Legal Status and Deprivation in Urban Slums over Two Decades

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Abstract

In India, 59% of urban slums are "non-notified" or lack legal recognition by the government. We use data on 2,901 slums from four waves of the National Sample Survey spanning nearly 20 years to assess the relationship between a slum's legal status and the severity of deprivation in access to basic services, including piped water, latrines, and electricity. Our analysis reveals a progressive reduction in deprivation the longer that a slum has been notified. These findings suggest that legally recognizing non-notified slums and targeting government aid to these settlements may be crucial for improving health outcomes and diminishing urban disparities.

Keywords

slums; legal status; notified; deprivation; basic services; health; water; sanitation; India

1 Introduction

In India, 52–98 million people live in urban slums (Census of India 2013; Millennium Development Goals database 2014). India's slum population has substantially poorer health outcomes compared with its non-slum urban population (Gupta et al. 2009). Variability also exists in the severity of deprivation among different types of slums, which may result in differences in health outcomes for different settlements within the same city (Agarwal and Taneja 2005; Osrin et al. 2011; Subbaraman et al. 2012). One source of this variability is a legal divide between notified slums, which are formally recognized by the government, and non-notified slums, which lack legal recognition. About 59% of Indian slum settlements are non-notified, while 37% of slum households are non-notified because non-notified slums have a smaller average population size (National Sample Survey Organization 2013).

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In some states, notified status confers basic security of tenure, such as the right to rehabilitation in the event of displacement for development projects (Murthy 2012). In addition, notification is often required to access city services, such as water supply and sanitation infrastructure, which may contribute to differences in health outcomes between slums (Subbaraman et al. 2012). To our knowledge, no studies have evaluated the relationship between legal status and access to services using nationally representative data. This relationship may be confounded by characteristics other than legal status that may cause deprivation, such as state government policies, the type of land on which a slum is located, or a slum's population size.

To investigate the contribution of legal status to deprivation in access to services, we analyze data from India's National Sample Survey (NSS), which collects information on socioeconomic, agricultural, and housing indicators. The NSS collected cross-sectional data on slums in four survey waves spanning nearly 20 years. The NSS is the only national-level survey that routinely collects information on the legal status of slums, providing a unique opportunity to assess the relationship between legal status and deprivation over time. Other surveys, such as the Census of India, have been criticized for undercounting non-notified slums (Ministry of Housing and Urban Poverty Alleviation 2010).

In this paper, we first discuss trends in slum notification and access to basic services over two decades—a time period after India's 1991 economic reforms, in which there was increasing liberalization of the economy. Second, we describe deprivation in India's slums over time by combining indicators for access to services into a composite basic services deprivation score (BSDS). Third, we identify risk factors for deprivation using a multilevel regression model to evaluate the hypothesis that legal status is independently associated with deprivation. Finally, we identify factors associated with the receipt of government financial aid by slum settlements to understand whether resources for slum improvement are being targeted to the communities most in need.

2 Methods

(i) The Process of Notification

Notification of slums in India is determined by state-level policies. As a result, there is considerable heterogeneity in the rules and processes by which notified status is conferred across India. To take the example of one state's policy, in Maharashtra, notification is determined by cut-off dates specified by the state government. In 2002, laws were amended to allow notified status to be conferred upon slum households with proof of having resided on state or city land as of January 1, 1995 (Murthy 2012). More recently, the cut-off date has been advanced to allow recognition of slum households who settled prior to 2000 (Subbaraman and Murthy 2015). Slums located on land owned by the central government in Maharashtra remain ineligible for notification, even if households have proof of residence prior to 1995 (Subbaraman et al. 2012).

In contrast to Maharashtra, other states in India have more or less stringent notification policies. For example, the National Capital Region of Delhi and Tamil Nadu state have more stringent policies; these states not notified new slums since 1973 and 1985, respectively

(Bhan 2009; Aditi 2017). Andhra Pradesh has relatively liberal notification policies, allowing for slums that have resided on government land for more than five years to apply for notification; the government also has strategies for notifying slums on private land (Kranthi and Rao 2010). The impact of this policy is reflected in the high proportion of notified slum households in Andhra Pradesh (89% in the 2012 NSS).

The heterogeneity in notification policies across India has implications for the methods and interpretation of the study findings. Differences in state-level policies provide the rationale for use of multilevel modeling in this analysis, as discussed further below. In addition, findings of an association between legal status and deprivation could be considered plausible, since this association would be robust to variability in notification policies across the country.

(ii) Data Sources and Descriptive Statistics

We use the 49th (1993), 58th (2002), 65th (2008—2009), and 69th (2012) NSS rounds, which provide nationally representative cross-sectional data on 2,901 slums across all survey rounds. One limitation of these surveys is that they capture information on entire slums (rather than on individuals or households). The surveys therefore describe living conditions for most residents in each slum but do not provide information on heterogeneity *within* each settlement.

