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Social network predictors of latrine ownership

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ABSTRACT

Poor sanitation, including the lack of clean functioning toilets, is a major factor contributing to morbidity and mortality from infectious diseases in the developing world.

We examine correlates of latrine ownership in rural India with a focus on social network predictors. Participants from 75 villages provided the names of their social contacts as well as their own relevant demographic and household characteristics. Using these measures, we test whether the latrine ownership of an individual's social contacts is a significant predictor of individual latrine ownership. We also investigate whether network centrality significantly predicts latrine ownership, and if so, whether it moderates the relationship between the latrine ownership of the individual and that of her social contacts.

Our results show that, controlling for the standard predictors of latrine ownership such as caste, education, and income, individuals are more likely to own latrines if their social contacts own latrines. Interaction models suggest that this relationship is stronger among those of the same caste, the same education, and those with stronger social ties. We also find that more central individuals are more likely to own latrines, but the correlation in latrine ownership between social contacts is strongest among individuals on the periphery of the network.

Although more data is needed to determine how much the clustering of latrine ownership may be caused by social influence, the results here suggest that interventions designed to promote latrine ownership should consider focusing on those at the periphery of the network. The reason is that they are 1) less likely to own latrines and 2) more likely to exhibit the same behavior as their social contacts, possibly as a result of the spread of latrine adoption from one person to another.

1. Background and significance

1.1. The problem of sanitation

Diarrheal diseases are one of the most common causes of death for children under the age of 5, with almost 50% of those deaths occurring in India, Nigeria, Pakistan, Democratic Republic of Congo, and China (Black et al., 2010). Poor sanitation, including the lack of clean functioning toilets, is a major factor contributing to these outcomes (Fewtrell et al., 2005; Pruss et al., 2002) and increasing access to sanitation is an important part of the Millennium Development Goals (MDG) (WHO and UNICEF, 2006). Exposed fecal matter pollutes ground water, drinking water, soil, and food sources (Bonu and Kim, 2009). Besides its contribution to morbidity and mortality due to diarrheal diseases, exposed fecal matter also spreads diseases like typhoid and parasitic infections caused by worms (Nath, 2003).

Not surprisingly, research shows that increasing access to latrines is a significant way to decrease diarrheal morbidity for children under 5 in India (Kumar and Vollmer, 2011), although, importantly, the effect of a child's individual household latrine ownership is relatively insignificant compared to the effect of increasing community-wide latrine ownership. For instance an analysis by Spears found that open defecation accounts for much of the childhood stunting in India (Spears, 2013). In some ways, latrine ownership is a classic network good, creating positive externalities for others beyond the actual owner and user. However, for an individual latrine user, the results of those positive externalities (i.e. lower rates of diarrhea and other fecal-transmitted infectious diseases, lower rates of stunting) may be hard to observe and/or hard to attribute to the proportion of her village that uses latrines, and

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therefore the spread of latrines may rely more on the change of normative influences than on the observed health benefits of adoption.

Although India has made considerable progress in increasing the number of latrines around the country, close to 74% of the population still defecates in the open (Bonu and Kim, 2009). Rural access to latrines in the south Indian state of Karnataka, from which the data for this study was collected, is consistent with that of the rest of the country. While approximately 75% of urban households have access to latrines, only 17% of those in rural areas have access (Baligar, 2006), although government-sponsored latrine building campaigns in the last decade have increased that number to approximately 30% through some areas of the state (Meenakshisundaram, 2008).

Socio-economic predictors of household latrine ownership in India are not unexpected. Besides living in an urban area, those with the most education and highest incomes are the most likely to have latrines (Bonu and Kim, 2009; Dickinson and Pattanayak, 2012; Veerashekharappa and Bhide, 2009). These factors affect both the resources to build a latrine as well as the exposure to, and understanding of, reasons why having a latrine would be beneficial. Caste may also serve as a proxy for many of these factors (Bonu and Kim, 2009). Those of the scheduled castes and scheduled tribe groups have historically been marginalized both socially and economically, and, consistent with these characteristics, they are the groups least likely to own latrines (Bonu and Kim, 2009; Veerashekharappa and Bhide, 2009). It has been suggested, however, that these groups are also geographically stymied with respect to latrine ownership given housing situations with little access to the kind of drainage necessary for a properly functioning latrine (Bonu and Kim, 2009). In some areas, it has also been found that Hindus are less likely to own latrines, as they believe that latrines situated close to their residences are polluting and find the latrines themselves "disgusting" (Meenakshisundaram, 2008).

