in rural India.

Methods for analyzing culture & health behavior

Many demographers and other researchers have considered the question of how culture can play an important role in demographic processes, both in situations of stasis and in situations of change (Hammel, 1990; Greenhalgh, 1990; Kertzer and Fricke, 1997; Fricke, 2003).[9] Such literature informs our analysis of how rural north Indian culture influences sanitation behavior, with consequences for mortality and the health transition.

Among accounts of cause and effect, cultural explanations require special methods. Fricke (2003) explains that "[d]escriptions of culture are necessarily descriptions of systems of meaning requiring different criteria of validity than causal explanations appropriate to individual variation" (p. 478). We follow this literature in emphasizing that an adequate interpretation of how culture influences behavior depends on its coherence with what is known about patterns of behavior and their meaning in a local context. In our case, we observe that sanitation behavior - and its meaning to participants in our interviews - coheres with a broader system of beliefs, values, and norms that have been described by other scholars of rural north India.

In our fieldwork, we put special emphasis on households in which one or more members have adopted latrine use in the recent past. This strategy is useful because it allows us to interview respondents during an "unsettled period" (Swidler, 1986), a time in which at least one person in the household is changing his or her regular defecation behavior. This is also typically a time when the household is making a large financial investment in a latrine or toilet. At such a time, we have an opportunity to observe which ideas are emphasized, which are deemphasized, and how these ideas interact with economic decision-making. Studying latrine owners reveals that many people in households that own latrines nevertheless defecate in the open. Interviews with these individuals enable us to separate the issues of *access* to a

[9]For example, there exist particularly well developed accounts of cultural influences on fertility behavior; see Greenhalgh (1995).

private latrine from *use* of a latrine. In interviews where some people are not using a latrine that other members of their households do use, we learn from intra-household disagreement; from changing attitudes and behaviors; and from expectations, rules, and opportunities that apply to some household members but not others.

Cultural context

Although culture and religion are often treated as distinct concepts both among researchers and in people's own accounts of their lives, it is impossible to characterize and understand the culture of north Indian villages without reference to Hinduism and the structure it provides for social and personal life. Ideas that have their origins and strongest expression in Hindu texts, rituals, and norms thoroughly influence the behavior of both Hindus and non-Hindus in rural north India. In all of the regions that we studied, Hindus make up between 80 and 90 percent of the total population, and a slightly higher fraction of the rural populations. To provide background for our findings about the meanings of latrine use and open defecation in north Indian villages, we present a cultural context that draws heavily upon anthropological work about the everyday practice of Hindu religion and Hindu culture.

Purity & pollution. Although this paper deals specifically with rural north Indian ideas about what is pure and what is polluting and what is clean and what is unclean, we note that many societies have ideas about purity and pollution that are related to what is dangerous, taboo, or profane (Douglas, 1966). Across societies, objects, situations or persons that are polluting are seen as a threat to sacred spaces or to a person's body. In rural north India, as in other societies, "some pollutions are used as analogies for expressing a general view about the social order" (Douglas, 1966, p. 4). That is, ideas about purity and pollution are used to create social divisions as well as physical ones.

In Indian society, purity and pollution are strongly related to subordination and hierar-

chy, and are practiced intensely, especially by members of "higher" castes, such as *Brahmins* (Harper, 1964). Rules about purity and pollution govern personal behavior, social interaction, how people interact with public and private spaces, and how they interact with their bodies. The specifics of how purity and pollution are practiced differ across sub-castes and households, from place to place, and they change over time. Nevertheless, the ideas about pollution and purity that we describe here are broadly applicable and have important consequences for human behavior across India.

Khare (1962) explains that in rural north Indian villages, the words "dirty" and "clean" are ritual concepts as well as physical ones. There is overlap between physical cleanliness and ritual purity in some instances and not in others. For example, some things are both ritually polluting and physically dirty, such as human feces and used menstrual cloths. A drain that removes waste water from the house, although it might be kept physically clean, is nevertheless considered ritually polluting. In Khare's study, vegetable peels strewn on the floor, or rat excreta in the flour, were seen as physically dirty but not ritually polluting.

Pollution and danger are transmitted not only by certain spaces and objects, but also by naturally occurring situations and sometimes by people. For instance, death and childbirth pollute both the people who experience them and the spaces in which they occur. Purity and pollution are also recognized as the unifying idea of the India caste system (Dumont, 1980). People from lower castes are seen as inherently less pure than people from higher castes. "High" and "low" caste distinctions are not binary; rather sub-castes are ranked in local purity-pollution hierarchies that are often renegotiated (Gupta, 2005). People from the "untouchable" castes, or *dalits*, are seen as permanently polluted and polluting to others.

Caste & untouchability. The pollution that *dalits* embody is often used as a justification for their oppression and extreme social exclusion. In rural India, *dalits* have traditionally been expected to do dirty, degrading tasks for higher caste households, such as the disposal

of dead animals,[10] and the cleaning of "dry toilets" used by women in *pardah* (Shah et al., 2013). Often, work performed by untouchables was not compensated, or *dalits* were given only grain as compensation for doing "dirty" and "disgusting" work. Purity and pollution hierarchies exist even among *dalit* castes; people belonging to castes which clean human feces are considered to be the most polluted, and thus are often even more marginalized than people belonging to other *dalit* castes.

The fact that *dalits* perform "dirty" work is often used as evidence of their permanent ritual pollution, and has been used as justification for excluding them from schools, public water sources, and more dignified employment (see Valmiki (2003)). Today, untouchability and caste-based social exclusion is being renegotiated in rural India. The exclusion of *dalits* from schools and water sources is less common than it once was, but it is still common for caste Hindus to refuse to eat food or take water from the houses of *dalits* and to exclude untouchables from temples (see Karanth (1996)). An important part of *dalits*' struggle for equality has been through resistance to performing the kinds of degrading tasks that are associated with untouchability (Shah et al., 2006).

A caste Hindu, that is, a Hindu who is not from one of the untouchable castes, may suffer social consequences if he or she is seen performing the kinds of tasks that are associated with untouchability. It is, therefore, uncommon for people other than the most marginalized among *dalits* to clean sewers, drains, latrine pits, or public places. Milner (1987) argues that these links between cleaning and caste mean that public spaces in India are uniquely filthy; most people see it as someone else's job to clean up. Milner also argues that people treat dirt as "primarily social, rather than physical," and place more emphasis on social purity and group order than on physical cleanliness. Lüthi (2010) suggests that caste-based notions of purity and pollution also impede the widespread acceptance of the germ theory of disease.

Private spaces & the body. Avoidance of pollution and the promotion of purity

[10] This often involved removing and selling their hides.

matters far more in private spaces, and with respect to one's own body, than it does in public spaces (Gupta, 2000). Indeed, of residents of a south Indian city, Lüthi (2010) writes: "outside of private and sacred zones like temples, they have no interest in cleanliness. Their interest in cleanliness stops at the doorsteps of private homes, and habits related to the outside define it as an irrelevant rubbish dump" (79).