To ensure we were correctly interpreting the datasets, we first replicated descriptive statistics contained in publicly available reports on these NSS waves, with the exception of select statistics from the 1993 report (National Sample Survey Organization 1997; 2003; 2010; 2013). We estimated 40 more slums (a 0.04% difference) and 147,472 more slum households (a 2% difference) at a national level than were reported in the 1993 report. These minor inconsistencies may be due to differences between the publicly available NSS data and those used to create the report or to small rounding errors in the survey weights.

For most descriptive statistics and the regression models, we restricted our analyses to 10 states with at least 10 observations (i.e., 10 slums) in each survey year to facilitate better estimates of state-level effects. The states included in the analysis are Andhra Pradesh, Bihar, Delhi, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Orissa, Tamil Nadu, and West Bengal. This restriction results in a sample of 2,411 slums across all survey years. Further restriction to slums with no missing information for variables in the analyses resulted in a final sample of 2,390 slums.

We generated descriptive statistics by using survey weights to estimate the total number of slums. We then estimated the percent of slums with different types of legal status and access to key basic services, stratified by survey year, to gain insights into trends over time.

(iii) Basic Services Deprivation Score

The outcome in regression analysis 1 is a 12-item index called the Basic Services Deprivation Score (BSDS). The item weights in Table 1 allow us to calculate a value for each slum ranging from 0 to 14. We convert this value into a BSDS ranging from 0 to 100 by dividing by the range and multiplying by 100. A higher score indicates greater deprivation.

Our rationale for the BSDS partly derives from Amartya Sen's definition of poverty as "capability deprivation" (Sen 1999). Each BSDS item represents a service that people "have reason to value" because it enhances human capabilities. These services require government intervention to support infrastructure or service delivery (in the case of waterlogging, the items serve as surrogate indicators of the quality of sewer and drainage infrastructure). Absence of any of these services may adversely affect quality of life. For example, a recent study found that deprivation faced by slum households in Mumbai—measured using a "slum adversity index" that includes many BSDS items—is strongly associated with psychological distress (Subbaraman et al. 2014).

All BSDS items are also associated with physical health. We weight water and sanitation items more heavily in the BSDS because these have the strongest relationship with health outcomes, such as infant mortality and child nutrition (Bartram and Cairncross 2010). Diarrheal illness is strongly associated with poor water and sanitation access, and diarrhea is one of the top causes of morbidity and mortality for children under five years of age who live in slums (Gladstone et al. 2008). Transitioning from an unimproved water supply to a high-quality piped supply leads to an average reduction in diarrheal illness of 80%, while access to sanitation leads to an average reduction of 70% (Wolf et al. 2014).

We weight other BSDS items less heavily because their associations with health outcomes are not as well characterized; however, deprivation with regard to any of the items can cause poor health. Lack of solid waste collection increases risk of diarrhea, dengue, and leptospirosis (Hagan et al. 2016; Hayes et al. 2003). Lack of government provision of electricity may lead slum residents to set up poorly wired connections, increasing risk of electrocution and fires (Subbaraman et al. 2012). Greater distance of slums from health facilities is associated with lower immunization rates (Ghei et al. 2010). Greater distance from schools can adversely affect mothers' educational attainment, resulting in poor child health outcomes (Agarwal and Srivastava 2009).

We conducted additional analyses to explore the results of using alternative BSDS scoring approaches, including (1) factor analysis using a polychoric correlation matrix and principal components analysis and (2) using scoring weights derived from a regression model of items correlated with infant mortality identified through a separate analysis of the National Family Health Survey-3. The regression results are qualitatively similar regardless of the BSDS scoring method. These findings are available in a detailed working paper available online (Nolan et al. 2017). Our analysis in this manuscript uses the BSDS scoring method in Table 1 because it has the most intuitive interpretation.

(iv) Regression Analysis 1—Predictors of Deprivation in Access to Basic Services

In this analysis, the BSDS is the dependent variable. The independent variable of primary interest is legal status, represented as the number of years a slum has been notified (a continuous variable), with 0 years indicating that a slum is non-notified. In an additional regression analysis (not included in this paper), we alternatively represented legal status as a dichotomous variable (notified vs. non-notified) and found qualitatively similar results (Nolan et al. 2017).

Other independent variables include: (1) the number of households in the slum (per every 100 household increase); (2) ownership of the land the slum is on (e.g., local government, central government, or private); (3) location within the city (i.e., fringe or central); (4) area around the slum (i.e., residential, commercial, or industrial); and (5) whether the slum has a community association. We control for the survey year as a fixed effect. We include quadratic (squared) terms for "years notified" and "number of households in the slum," since quadratic terms for these variables were statistically significant at the 5% level.