More nuanced studies have found that, even controlling for more obvious demographic factors, social norms and social expectations may drive latrine building decisions (Pattanayak et al., 2009). For instance, results from a qualitative study in Benin highlighted the fact that latrine-building decisions were primarily rooted in motivations such as prestige, and had little to do with concerns regarding health (Jenkins and Curtis, 2005). Indian villagers have reported preferring open defecation because it allows people the chance to chat together, or because it is a time honored custom in their community (Dickinson and Pattanayak, 2012). Results from a study assessing the effects of Community Led Total Sanitation (CLTS) demonstrated that galvanizing entire communities was a necessary aspect of a latrine adoption campaign, and that the adoption decisions of the entire community were one of the strongest influences in a household's decision to build a latrine (Dickinson and Pattanayak, 2012). The most successful latrine building campaigns have been those initiated by CLTS that successfully shift the norms of the community towards intolerance of open defecation, and that foster community willingness to invest in building latrines (Dyalchand et al., 2008). While the Indian government has increased its efforts to provide latrine coverage for the nation, modeling its programs after CLTS, it has been unsuccessful at achieving positive results for those living in the most poverty, those belonging to marginalized castes, and those living in rural areas (Bonu and Kim, 2009). Government subsidies for building latrines have been largely unsuccessful as deeper social forces, including caste-based social divides, seem to affect the adoption of latrines within communities (Chambers, 2009; Lamba and Spears, 2013). Pattanayak et al. (2009) have found, in fact, that for those above the poverty line, social shaming is a more economical and efficacious strategy for promoting latrine adoption than the use of subsidies, although monetary support may be necessary for those below the poverty line.

1.2. Perspectives on social effects

Research on social norms has highlighted the difference between "descriptive norms", which are prevalent behaviors within a community, and "injunctive norms" or norms that are enforced within a community through sanctions – either positive sanctions for behaving within normative expectations, or negative sanctions for normative violations (Cialdini et al., 1991; Lapinski and Rimal, 2005). As new norms begin to become entrenched in a community, there is often a tipping point, or a point at which a high enough proportion of the population has adopted the new process that from there on it begins to spread more rapidly, such that it may seem like an instantaneous change (Burke and Young, 2009; Sunstein, 1996).

In some developing world communities, the practice of open defecation may be simply a descriptive norm, and persist because it is commonly practiced. In other areas, however the practice may be an injunctive norm, and those who attempt to transgress may be ridiculed or criticized. For instance, researchers in Kenya discovered that normative taboos around defecation include the belief that the feces of a father-in-law and daughter-in-law should not mix together, and therefore open defecation is a means by which this restriction is protected (Bwire, 2010). In order to discourage people from practicing open defecation, programs such as CLTS are attempting to foster injunctive norms to create an atmosphere of shame for those who defect from appropriate sanitation practices (Dyalchand et al., 2008). With this strategy, community members who defecate in the open receive negative sanctions, such as ridicule and public shaming. Villages are encouraged to be "open-defecation free", a process that requires all of the members of a community to change their behavior as well as monitor the behavior of others.

Social contagion, a term which refers to the mechanism by which social behaviors can diffuse through a population, can differ according to the type of norm held in place. *Social learning* is more likely to take place in the context of descriptive norms, when individuals observe others engaging in a behavior which seems beneficial, such as having a latrine for their household (Kohler et al., 2001; Montgomery and Casterline, 1996). The fact that others have taken the risk to engage in the behavior and seem to be accruing benefits from it makes it easier for the individual to adopt the behavior themselves. On the other hand, *social influence* processes are those that occur when behaviors are encouraged or constrained due to injunctive norms. The CLTS programs are designed with the idea that social influence dynamics can be cultivated in order to abolish the practice of open defecation within villages. Individuals are afraid to defect because to do so would risk the disapprobation of those in their social networks.

Social network analysis can be used to elucidate some of the nuances of these processes. Research on networks has suggested that many behavioral processes are in fact the function of network dynamics. Broadly speaking, two main network mechanisms can impact the behavioral decision of any individual: connection and contagion.

Contagion occurs when information or behaviors spread through a network from individual to individual. Recent research on network contagion has suggested that a wide variety of health-related and social behaviors and outcomes may spread from person to person through social networks in both observational and experimental settings (Christakis and Fowler, 2007, 2012; Fowler and Christakis, 2010; Rosenquist et al., 2010). These dynamics have been observed up to three degrees of separation, and they may

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