In contrast, people take considerable effort to maintain purity of the home and the body. Maintaining the purity of the body is associated with strength, health, vigor and masculinity (Alter, 2011; DasGupta Sherma, 1998). If unavoidable polluting activities, such as defecation, are handled with discipline and proper adherence to ritual, they can be made less polluting. For instance, in an early ethnography of village life in India, Padfield (1896) describes the morning routines of a high caste (*brahmin*) man, who rises two hours before dawn, goes to defecate in the open, returns, and takes a bath to counteract the pollution associated with defecation. Only after his bath does he commence the day by praying, and then eating. Joseph Alter's recent work on wrestlers in north India also highlights links between defecation and purity, and how practices to keep men's bodies pure display to others evidence of an inner state of morality (Alter, 2011).

Practicing purity & pollution. Caste, gender and religion are related to how, and how strictly, a person in rural India practices purity and pollution. Women are, in part because they menstruate, seen as inherently less pure than men (Fuller, 2004; Thompson, 1985), and so may experience less social benefit from strict adherence to purity and pollution rules. People from higher caste typically spend more time and economic resources maintaining and demonstrating their ritual purity than do people from lower castes. However, sociologists of India have remarked that upwardly mobile members of lower castes tend to adopt ritual purity-related practices associated with higher castes (Srinivas, 2003).

Indian Muslims have beliefs, values, and norms about purity and pollution that differ from the Hindu majority (Jeffery, 1997; Ali, 2002). However, Indian Muslims are also importantly

influenced by the Hindu ways of thinking about purity and pollution described here; for example many Indian Muslims discriminate against *dalits*, and many identify with sub-castes, or *jatis*, that are, like the *jatis* used by Hindus, hierarchically ranked. Despite the fact that the ideas about purity and pollution described here are most intensely practiced by high caste Hindu men, this system of thinking motivates the behavior of a very large proportion of the population of rural north India.

Understanding open defecation in rural north India

The meaning of a simple latrine

Latrines & pollution. Khare (1962) explains that some objects are considered both ritually polluting and physically dirty, others are physically dirty but not ritually polluting, and still others are physically clean but nevertheless ritually polluting. Some of our respondents viewed *all* latrines as ritually polluting, no matter how physically clean they are kept. One such young man, a *Brahmin* from Haryana,[11] misappropriates the germ theory of disease in explaining the ritual pollution he associates with having a latrine at home:

> If a latrine is in the house, bad smells will come, germs will grow. Latrines in the house are like...hell. The environment becomes completely polluted. There is no benefit of lighting [religious candles and lamps], no benefit at all.

This young man's distaste for latrines, and the distaste we find among other conservative rural Hindus, has to do with the importance of maintaining purity in the home. Participants in all four field sites state values about maintaining purity in the home which are similar to those expressed by participants in other studies of domestic purity and pollution, such

[11] We find that *dalits* and Muslims are less likely to use words that refer specifically to ritual pollution but not to physical pollution, perhaps because language about ritual pollution is often used in reference to their own bodies. However, *dalits* and Muslims very often share with caste Hindus the views of latrines and latrine use that we describe here.

as Khare (1962) and Lüthi (2010). Several participants feel that having latrines close to kitchens poses a threat to the purity of the home. A middle aged Gujarati man from a mid-ranking Hindu caste explains: " [A latrine] should be 25-30 feet away from the kitchen. In cities, those assholes eat and shit in the same place. In our village, people don't live like that, we keep these things separate, and that's a good thing. It's filthy, no?"

Research on pollution and purity in South India finds that people are particularly concerned about the accumulation of trash inside their homes. Lüthi (2010) writes, "waste should not be stored anywhere inside, [so] there are no waste bins, and rubbish is simply dropped on the floor to be swept later" (72). People in rural north India may be similarly concerned about the *accumulation*, rather than the mere presence, of feces near their homes. We found that in households without latrines elderly and handicapped family members often defecate within the home or the compound.[12] These feces are later disposed of outside, often by women, who sometimes admit to being disgusted by the task, but who also see it as a duty to their elders. Distaste for the presence of latrines, together with the acceptance of the occasional need for someone to defecate in or near the private, sacred space of the home, coheres with Lüthi's finding that waste can be put on the floor and then cleaned up, but should not be stored in the house.

Simple latrines & pit emptying. Although some conservative rural Hindus find latrines of any sort distasteful, most people feel that expensive latrines with large pits or septic tanks are not polluting, but rather are a useful addition to a wealthy person's home. Expensive latrines with large pits or septic tanks help their owners avoid pollution in part because they help avoid the problem of pit emptying. Latrines with smaller pits, such as those recommended by the WHO and those provided by the government, are almost

[12]Small children are allowed to defecate almost anywhere–whether in the house, in the village lanes, or in the spaces between homes–without suffering social consequences. People do not believe that the feces of small children are ritually polluting, despite the fact that child feces are likely to spread infectious diseases than adult feces.

uniformly seen as polluting. Almost all of the households that we interviewed had some exposure to simple latrines because of the government's long-running latrine construction programs. Of the 78 families we interviewed in India, 18, or about a quarter of them, had been recipients of government latrines, although of these only 8 families had at least one member who was using the government latrine regularly.[13] Others had seen or heard about government latrines from relatives and neighbors. One respondent had worked as a mason constructing government latrines.

People refer, with considerable disdain, to government latrines, and other sorts of simple latrines as "temporary," "fake," or "kaccha," a word that is used to describe something that is incomplete, made from natural materials, or inferior. Very often, people who receive government latrines do not use them for defecation at all; they may repurpose the materials or use the latrine superstructure to bathe or wash clothes. A high caste Hindu man from Uttar Pradesh who defecates in the open explains why he did not accept the government latrine that the village leader offered him:

> Yes, the *pradhan* wanted to give me a latrine, but I didn't take it. I don't have so much space, and as you can see I have Lord Shiva's temple in front of my house, there is also Barhamdev baba's temple. And so if I get a latrine built here, I would not like it...Brother, I do not like [having a latrine inside the house] either, if these things are in the house then they pollute the house. I really don't like that...I am the kind of person who lives in a clean and pure place, I feel polluted in having a latrine. It gives off bad smells, the smell of dirtiness will come.

In addition to associating the presence of simple latrines with the pollution of private spaces, people reject government latrines because of concerns about pit emptying. We came to understand the importance of pit emptying to rural north India's sanitation outcomes by looking at how privately constructed pits differ from simple latrine pits. In both the SQUAT survey and the qualitative interviews, we asked respondents about the kinds of latrines that

[13]Among these, 6 had invested their own money to increase the size of the pit. In the 2 households that had not invested additional money, the latrine was used by only one or two members of the family.

they find acceptable and the kinds to which they aspire. Figure 1 shows the size of pits recommended by the WHO (WHO, 1996), those recommended by the Indian government in its 2012 guidelines (Government of India, 2012a), and the median pit size among latrines owned by households interviewed for the SQUAT survey. In the SQUAT survey, among latrines that were being used by at least one member of the household, less than 4% had pits that were 60 cubic feet or less. The median pit size of a latrine that is being used by at least one household member is 250 square feet. Figure 1 also plots the size of a "10 by 10 by 10" pit, the ideal pit size described by many of our respondents in the qualitative interviews.[14]

The main reason why people find "small pits" so objectionable is because they have to be emptied manually. Most people wrongly believe that these pits fill up in a matter of months, rather than years, and require frequent manual emptying. Mechanical emptying of small pits is impractical, both because it is excessively costly to pump small quantities of sewage, and because simple latrines are often built in places that are difficult for vacuum trucks to access. In order to avoid emptying latrine pits, many people make septic tanks so large that they do not need to be emptied in their lifetimes. A man in Uttar Pradesh who defecates in the open and does not own a latrine explained: "pit emptying does not happen here...you would get a new pit dug so deep that it would never fill up." A woman with a 450 square foot latrine pit in Gujarat explained why her household had invested so much money in the pit: "if we made [the pit] less expensively, it would not last a lifetime."