India is a federal country with different policies at the national, state, and local levels. The NSS data are similarly organized in a hierarchical fashion with slums "nested" within states. Slums within the same state are likely to be more alike than slums in different states (i.e., "clustering"), because of exposure to the same state-level policies and regional economic environment. Multilevel models more appropriately mirror this nested structure than regular regression models and therefore may produce more precise standard errors, confidence intervals, and point estimates. Multilevel models also enable estimation of intra-class correlation, or the proportion of variation in the outcome that is accounted for by clustering, which in this case is the proportion of variation in the BSDS accounted for by clustering of slums within states. In more explicit terms, the varying intercept multilevel model we estimate is as follows (Gelman and Hill 2007):

$$y_i = N(\alpha_{j[i]} + \beta_{x_i}, \alpha_y^2)$$
$$\alpha_j \sim N(\mu_\alpha, \alpha_\alpha^2)$$

Where i represents each slum, N is the total number of slums, y is the basic services deprivation score (BSDS), α is the intercept for each state j (which is distributed normally with mean μ and variance α^2), and β_x is a vector of covariates containing the independent variables. Differences in slum deprivation across states are represented by random state-level intercepts (which have their own variance), which can help illuminate the influence of state policies.

We also evaluated how much of the variation in the BSDS is accounted for by legal status and other variables. Using a generalized version of Cohen's F^2 effect size measure, we assess changes in the adjusted R^2 for the model when each independent variable is excluded. To understand the proportion of variation attributable to the state variable, we compare the multilevel model to one without the state random effect.

(v) Regression Analysis 2—Predictors of Receiving Financial Support through a Slum Improvement Scheme

Using 2012 NSS data from 706 slums in the 10 states with the largest slum population, we investigate whether the central government's financial support for slum improvement has been equitably distributed. The 2012 NSS asked whether each slum "benefited from the Jawaharlal Nehru National Urban Renewal Mission (JNNURM), the Rajiv Awas Yojana (RAY), or any other slum improvement scheme" (National Sample Survey Organization,

2013). The answer to this question ("yes" or "no") is the dependent variable in the multilevel logistic regression model. This question was not asked in NSS waves prior to 2012.

We include legal status as a dichotomous independent variable (i.e., "notified" or "non-notified"), because, unlike in regression analysis 1, we are trying to understand whether each slum's current legal status (rather than the length of time it has been notified) influences the odds of receiving financial support. We include the BSDS as an independent variable to understand whether severity of deprivation influences the odds of receiving support. We divide the BSDS into three categories: low (30), medium (31–60), and high (>60) deprivation. We also include the other covariates from regression analysis 1 in this model.

3 Results

(i) Trends in Slum Notification Over Two Decades

The number of non-notified slums at the national level and in the 10 states with the largest slum populations decreased between 1993 and 2012; however, the percent of all slums that are non-notified declined from 1993 to 2002, but then plateaued and increased between 2008 and 2012. With regard to slum households, both the number and percent of non-notified households at the national level and in the 10 states decreased from 1993 to 2002, but then plateaued and increased between 2008 and 2012 (Table 2).

(ii) Trends in Access to Basic Services Over Two Decades

In the 10 states with the largest slum populations, most indicators show a decrease in the percent of slums with lack of access to services from 1993 to 2012 (Table 3). The percent experiencing deprivation increased during this time period for only three indicators: lack of a motorable or cartable approach road, lack of a school within one kilometer, and lack of a health center within one kilometer.

However, these trends differ based on legal status, with notified slums experiencing greater reductions in deprivation for most indicators than non-notified slums (Table 3). For the services that are most vital for health—water, sewer, and toilet access—the percent of slums without access fell among notified slums, while the percent without access increased (in the case of water) or essentially remained stable (for sewers and toilets) for non-notified slums. For other indicators (electricity, drainage, and a functional road within the slum), the percent without access declined for both notified and non-notified slums, but notified slums experienced considerably greater reductions in deprivation. In 2012, for every basic service assessed by the NSS, a greater proportion of non-notified slums lacked access as compared with notified slums (Table 3).

By providing a composite measure of deprivation, the BSDS allows for analysis of general trends in deprivation over time in the 10 states with the largest slum populations. In 1993, there was no statistically significant difference between the mean BSDS for notified and non-notified slums (p=0.103) (Table 4). For notified slums, the mean BSDS declined 34% between 1993 and 2012 (p <0.001), whereas the mean BSDS for non-notified slums declined 8%, which is not statistically significant (p=0.146) (Figure 1). On average, disparity in deprivation between notified and non-notified slums has widened.

(iii) Predictors of Deprivation in Access to Basic Services

In the multilevel regression model, legal status has a substantial association with the BSDS after controlling for covariates (Table 5). Every additional year of notification is associated with a 0.768 point decline in BSDS (p<0.001). The quadratic term for years notified suggests a non-linear association in which the magnitude of decline in BSDS lessens with increasing years of notification. A scatterplot based on the regression model—with a fitted line estimating the predicted BSDS with increasing years of notification—illustrates this non-linear association (Figure 2). After controlling for covariates, the predicted BSDS is 50 for slums that have never been notified, 39 for slums notified for 10 years, 35 for slums notified for 20 years, and 24 for slums notified for 40 years. The most rapid decline in average BSDS occurs in the first decade after notification.