Manual pit emptying presents special subjective challenges in rural India due to its history of caste-based oppression. Since avoiding "dirty work" such as cleaning feces has been been central to *dalits*' struggle for equality, few *dalits* are willing to empty latrine pits.

[14]Only on a very few occasions did we encounter privately constructed latrines with pits close to the size recommended by the government or the WHO; these were built by poor families with a disabled member or by Muslim households. Hindu owners of such latrines viewed them as shameful objects. On one occasion, a caste Hindu household would not admit that the simple latrine they had built for their son, who had polio and could not walk, was indeed a latrine. On another occasion, an elderly Hindu man refused to show one of us his latrine; later, when he was no longer present, his grandson explained that he was ashamed of how simple the latrine was. It was, in fact, a serviceable and hygienic latrine that met WHO standards.

Indeed, employing a "manual scavenger," someone who removes feces by hand from a regular defecation site, often using a broom and a metal pan, was made illegal in 1993.[15] Although the Indian government does not classify emptying a "two-pit" latrine as manual scavenging,[16] many people who we interviewed associate manual emptying of latrine pits with manual scavenging. Our fieldwork suggests that in many places, presumably because demand for such labor exceeds supply, the few *dalits* who empty latrine pits are able to command higher wages for doing these types of jobs than for other types of manual work, such as construction or agricultural labor, which can be at least as physically demanding and may also be hazardous to health.[17]

An interview with a caste Hindu *anganwadi* worker – that is, a village-level government employee whose job is to implement an early childhood education and nutrition program – illustrates the problems around pit emptying in rural India. In addition to running the early childhood program, the *anganwadi* worker is supposed to promote sanitation in the village. She had received a government latrine which she and her family use. After several years of use, the pit needed to be emptied. Initially, the *anganwadi* worker did not admit to us that she had hired someone from a manual scavenging caste to empty the pit; as a government worker, she recognizes that part of her role is to represent the sanctioned messages of the modernizing state, which include official condemnation of manual scavenging. Instead, she

[15]This law is not enforced; a 2013 article in *The Hindu*, a widely circulated Indian newspaper, claimed that there has not been a single case of manual scavenging prosecuted since the law took effect (Staff, 2013).

[16]Emptying fresh fecal sludge from a latrine pit anywhere in the world would be hazardous to health. The Indian government claims to promote WHO-recommended two-pit latrines, in which the fecal sludge in a full pit is left unused for several months and allowed to convert to manure, while the household uses the second pit. However, many rural people are unaware of the technical details of two-pit technology. Where the government has built toilets, little has been done to educate people about the reasons for using two pits. Where we have explained the conversion of full, unused pits into manure, caste Hindus, and non-untouchable Muslims nevertheless claim that the emptying such pits would have to be done by untouchables.

[17]An NGO employee who wanted to improve pit emptying services in rural Bihar explained to us that the few *dalits* who engaged in pit emptying were well paid, but suffered extreme social exclusion. He said: "for them [people who empty latrine pits] it was like this: if you earn well, but you can't go to a restaurant, and you can't go to a temple, then what is the use?" We note that no quantitative data of which we are aware would allow confirmation of the claim that *dalits* are paid more for latrine pit emptying than for other manual work.

claimed that she had hired a vacuum truck from a nearby town. When we pointed out that it would be impractical to clean a small pit with a vacuum truck, she recanted, and nervously admitted to hiring a manual scavenger for the job.

Even if the market for pit emptying services were to run smoothly, there is reason to believe that people may nevertheless find having a latrine pit emptied near their home an unpleasant, disgusting, and perhaps even shameful experience. Feces fall into a similar subjective category as menstrual blood, menstrual pads and placentas; prior research finds that people want these polluting bodily objects to "become invisible." In her study of placenta disposal in rural Uttar Pradesh, Pinto (2013) finds that "[t]he invisibility of the discarded placenta is essential...Many women feel its visibility is 'shameful,' not just embarrassing but socially threatening to the family" (110-111). Similarly, Lüthi (2010) finds that women in urban Tamil Nadu burn menstrual cloths because disposing them on public trash heaps, as they do other trash, would be shameful; indeed, she suggests that women do not dispose of trash in plastic bags so that neighbors are aware that they have not discarded any "very polluting" objects (73). Our respondents' discomfort with the idea of having a simple pit latrine emptied near their homes suggests that similar processes may be at play; we suspect that large septic tanks allow feces to disappear or become subjectively "invisible" in a way that simple pit latrines do not.

The meaning of open defecation

Many outside observers, including urban Indians and Indian policy makers, assume that rural people, especially women, are "forced to defecate in the open" due to the lack of "access" to latrines.[18] However, many people feel that open defecation it is a natural and positive part of village life. It is rarely seen as socially unacceptable or shameful to defecate

[18]For some current examples from major Indian newspapers, see Nigam (2014) and Express News Service (2014).

in public places.[19] There are some places where social rules dictate that adults and older children[20] should not defecate: within the confines of the village, near a temple, too close to someone's house, or in crops that are soon to be harvested. However, most other places – including the shores of ponds, the banks of rivers, along well-traveled roads or paths, behind public buildings, and in canals, fields, orchards, and forests – are socially acceptable places to defecate. Indeed, the opening of Valmiki (2003)'s autobiography describes an apparent contradiction: caste Hindu women in his village often stayed indoors and covered their faces in front of men, but it was perfectly acceptable for them to defecate in the open during daylight hours, especially near *dalit* homes. He writes:

> All the women of the village, young girls, older women, even the newly married brides, would sit in the open space behind these homes at the edges of the pond to take a shit. Not just under the cover of darkness but even in daylight. The purdah-observing *Tyagi* women, their faces covered with their saris, shawls around their shoulders, found relief in this open-air latrine. They sat on [the shores of the village pond] without worrying about decency, exposing their private parts (1).

Although some of our respondents cite protecting the "dignity" of young women as their primary reason for building a latrine, and although most government slogans use the apparent contradiction between practices that enforce women's modesty, such as *pardah* and *ghoonghat*, and open defecation to try to promote latrine use, most respondents find nothing objectionable about open defecation, whether it is practiced by men or by women. There are, however, important gender and age dimensions of open defecation, which we will discuss further below. The attitudes of young women, in particular, towards open defecation are mixed. In some households, young women are expected to defecate in the open during non-daylight hours, or to be accompanied by another family member; these restrictions can be

[19] We found exceptions to this rule in some villages in Gujarat and Haryana where most people had latrines and villages were urbanizing quickly.