The 2002, 2008, and 2012 survey years are associated with a statistically significantly lower BSDS compared with 1993 (Table 5). Larger slum size (in households) is associated with a lower BSDS, and the quadratic term suggests a non-linear relationship in which the magnitude of decline in BSDS decreases as slum size increases. As compared with slums on city or state government land, slums on central government land have a statistically significantly higher BSDS, and slums on private land have a lower average BSDS. Slums on city fringes have a statistically significantly higher BSDS on average than those in central areas. Having a community slum improvement association is statistically significantly associated with a lower BSDS. In the multilevel model, Andhra Pradesh, Delhi, Karnataka, Maharashtra, and West Bengal have statistically significantly lower BSDS on average, while Bihar and Orissa have statistically significantly higher average BSDS.

Evaluating the model R^2 with and without each independent variable shows that legal status explains the largest percent of variance in the BSDS (9.3%), as compared to the state random effect (5.0%), slum location in a central or fringe area (4.4%), survey year (2.4%), land ownership (1.9%), presence or absence of a community association (1.0%), number of households (0.7%), and type of area surrounding the slum (0.5%).

(iv) Predictors of Receiving Financial Support for Slum Improvement

The logistic regression model shows that non-notified slums have lower odds of receiving financial support from government schemes than notified slums (p<0.001) (Table 6). The BSDS is not statistically significantly associated with receiving financial support, suggesting that funding was not distributed based on the severity of a slum's deprivation. Slums in West Bengal had statistically significantly higher odds of receiving financial support compared with slums in other states.

4 Discussion

(i) Legal Status and Deprivation in Slums

In this analysis of four waves of NSS data, we find that legal status has a strong influence on access to basic services in slums in India. Non-notified slums have lagged in access to every basic service provided by municipalities. The difference in average BSDS between notified and non-notified slums increased considerably over two decades, revealing widening

disparity in deprivation. Of greatest concern is that disparities in access to services that are crucial for health increased the most. In fact, for non-notified slums, the percent without piped water actually increased and the percent without sewer infrastructure remained essentially unchanged between 1993 and 2012.

Our finding of increasing inequality between non-notified and notified slums parallels a more general pattern of rising economic, spatial and social inequality within Indian cities during the post-1991 period of economic liberalization (Motiram and Vakulabharanam 2013; Vakulabharanam and Motiram 2012). Prior studies have highlighted inequalities in health and social indicators between non-slum and slum populations in Indian cities (Gupta et al. 2009). Our findings build upon this work by showing that, even within already relatively deprived slum populations, non-notified settlements represent particularly severe sites of deprivation and social exclusion in India's cities. Over a time period when India had one of the most rapidly growing economies in the world, non-notified slums experienced no meaningful improvement in living standards, as indicated by the statistically unchanged BSDS between 1993 and 2012.

The multilevel regression analysis shows that this association between legal status and deprivation is statistically significant even after controlling for other factors that could explain the severity of deprivation. Most convincingly, we find a progressive non-linear reduction in deprivation the longer that a slum is notified, with benefits accruing most rapidly in the first decade after notification. Providing legal recognition may therefore be a powerful intervention for improving access to basic services, thereby improving health outcomes in slums.

Previous studies have focused on how legal recognition may motivate slum residents to improve the quality of their homes, due to lower threat of eviction (Field 2005; Gandelman 2010; Nakamura 2016). Our findings suggest that the benefits of legal recognition extend beyond improvements in housing quality. By eliminating legal barriers to government provision of services, notification may serve as a gateway to accessing entitlements that are vital for life—including water, sanitation, electricity, schools, and health centers. Even if service delivery is suboptimal, notification confers rights and social recognition upon slum residents, empowering them to mobilize to claim these entitlements (Appadurai 2001).

(ii) Barriers to Reducing Deprivation in Non-Notified Slums

Our analysis reveals two other concerning trends with implications for deprivation in India's slums. First, progress on notification seems to have stalled and reversed between 2008 and 2012, when the number and percent of non-notified slum households in India increased. Neoliberal ideology may be undermining the public's perception of slum residents as legitimate urban citizens, resulting in less liberal notification policies, part of a broader trend towards less inclusive cities (Bhan 2009; Vakulabharanam and Motiram 2012). If this becomes a longer-term trend, reversal of progress in slum notification could increase urban deprivation and worsen inter-slum disparities (between notified and non-notified slums) and intra-urban disparities (between slum and non-slum populations).

A second barrier to reducing deprivation is that non-notified slums were less likely to receive government financial aid, despite suffering from greater deprivation on average. Provision of government aid also has no association with the severity of a slum's deprivation. While schemes like the JNNURM did not list legal status as a formal barrier to receiving support, in practice, non-notified status may serve as a hurdle that prevents these schemes from helping communities that need this aid the most. While national-level data are not yet available on more recent Central Government initiatives aimed at improving urban life, such as the Smart Cities Mission and the Atal Mission for Rejuvenation and Urban Transformation (AMRUT), recent reports suggest that these initiatives do not seem to be directing resources to disadvantaged communities. For example, the Smart Cities Mission, which is focused on expanding access to information technology rather than basic services, seems to be delivering the vast majority of its funding to city areas that are already highly developed (Nair 2017). This initiative therefore seems likely to increase, rather than mitigate, urban inequality.