[20] Babies and children up to four or five years old defecate in their own houses and in the village without social consequences.

quite burdensome and in such situations young women tend to find latrines highly desirable. In other households, young women report enjoying the social aspects of open defecation, and the temporary freedom it provides them. One of four daughters-in-law in a *dalit* household in Haryana which owns a latrine explained, "The reason that we go outside [to defecate] is that we get to wander a bit...you know, we live cooped up inside."

For most of the men and women we interviewed, and especially for middle-aged and older people, open defecation is saliently linked to health, longevity and strength. The mother-in-law of the four young women in Haryana explains why people many people defecate in the open despite owning a latrine:

> People go outside for this reason, I'll tell you why...people say, I'll take a walk outside, so if there is any illness, it will get some open air, don't you think? The stomach's fullness also reduces a bit, and walking also makes [blood flow in the veins]...brother, a person who can walk will go out in the open, a person who cannot walk will remain on his cot.

Men placed even greater stress on the benefits of open defecation, perhaps because open defecation is seen as promoting and signaling traits important for masculinity, such as strength and vigor. Although defecation is inherently polluting for bodies, enacting a morning routine that involves rising early, taking a walk, defecating in the open, and taking a bath is associated with the purity of the body (see Padfield (1896); Kapur (1988)). An older, *dalit* man from Haryana who had used latrines in the Indian army, and who built a latrine for his daughters-in-law and grandchildren to use, but who defecates in the open explains:

> I do not want to go inside the latrine... one benefit of going out in open is that one can have some exercise and the second is that all the impurities of ones breath get out...but if one eats and drinks and goes to the latrine in the house one would not live long.... this is the reason why people in the villages live long – for 100 years – and the people in the cities live only 60, 70, 80 or 85 years.

Here open defecation is described as an act that promotes the purity of the body, as well as longevity and health. These sentiments are echoed by others who stress the wholesomeness of morning routines that involve open defecation, and who feel that defecating in the house is "dangerous" for bodies. A young middle-caste man in Parsa, Nepal explains:

> People here do not use latrines. They said that we'll go early in the morning...There are orchards, there are mango trees all around. When they go there early in the morning before sunrise, when they go to defecate early in the morning, at four in the morning, waking up at four in the morning, at four...then getting up while it is still dark everyone gets some fresh air as well...Some five to ten people in the village have latrines but they do not use them because people only use latrines who are sick and so are not able to go out and defecate in the open. Only in such a condition does a man use a latrine. Otherwise you should comfortably go, comfortably go and take in the clean outdoor environment, take in some fresh air, and then return home. Village men are strong because they work in the fields and because there they also get fresh air. If you have a latrine, and a place for bathing, and you defecate in your house, and you do not take a walk anywhere, you do not get out, then you will have pains in your body.

The importance of discipline and routine in the context of defecation behavior is also discussed by Alter (2011). His study of Hindu wrestlers in north India discusses links among masculinity, health, and hygiene, and points towards a coherence in understandings of the body among the domains he analyzes and the beliefs about open defecation that we document. We find that ideas about taking a walk, exposing oneself to fresh air, and defecating in the open as ways to promote the body's purity and strength are especially important for Hindu men, but that associations between open defecation and good health cross caste, age, religious, and geographic boundaries.

Hindus & Muslims

If Hindu culture importantly influences defecation behavior in rural India, we would expect to find differences in defecation-related beliefs and behaviors between Indian Hindus and Indian Muslims. Indeed, rural Muslim households in India are 19 percentage points less likely to defecate in the open than rural Hindu households, despite the fact that they are poorer on average.[21] Nationally representative data, as well as our own quantitative data on latrine use, show differences between Hindus' and Muslims' sanitation behaviors, which suggest differences in attitudes and beliefs between religious groups. The differences that we observe provide further evidence that ideas about purity and pollution rooted in Hinduism help explain widespread open defecation in rural India.

Rural Muslims are not only more likely than rural Hindus to own latrines, but that they are also more likely to own simple latrines. India's 2005 DHS found that only 4% of rural Hindus used simple pit latrines, compared to 15% of rural Muslims. If Hindus understand the presence of simple pit latrines to be polluting, and if, as Jeffery (1997) and Ali (2002) suggest, Muslims often practice purity and pollution differently than Hindus, it makes sense that rural Indian Muslims would be more likely to construct simple, inexpensive pit latrines.

Muslims are also more likely to use the latrines that they own. Figure 2 uses data from the SQUAT survey to show the fraction of people who regularly defecate in the open, conditional on latrine ownership. We break up these results into four groups: Muslims who own privately constructed latrines, Muslims who own government provided latrines, Hindus who own privately constructed latrines, and Hindus who own government latrines. Because it is so common to find government latrines or government-provided latrine parts that are not in use, we only include latrines that at least one person is using among "owned" latrines.

[21] This statistics is computed from India's 2005 DHS. Geruso and Spears (2013) find that the difference between Muslim and Hindu infants' exposure to open defecation in their primary sampling units fully accounts for the "Muslim mortality paradox" that 14 per 1000 more Muslim babies than Hindu babies survive infancy despite worse economic circumstances.

For both government and privately constructed latrines, Muslims are less likely to defecate in the open conditional on latrine ownership than Hindus. Further, there is a large gap between the fraction of Hindus who use a privately constructed latrine, and the fraction who use a government constructed latrine; this gap is not present for Muslims. This figure is consistent with a story in which Hindus are more concerned about pit emptying than Muslims.

Muslim participants in our qualitative study are often aware of differences in open defecation and latrine use between the two groups. An older Muslim woman in Uttar Pradesh who owns and uses a latrine explains:

> The way of life varies from place to place. For all the Muslims it is fine [to use a latrine]. But Hindus are always headed outside to defecate in the open... only they know why they do this. *[Her son then interjected, suggesting that open defecation among Hindus is less widely practiced than it once was. However, the woman objected, saying:]* It's not that it is something that's left over from the old days! Even if Hindus have made a latrine, still they go out to defecate in the open. Now for our people [Muslims], it's not a problem [to use a latrine]. If we have a latrine in the house, we will use it.

It is important to note, however, that relative to Muslims in other parts of the developing world, Muslims in rural India are nevertheless relatively unlikely to build and use latrines. According to DHS data, 41% of rural Indian Muslim households use latrines. This contrasts with 86% of rural Muslim households in neighboring Bangladesh (2012 DHS) and 66% of rural Muslim households in Nigeria (2008 DHS). We hypothesize that the differences in latrine ownership between rural Muslims in India and in other parts of the world reflect the fact that rural Indian Muslims live amongst a Hindu majority for whom open defecation is normative, and for whom simple latrines are counternormative. Indeed, several of the Muslims respondents to our qualitative interviews expressed views about latrine ownership and use that mirrored the views of the Hindu majority. For instance, a young Muslim woman in Uttar Pradesh, who owns a latrine explains why she sometimes defecates in the open:

> "In the summer, you can get some fresh air, and some peacefulness [when you defecate in the open.] If you're cooped up in the house all day, then you go outside and your mind and body get refreshed. There is this benefit of going outside [to defecate]."

Understanding the latrines that exist & their use

We have shown why simple latrines of the sort that are used to reduce open defecation and improve the disease environment in other parts of the developing world are not socially acceptable in rural India: they introduce ritual impurity into private spaces that should be kept ritually pure. Further, the manual emptying of latrine pits presents special challenges due to India's history of caste-based oppression. As a result of the subjective need to construct a very large latrine pits, rural Indians have an expensive idea of what constitutes a minimally acceptable latrine.[22] Here, we argue that the expensive latrines with large pits that we do observe in rural areas, and the ways in which they are used by the households that own them, ultimately reinforce the practice of open defecation among the many rural poor.

Latrine ownership is for the wealthiest people

Although some conservative rural Hindus find latrines of any sort distasteful, most people feel that an expensive latrine with a very large pit or septic tank is not polluting, but instead is a useful asset. It is an appropriate, although not necessary, addition to a house that is made out of bricks and cement, and already has rooms for other purposes, such as cooking, sleeping, and bathing.[23] These latrines are considered convenient for occasions when someone

[22]Indeed, we asked respondents in the quantitative study to estimate the cost, part by part, of a minimally acceptable latrine, they estimated that it would cost, on average, 21,000 rupees, or US$350 dollars at exchange rates, to construct a latrine worth using. See Coffey et al. (2014) for further details.

[23]Only one of 65 households that had a member who switched from open defecation to regular latrine had a house that was completely *kaccha*, that is made out of temporary or impermanent materials. In

has diarrhea; at night when it is difficult to walk far from the house; or when the household has an elderly or handicapped member who cannot defecate in the open. Due to their cost, these latrines are considered a luxury item that only wealthy people can afford.

National data for rural India supports these qualitative findings. Over the last 20 years, significant improvements have been made to rural houses, but that similarly widespread investments have not been made in latrines. India's 1991 census found that 40% of rural houses had permanent, or *pacca*, walls, and 21% of rural houses had permanent rooves. By 2001, 58% had permanent walls, and 61% had permanent rooves. However, by 2001, 30% of rural households owned latrines, compared to 9% in 1991. Increasingly, many rural Indians can afford both permanent houses and latrines, especially simple ones, but are far more likely to invest in houses.

The high cost of constructing a suitably large latrine pit contributes to the slow adoption of latrines. Our interviews suggest that the way in which a small group of wealthy and influential villagers build latrines reinforces open defecation among the many poor, who cannot afford such expensive latrines. The adoption of only expensive latrines with large pits, but not of more affordable latrines, reflects Srinivas's (2003) observation that part of what it means to demonstrate upward mobility in Indian villages is to adopt more intense practices of purity and pollution.

Awareness of others' expensive latrines with large pits influences how poor people interpret their own sanitation options. A *dalit* woman who we interviewed in Uttar Pradesh received a simple, usable latrine from the government; her two small children use it regularly. The latrine was clearly convenient for her: she did not have to worry about her young children walking far from the house, and she did not have to clean up their feces, which

this household, the latrine was made by a young man, who otherwise worked as a mason, for his elderly grandfather who had become too weak to defecate in the open. The elderly man was grateful for the latrine, but ashamed that he was no longer able to defecate in the open, and that his family had gone to considerable expense to construct a latrine for him. Despite the fact that the household was poor, and their house made out of mud, the latrine was made out of bricks and cement, and had a large pit and an attached bathroom.

would otherwise be left in the outdoor area in front of her house. Yet, she said that she had not wanted to accept the latrine; she only did so because the village leader had not given her a choice. She said that the children would stop using the latrine when they were old enough to defecate in the open unaccompanied. Despite the fact that latrine was functional and convenient, she viewed it with contempt and shame. She explains why:

> The *pradhan* made this [latrine]. If we'd made it, we'd have made it the way we wanted. All of this *Indira Vikas* money has come, so the *pradhan* has made it. But he only got a very little pit dug. If we made it the way we wanted, then wouldn't we have used a whole room full of bricks? How can a poor man...? It costs 20 or 25 thousand rupees to [make a latrine].

The "room full of bricks" to which the woman refers, and which she could not afford, is the pit. She, and many other respondents, likens the investment that would be needed to build an acceptable latrine pit to the investment that would be needed to build an extra room for a house.

The expense required to make a latrine with a large pit, together with the social acceptability of open defecation, imply that it makes little sense for poor people to construct and use latrines. Using the language of physical uncleanliness to refer also to ritual uncleanliness, a wealthy middle-caste man in Gujarat who owns two latrines with large pits explains why he does not expect his poorer neighbors, who belong to a marginalized *Adivasi* group, to build latrines, or even to use the latrines they receive from the government:

> "The [latrines] that you get from the government are no use, they are so small...their pits are so small that in two or three months they will fill up. There will be bad smells and filth in the surroundings. For *Adivasi* people, who don't have much land, wouldn't they make a house rather than a latrine? [If they made latrines] it would be dirty."

Latrine use is for weak people

Not only does the way in which latrines are constructed in villages reinforce open defecation among the many poor, so does the way in which they are typically used. Figure 3 uses data from the qualitative interviews to plot open defecation by sex and age group among individuals living in households that own a latrine. We find that, at all ages, men are less likely to use an available latrine than women, and that the people who are most likely to use latrines are those with the least decision making authority in the household: young women and elderly people. The demographic groups with the most decision making authority in rural households – middle-aged and senior men – are the groups which are most likely to defecate in the open conditional on owning a latrine.

We were repeatedly told that latrine use is appropriate for the lowest ranked members of rural households: elderly people, young children, pregnant women, and the disabled. A middle-aged woman in Haryana talks about why her family built a latrine:

> For the old people, like this old lady [signaling her mother-in-law] she couldn't walk, so we made [the latrine] for her...where would this old lady go? And for little kids, or if a woman has given birth and she can't go outside. After a baby is born she will defecate inside the house.

It is common knowledge that many men who own latrines do not use them, and in many of the villages we visited, latrine owners and non-latrine owners alike share the view that people who have no physical problems walking long distances and no social constraints keeping them near the home would find it preferable to defecate in the open. A young *dalit* man whose household had received funds for a government latrine, but had not built one, explained: "We have the fields and the jungle, which are good...here people who can walk go there. Those who can't walk will use latrines. We can walk to the fields, so we go there."

Because latrines are most likely to be used by the household members with the least economic decision-making power, they are generally not investment priorities. Building a

latrine may become a priority when it is forced by a newly developed weakness: advancing age, injury, or the restrictions governing a daughter-in-law who has recently moved into the household. But these very weaknesses remind people that latrines and latrine use are not everyday necessities, but occasional conveniences that only the wealthy can afford. When wealthy, high-status men who own latrines are seen choosing to defecate in the open despite owing a latrine, they publicly reinforce open defecation as the desirable choice for the strong.