(iii) Other Predictors of Deprivation in Slums

Our analysis highlights additional factors that influence deprivation. Slums on central government land (as compared with city or state land) experience greater deprivation. India's constitution designates certain city areas (including railways, airports, and seaports) as being under the legal jurisdiction of the central government, which has no policy for providing slums with legal recognition (Gangan 2010). Unlike city and state governments, which face democratic pressure to extend services to slums, the central government is not held accountable for the living conditions of slum residents through elections (Murthy 2012). Even when city governments are motivated to extend services to these slums, they cannot do so without a "no objection certificate" from central government authorities. As a result, slums on central government land—despite having existed for decades in some cases —often suffer from severe deprivation (Subbaraman et al. 2012).

Our finding of lower average deprivation in slums with community associations affirms previous studies highlighting the role that slum dwellers' federations play in empowering communities to negotiate for services from local governments (Appadurai 2001; Patel et al. 2012). Slums that are smaller, on city fringes, and in industrial areas suffer from greater deprivation. Slums on the city periphery or in industrial areas generally attract newer migrants, who may not be as politically empowered as longer established populations (Davis 2006). Furthermore, slum residents are often relocated to city peripheries after episodes of home demolition, so the greater deprivation in these slums could partly reflect a "penalty" resulting from displacement.

(iv) Limitations of the Analysis

The NSS does not follow the same slums longitudinally, which would provide a better understanding of the temporal relationship between notification and deprivation. In theory, this association could be due to reverse causation. For example, slums with less deprivation could have greater collective efficacy to lobby for notified status. However, our finding that the average BSDS declines with increasing years of notification highlights a "dose-dependent" association that strengthens the likelihood of a causal relationship (Bradford Hill

1965). In addition, case studies highlight lack of security of tenure as a critical barrier to accessing services in slums, suggesting that a causal relationship is plausible (Murthy 2012; Subbaraman et al. 2012).

The NSS data assume that all households within a slum have the same legal status. However, in some settings, households within a slum may be heterogeneous with regard to legal status. For example, in Mumbai, individual slum households may gain legal recognition and access to services based on whether the family was living in the home prior to a specified cut-off date (Murthy 2012). As a result, slums in Mumbai may have a mix of notified and non-notified households. The NSS collected community-level information, which limits our understanding of the influence of this household-level variability on deprivation. However, because many services require community-scale infrastructure development, if most households in a slum are non-notified, adjacent notified households are also likely to partly suffer from the "neighborhood-level" effects of deprivation (Lilford et al. 2016).

If heterogeneity in legal status exists within slums that the NSS did not capture, this would bias the analysis toward the null hypothesis that legal status has no association with the BSDS. In other words, the magnitude of the association we found between legal status and deprivation is likely to be greater than is reported in our analysis. Future large-scale surveys, such as the NSS and the National Family Health Survey, should include robust measures of legal status at the household level to better understand the relationship between legal status and deprivation for people living in slums.

5 Conclusions

Lack of legal recognition seems to be an intractable issue for slums in India and globally. Millions of urban citizens remain "off the map" from the standpoint of political and social recognition (Subbaraman et al. 2012). Many governments justify failing to extend basic services to slum residents using the concept of "opportunistic influx"—the idea that provision of services might encourage greater migration from rural areas, thereby paradoxically increasing urban deprivation.

This argument is rooted in older academic theories that claim that providing jobs and improving living standards for the urban poor would accelerate urban unemployment and poverty through increased migration (Harris and Todaro 1970). However, these theories have fallen out of favor because they are supported by little empirical evidence. A substantial proportion of urban population growth occurs in situ and is not due to rural-urban migration. Moreover, extensive evidence suggests that provision of basic services enhances human capabilities and economic growth (Marx et al. 2013; Sen 1999). Despite the absence of evidence to support the theory of opportunistic influx, many government policies remain stuck in a state of inertia, leaving non-notified slums in a legal limbo, sometimes for decades (Marx et al. 2013).

Our study adds to a growing literature suggesting that lack of legal recognition perpetuates urban inequality in housing conditions, quality of life, and health outcomes (Nakamura 2016; Subbaraman et al. 2012, 2014). Providing legal recognition could be a powerful

strategy for reducing deprivation and suffering by transforming slum residents into urban citizens with fundamental rights.

Where governments are unwilling to provide legal recognition, strategies for partial extension of services to slums without providing security of tenure may be one avenue around the policy trap. For example, a recent Bombay High Court ruling disentangled the right to water from land tenure by ordering Mumbai's city corporation to provide basic access to water for non-notified slums (Subbaraman and Murthy 2015). Given the stalling of progress on slum notification in India, disentangling service delivery and security of tenure may provide an alternative strategy for reducing deprivation.

Finally, non-notified slums have been less likely to receive support from government schemes aimed at reducing urban disparities. Given that legal status is a strong marker of deprivation, government schemes for improving life in cities should target resources to non-notified slums. Alternatively, mapping the severity of deprivation in different slums—using evidence-based metrics that correlate with health outcomes—could help target financial support to communities most in need (Osrin et al. 2011). Unfortunately, current government initiatives to create "smart" cities may be bypassing slums and other marginalized populations altogether, based on the way these funds are being distributed (Nair 2017). Action towards large-scale legal recognition and delivery of financial aid to non-notified slums is urgently needed, lest India continue to leave behind its most marginalized urban citizens.

Acknowledgments

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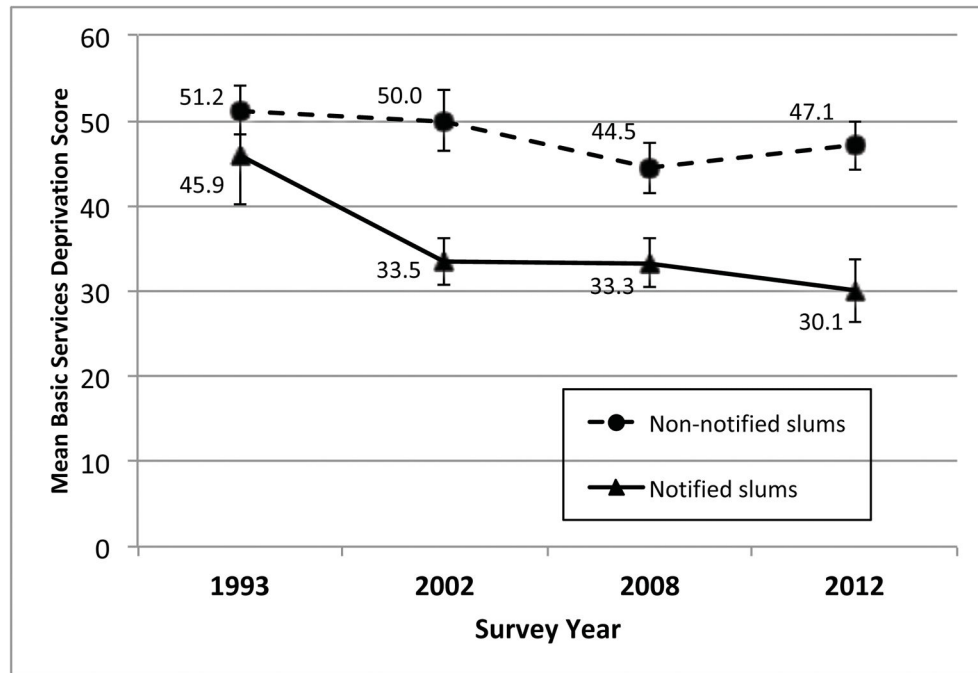
Figure 1.
Trends in the Basic Services Deprivation Score in 10 States with the Largest Slum Populations, 1993–2012
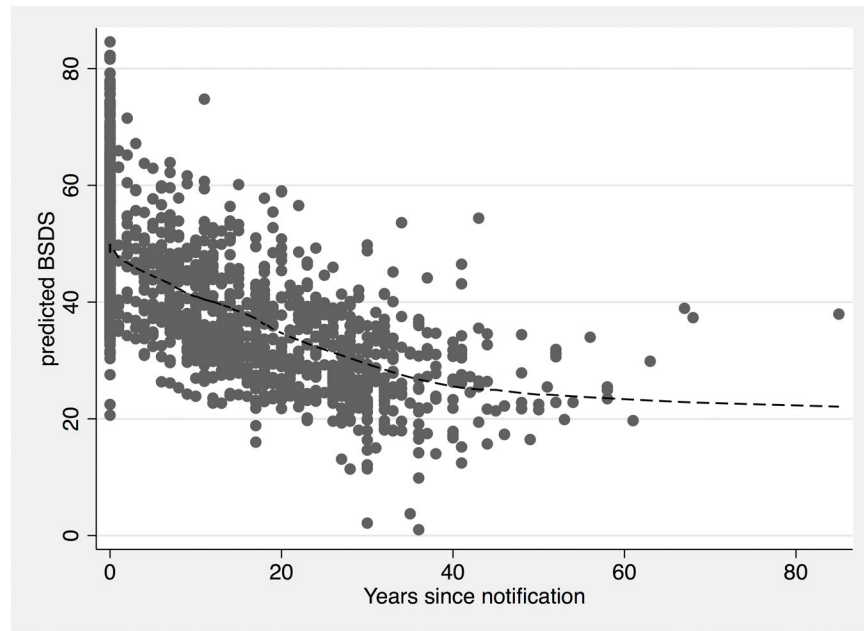
Figure 2.
Scatterplot and Fitted Line Estimating the Relationship between Years of Notification and the Basic Service Deprivation Score (BSDS) after Adjusting for Covariates in a Multilevel Regression Model

Table 1

National Sample Survey Items Used to Construct the Basic Services Deprivation Score