Discussion

Despite the importance of rural sanitation for India's health transition, there has been relatively little scholarly work on India's sanitation puzzle: why is open defecation in rural India is so much higher than in countries with similar or worse economic conditions, literacy rates, and drinking water access? We use new qualitative and quantitative data from multiple sites across north India to shed light on the cultural reasons for widespread open defecation. We present a coherent analysis of the meanings of latrine use and open defecation, and show how the simple pit latrines that are used to reduce disease transmission in other developing countries are seen as ritually polluting and socially undesirable. India's history of caste-based oppression and present-day struggles for caste equality mean that latrine pit emptying poses special challenges that are not similarly present in other societies. Further, we find that open defecation is understood to help reduce personal bodily pollution associated with the act of defecation, and that it is associated with good health, wholesomeness, and masculine strength.

Despite the importance of culture for rural India's sanitation crisis, the government has done little to try to change the meanings of latrine use and open defecation in villages. Sanitation policy focuses almost exclusively on constructing the kinds of simple latrines that villagers reject. It is clear that constructing these latrines without achieving changes in the

cultural meanings of latrine use and open defecation will do little to reduce open defecation among the majority of north Indian villagers.

This paper has also outlined some reasons why attitudes and beliefs about latrines and latrine use in rural India will be especially difficult to change. The village elite has already defined an acceptable latrine as an expensive investment that is out of reach for most poor people. Affordable pit latrines require pit emptying, an unthinkable task for caste Hindus, and one that for rural *dalits* is symbol of an ongoing struggle for social equality. Further, those individuals for whom latrine use is considered most appropriate are those who have the least decision making power in rigid household hierarchies. These findings, and the uniqueness of rural Indian understandings of pollution and caste, imply that sanitation behavior change programs developed for other cultural contexts are unlikely to be successful if transplanted to rural north India.

Economic growth may allow more rural Indian households to switch from open defecation to expensive latrines with large pits in the next several decades. In the meantime, however, open defecation poses a major, and in many cases growing,[24] threat to health in rural India, and particularly to the health and human capital accumulation of children. Future research should explore the extent to which efforts to promote changes in the meanings of latrine use and open defecation would allow rural Indians to enjoy the same public health benefits of simple latrines that are enjoyed in other developing countries.

[24]Spears (2014) finds that most people in India live in a district in which the population density of people practicing open defecation increased between the 2001 and the 2011 censuses.

Appendix: Data and methodology

This paper draws on both qualitative and quantitative data collected in six states in north India, and in Parsa district in the terai region of Nepal. The survey design, sampling, and summary statistics for the quantitative SQUAT survey have been described in Coffey et al. (2014). Here we describe the collection and analysis of the qualitative interviews that are the primary source of empirical data for this paper.

We conducted 65 semi-structured interviews with households in which at least one member adopted latrine use in the past 10 years, and 35 interviews with households in which every member defecates in the open. The interviews covered a variety of topics, including respondents' views on latrine ownership and use; open defecation; who in the household uses the latrine and why; the decision to make a latrine; the design of the latrine and the cost; and whether government or other organizations played a role in motivating the household or in constructing the latrine. The sampling strategy used to select households involved choosing regions, districts, villages, and households. Within households we interviewed adults who reported having decision-making authority about large household purchases. Other family members were encouraged to join the conversation and often did so. Table 2 presents region-specific information about the interviews and the respondents.

Purposive sampling. Interviews were conducted in four regions in northern India and southern Nepal; three regions are Indian states, the fourth is the terai region of Nepal.[25] We selected the Indian states of Haryana, Gujarat and Uttar Pradesh by comparing north Indian states' 2005 GDP per capita and change in rural latrine coverage between 2001 and 2011. Haryana is a relatively wealthy state that made more progress than other states on improving latrine coverage between 2001 and 2011; Gujarat is a relatively wealth state that made relatively less progress on improving latrine coverage between 2001 and 2011; Uttar

[25]The largest administrative division of Nepal breaks the country into "mountains," "hills," and "terai."

Pradesh is a poorer states that made relatively little progress on latrine coverage between 2001 and 2011. We also visited the terai region of southern Nepal because it has a similar 2005 GDP per capita to Uttar Pradesh, but is making better progress building latrines than any similarly poor north Indian state. Despite these differences, we find that attitudes, beliefs, norms and practices towards latrines and latrine use in these four regions have much in common.

In each region or state, we visited the district in which the rate of improvement in latrine coverage between 2001 and 2011 most closely matched the improvement in latrine coverage in the region or state as a whole during this period. In Indian districts, we selected *gram panchayats* (GPs) from a list of GP names that was used as the sampling frame for the District Level Household Survey, 2004 (DLHS-2). The GP is the lowest level of rural government administration in India. We visited those GPs in which the estimated village level 2004 latrine coverage most closely matched the 2004 district level latrine coverage from the DLHS-2. Where a selected GP contained more than one village, or hamlet, we selected households from the village whose name matched the name of the village of the DLHS-2 sampling list; this was often the largest village. In Nepal, where no district level sample survey is available, we selected villages randomly from a list of census villages.

In each village, we completed between 4 and 6 household interviews. We selected households using an in-field randomization procedure similar to the one used by PRATHAM to conduct the ASER surveys.[26] If no one was home in the selected household, if household members refused to participate, or if we had already interviewed enough households of that household's type (open defecators vs. households in which at least one member switched to

[26]We began by walking around the village and drawing a map that divided the village into between four and six sections. We then randomly selected which section to visit first. After each interview, we randomly selected a new section to visit, subject to the constraint that we did not visit a section twice until we had done at least one interview in each section. In the approximate center of each section, we spun a spinner which indicated the direction we would proceed. We then consulted a random number sheet that indicated whether we should start from the center of the section or the edge, and how many households to pass before stopping at a household and requesting an interview.

latrine use in the past 10 years) in that village, we knocked on each door to the selected household's right until we found an appropriate household to interview. Table 3 presents summary statistics about the number of households approached as we followed this sampling strategy.

Within households, we interviewed adult decision makers. In joint households, this was often an older man, but we also interviewed women and younger men if they reported being involved in either deciding to invest in a latrine, or, if they did not own a latrine, in other large purchases. We conducted an interview only if such a person were at home and available. Table 3 also presents information on the number of households for which a decision maker was not available, as well as the number of households which we screened but did not interview because they had been using a latrine for more than 10 years, or were locked, abandoned, or occupied by renters.[27]

Semi-structured interviewing. To facilitate semi-structured interviewing, we used an interview guide that listed the themes to be discussed. The interview guide was piloted in Sitapur district of Uttar Pradesh, is available online at www.riceinstitute.org. The interview had qualitative and quantitative components; the quantitative components included a household roster which asked about age, sex, education, occupation and latrine use for each person individually, a two page questionnaire based on an observation of the latrine, and an asset list. We conducted interviews in groups of two or three interviewers; these almost always included at least one male and one female interviewer. We asked mainly open-ended questions and encouraged respondents to give in-depth responses. We placed special emphasis on developing a rapport with respondents; for each interview we had an initial conversation about the construction of the respondent's house which allowed us to gain his or her trust

[27]We encountered renters only in only one village in Gujarat. In this villages, people from poorer parts of India rented small rooms and worked in nearby factories. Landlords had built blocks of latrines for people living in these rooms. We did not complete interviews among these renters because we were interested in people who had made active decisions to use latrines.

and clarify our purpose in conducting the interview before talking about defecation behavior. 87 out of 100 interviews were recorded to facilitate data analysis. When a respondent declined to have the interview recorded, we conducted the interview nevertheless, taking more detailed written notes. Interviews lasted between one and two hours. Ethical approval for the study was obtained from Princeton University's Institutional Review Board (IRB).