National Sample Survey item	Description	Weight
Source of drinking water	Tap	0
	Tubewell or handpump	1
	Well or other (tank, river, etc.)	2
Latrine facilities	Septic, flush, or pour flush	0
	Service or pit latrine	1
	Other (public latrine with or without payment)	1
	No latrine	2
Sewers	Underground sewer system	0
	No underground sewer	2
Solid waste disposal	Collection by the municipality or panchayat	0
	No arrangement or collection by residents	1
Drainage	Underground or covered	0
	Open high-quality drainage	0.5
	Open low-quality or no drainage	1
Electricity	Household use with or without street lights	0
	Street lights only	0.5
	No electricity	1
Quality of road within the slum	Motorable or cartable	0
	Non-motorable or non-cartable	1
Road within slum gets waterlogged in the monsoon	No	0
	Yes	1
Quality of approach road to the slum	Motorable or cartable	0
	Non-motorable or non-cartable	0.5
Approach road gets waterlogged in the monsoon	No	0
	Yes	0.5
Distance to nearest government primary school	<1 km	0
	1 km	1
Distance to nearest health center	<1 km	0
	1 km	1

For some items, multiple responses have been collapsed into single categories.

Table 2

Trends in Slum Notification for All Indian States and for the 10 States with the Largest Slum Populations

Year	Category of slum	Slum settlements – All states		Slum households – All states		Slum settlements –10 largest states		Slum households –10 largest states	
		Sample[a] N	Estimated[b] N (%)[c]	Sample[a] N	Estimated[b] N (%)[c]	Sample[a] N	Estimated[b] N (%)[c]	Sample[a] N	Estimated[b] N (%)[c]
1993	Notified	194	20,805 (36.9)	38,823	2,798,718 (46.0)	154	18,423 (37.7)	24,070	2,309,319 (44.3)
	Non-notified	404	35,560 (64.1)	72,363	3,282,754 (54.0)	343	30,499 (62.3)	33,698	2,903,605 (55.7)
	All	598	56,364 (100)	67,533	6,081,472 (100)	497	48,932 (100)	57,768	5,212,924 (100)
2002	Notified	360	26,166 (50.6)	40,005	5,358,272 (65.1)	293	24,474 (52.9)	64,176	5,153,874 (66.1)
	Non-notified	332	25,522 (49.4)	126,113	2,871,472 (34.9)	265	21,805 (47.1)	35,749	2,648,505 (33.9)
	All	692	51,688 (100)	112,368	8,229,744 (100)	558	46,279 (100)	99,925	7,802,379 (100)
2008	Notified	365	24,781 (50.6)	126,113	7,030,004 (69.2)	309	22,852 (50.7)	87,317	5,554,564 (65.2)
	Non-notified	365	24,213 (49.4)	49,048	3,129,820 (30.8)	320	22,212 (49.3)	44,007	2,959,573 (34.8)
	All	730	48,994 (100)	175,161	10,159,824 (100)	629	45,064 (100)	131,324	8,514,137 (100)
2012	Notified	441	13,761 (41.1)	684,257	5,559,775 (63.1)	350	11,140 (38.9)	604,146	4,940,409 (62.2)
	Non-notified	440	19,749 (59.9)	259,353	3,249,239 (36.9)	356	17,495 (61.1)	216,530	3,006,599 (37.8)
	All	881	33,510 (100)	943,610	8,809,013 (100)	706	28,635 (100)	820,676	7,947,008 (100)
All years	Notified	1,360	85,514 (44.9)	911,443	20,746,769 (62.3)	1,106	76,889 (45.5)	779,709	1,795,8167 (60.9)
	Non-notified	1,541	105,043 (55.1)	387,229	12,533,284 (37.7)	1,284	92,011 (54.5)	329,984	11,518,282 (39.1)
	All	2,901	190,557 (100)	1,298,672	33,280,053 (100)	2,390	168,901 (100)	1,109,693	29,476,449 (100)

[a]"Sample" indicates the unweighted number of slums or slum households. For the 10 largest states, only observations with no missing data for the model variables are included.

[b]"Estimated" indicates the weighted number (the number of slums or households the sample represents).

[c]Represents the percent out of all estimated slums or households in a given year.

Table 3

Trends in Access to Services by Legal Status in 10 Indian States with the Largest Slum Populations