Data analysis. Piloting, interviewing, and primary data analysis were done over a period of nine months. After each day of interviewing, authors met to discuss the day's interviews. We tried to reach consensus about why the households that had built latrines did so. Based on the recording and notes taken on the discussion guides, one of the authors completed a detailed summary for each interview. These were then read and reviewed by the other authors, and in many cases, the authors listened to one another's recorded interviews as well. Meeting about, writing, and reviewing summaries from early interviews allowed us to identify themes, develop hypotheses, and test those hypotheses in future interviews. We changed the interview guide in small ways over time to accommodate new questions and ideas. We also kept tabulations related to the themes that arose during the interviews. For example, some of the tabulations related to primary reasons for building latrines, for using them, views of the health benefits of open defecation, and whether anyone in the household objected to owning a latrine. Before writing, the authors met to outline the paper, and identify open questions. We did several informal interviews in Uttar Pradesh, Rajasthan and Bihar to follow up on key areas of interest, especially the caste dimensions of pit emptying.

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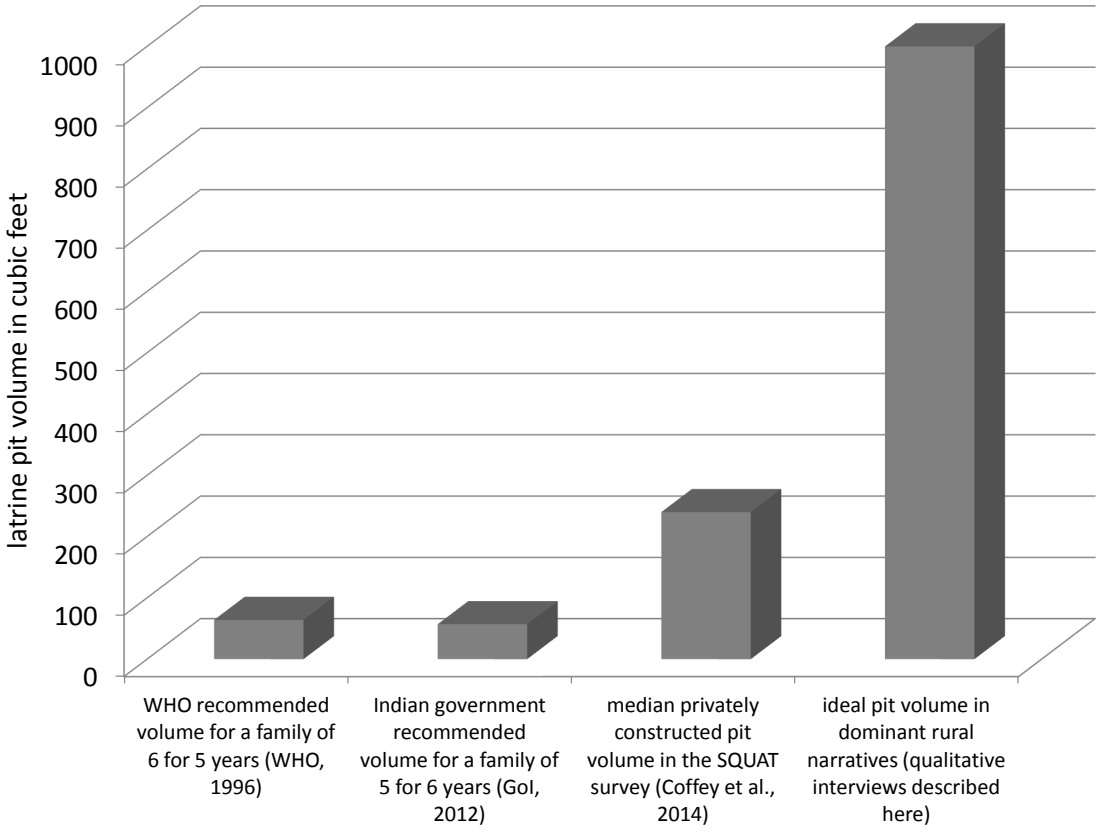

Figure 1: Latrine pit volume in comparative perspective

Table 1: International comparisons

indicator	open defecation	rural open defecation	rural drinking water access	GDP/capita (US $)
source	JMP, 2012	JMP, 2012	JMP, 2012	World Bank, 2012
south Asia				
all south Asia	38.1	52.5	89.3	4,666
India	48.3	65.0	90.7	5,050
Pakistan	23.1	34.3	89.0	4,360
Bangladesh	2.5	3.5	84.4	2,364
sub-Saharan Africa				
all sub-Saharan Africa	24.9	34.4	52.5	3,263
Nigeria	23.0	31.5	49.1	5,291
south east Asia				
all south east Asia	12.5	17.1	84.7	9,446
Indonesia	21.9	30.7	76.4	8,855

indicator	poverty HCR ($1.25/day)	poverty HCR ($2/day)	literacy rate among women	literacy rate among men
source	World Bank, mult. years	World Bank, mult. years	World Bank, mult. years	World Bank, mult. years
south Asia				
all south Asia	24.8	60.4	50.1	72.7
India	24.7	60.6	50.8	75.2
Pakistan	12.7	50.7	42.0	67.0
Bangladesh	43.3	76.5	55.1	62.5
sub-Saharan Africa				
all sub-Saharan Africa	40.7	62.7	49.0	69.1
Nigeria	62.0	82.2	41.4	61.3
south east Asia				
all south east Asia	18.1	58.2	91.0	95.1
Indonesia	16.2	43.3	90.1	95.6

JMP figures are from the WHO-Unicef Joint Monitoring Report, 2012. World Bank figures are taken from the World Bank Development Indicators series, available at www.data.worldbank.org. For all indicators, regional estimates are computed without Myanmar and Somalia, for which data are missing. Literacy rates for sub-Saharan Africa do not include Ethiopia, Sudan, or south Sudan; these data are missing. Brunei, Singapore, Eritrea, Equatorial Guinea and south Sudan are not included in regional poverty estimates due to missing data.

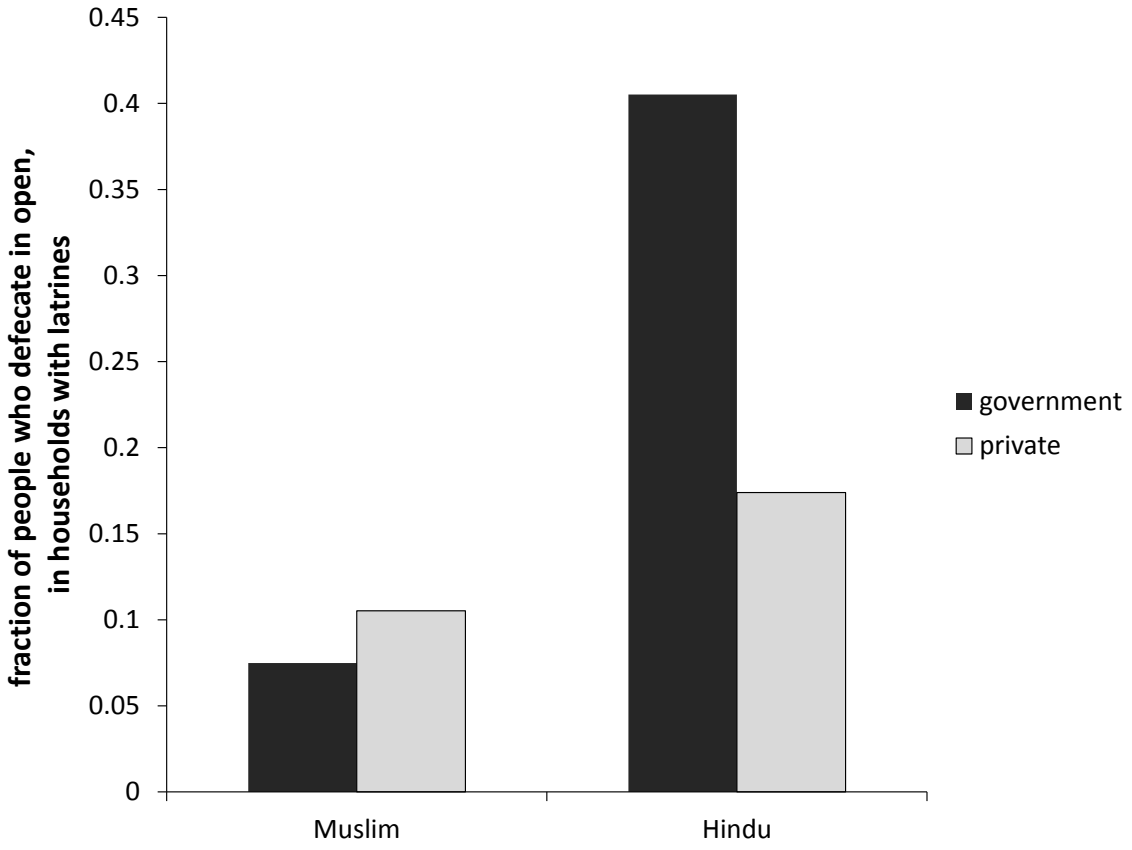

Figure 2: Latrine use among people in households with latrines, by religion & latrine type

Latrine use computed using data from the SQUAT survey (Coffey et al., 2014).

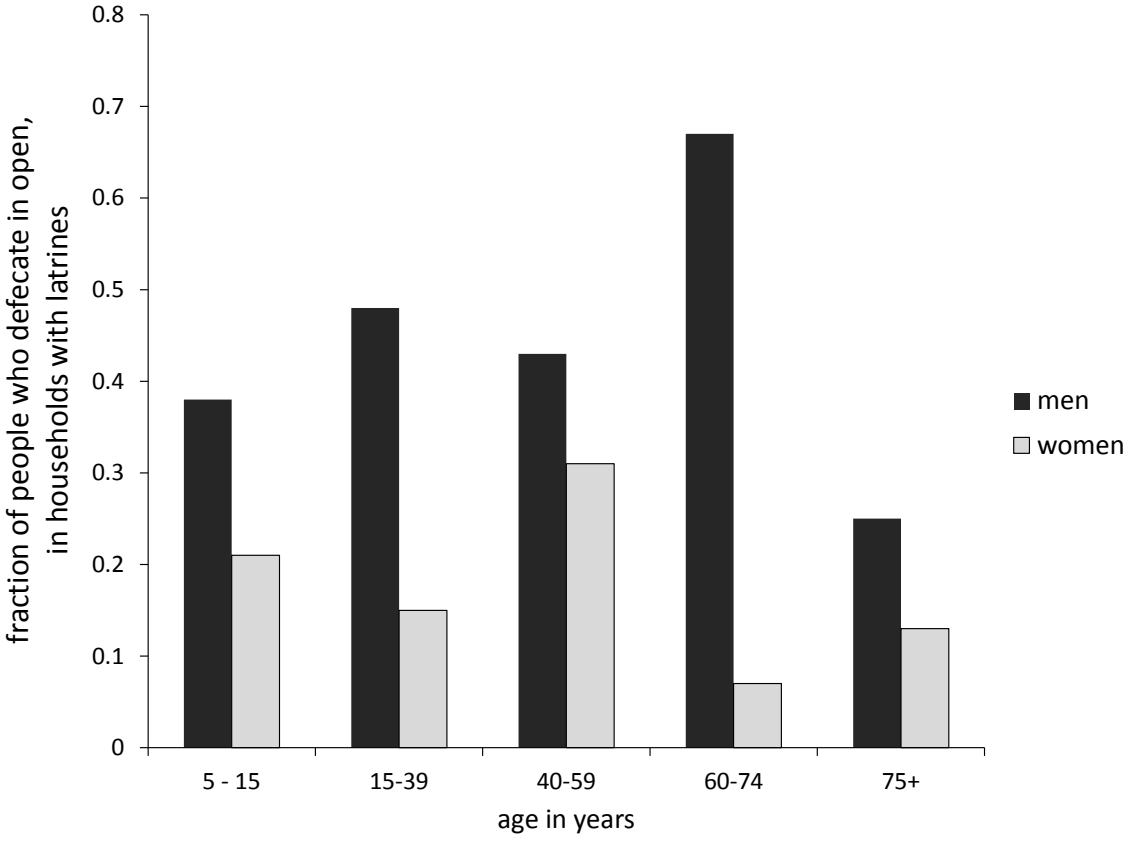

Figure 3: Latrine use among people in households with latrines, by sex & age

Latrine use computed using data from qualitative interviews. See the Appendix for more information about these data.

Figure 4: Appendix figure: Map of districts visited for qualitative interviews

Table 2: Appendix table: Households and respondents in the qualitative study

	no. of villages visited	total no. of households interviewed	households in which all members defecate in open	households in which at least one person uses a latrine	no. of households with multiple respondents
Rewari, Haryana	4	24	10	14	14
Fatepur, Uttar Pradesh	5	25	8	17	15
Valsad, Gujarat	5	29	9	20	17
Parsa, Nepal	4	22	7	15	14

	no. of households in which primary respondent is male (18-40)	no. of households in which primary respondent is male (40+)	no. of households in which primary respondent is female (18-40)	no. of households in which primary respondent is female (40+)
Rewari, Haryana	4	9	4	7
Fatepur, Uttar Pradesh	9	7	5	4
Valsad, Gujarat	8	5	3	13
Parsa, Nepal	6	11	2	5

Table 3: Appendix table: Households and respondents in the qualitative study

	all defecate in open	at least one latrine user
households approached	348	111
completed interviews	35	65
partial interviews	2	2
refusal	6	24
decision maker not available	11	18
no longer needed that type of interview in village	294	2
using a latrine for more than 10 years	107	
locked/renting	82	