Service	Category of slum	1993 Estimated N (%)[a]	2002 Estimated N (%)[a]	2008–09 Estimated N (%)[a]	2012 Estimated N (%)[a]
Lack of piped water	Notified	6,881 (37.3)	3,503 (14.3)	4,111 (18.0)	1,805 (16.2)
	Non-notified	9,216 (30.2)	5,762 (26.4)	4,518 (20.3)	5,873 (33.6)
	All	16,097 (32.9)	9,265 (20.0)	8,629 (19.1)	7,678 (26.8)
Lack of septic, flush, or pour flush toilet	Notified	11,357 (61.6)	8,026 (32.8)	7,324 (32.1)	3,090 (27.7)
	Non-notified	19,088 (62.6)	13,582 (62.3)	11,253 (50.7)	9,963 (57.0)
	All	30,445 (62.2)	21,608 (46.7)	18,577 (41.2)	13,054 (45.6)
Lack of sewer infrastructure	Notified	14,572 (79.1)	16,925 (69.2)	14,835 (64.9)	5,995 (53.8)
	Non-notified	25,933 (85.0)	18,265 (83.8)	17,940 (80.8)	14,350 (82.0)
	All	40,506 (82.8)	35,190 (76.0)	32,775 (72.7)	20,345 (71.0)
Lack of solid waste disposal	Notified	4,764 (25.9)	4,714 (19.3)	5,164 (22.6)	1,981 (17.8)
	Non-notified	16,502 (54.1)	11,642 (53.4)	9,458 (42.6)	8,459 (48.4)
	All	21,265 (43.5)	16,356 (35.3)	14,621 (32.4)	10,441 (36.5)
Lack of underground or covered drainage	Notified	15,105 (82.0)	17,875 (73.0)	13,367 (58.5)	7,129 (64.0)
	Non-notified	27,052 (88.7)	18,632 (85.4)	16,603 (74.7)	13,603 (77.8)
	All	42,158 (86.2)	36,507 (78.9)	29,971 (66.5)	20,732 (72.4)
Slum faces waterlogging	Notified	5,638 (30.6)	5,783 (23.6)	7,545 (33.0)	3,988 (35.8)
	Non-notified	15,377 (50.4)	10,301 (47.2)	9,658 (43.5)	7,477 (42.7)
	All	21,015 (43.0)	16,084 (34.8)	17,202 (38.2)	11,465 (40.0)
Lack of electricity for household use	Notified	7,571 (41.1)	1,033 (4.2)	1,468 (6.4)	312 (2.8)
	Non-notified	10,268 (33.7)	3,792 (17.4)	4,209 (19.0)	3,233 (18.5)
	All	17,839 (36.5)	4,825 (10.4)	5,677 (12.6)	3,546 (12.4)
Lack of motorable or cartable roads within the slum	Notified	7,038 (38.2)	6,779 (27.7)	4,927 (21.6)	1,808 (16.2)
	Non-notified	18,508 (60.7)	12,760 (58.5)	8,944 (40.3)	7,184 (41.1)
	All	25,546 (52.2)	19,540 (42.2)	13,871 (30.8)	8,992 (31.4)
Lack of motorable or cartable approach road	Notified	1,325 (7.2)	4,097 (16.7)	5,485 (24.0)	1,897 (17.0)
	Non-notified	6,432 (21.1)	6,573 (30.1)	6,783 (30.5)	3,862 (22.1)

Service	Category of slum	1993 Estimated N (%)[a]	2002 Estimated N (%)[a]	2008–09 Estimated N (%)[a]	2012 Estimated N (%)[a]
	All	7,748 (15.8)	10,670 (23.1)	12,268 (27.2)	5,759 (20.1)
No school within 1 km	Notified	837 (4.5)	1,709 (7.0)	2,540 (11.1)	937 (8.4)
	Non-notified	3,433 (11.3)	1,886 (8.6)	2,990 (13.5)	1,870 (10.7)
	All	4,270 (8.7)	3,595 (7.8)	5,530 (12.3)	2,807 (9.8)
No health center within 1 km	Notified	3,580 (19.4)	12,777 (52.2)	10,437 (45.7)	5,427 (48.7)
	Non-notified	13,176 (43.2)	11,187 (51.3)	12,576 (56.6)	9,089 (52.0)
	All	16,757 (34.3)	23,964 (51.8)	23,013 (51.1)	14,516 (50.7)

[a] Represents the estimated number and percent of slums lacking access to each service within each slum category (i.e., notified, non-notified, or all slums). For example, 6,881 notified slums in 1993 lacked piped water access, which is 37.3% of all 18,423 notified slums in 1993.

Table 4

Basic Services Deprivation Score (BSDS) by Legal Status in 10 States in India with the Largest Slum Populations

Year	BSDS in All Slums (Sample *N*=2,390; Estimated *N*=168,901) Mean (SE)	BSDS in Notified Slums (Sample *N*=1,106; Estimated *N*=76,889) Mean (SE)	BSDS in Non-Notified Slums (Sample *N*=1,284; Estimated *N*=92,011) Mean (SE)	p-value for the difference in mean BSDS between notified and non-notified slums
1993	49.2 (1.37)	45.9 (2.91)	51.2 (1.48)	0.103
2002	41.3 (1.21)	33.5 (1.41)	50.0 (1.80)	<0.001
2008	38.8 (1.07)	33.3 (1.44)	44.5 (1.53)	<0.001
2012	40.5 (1.89)	30.1 (1.90)	47.1 (1.45)	<0.001

SE=standard error.

Table 5

Predictors of the Basic Services Deprivation Score (BSDS) in a Multilevel Regression Model with Data from 10 States with the Largest Slum Populations

	Descriptive statistics Continuous variables: Mean (SE) Categorical variables: Estimated N (%)	Multivariable findings (Estimated N=168,901) β-coefficient (95%CI)	p-value*
Years notified (*per each one-year increase in time notified*)	7.86 (0.33)	−0.768 (−0.914, −0.622)	<0.001
Years notified, quadratic term	203.39 (12.81)	0.009 (0.005, 0.013)	<0.001
Year of survey			
1993	48,923 (29.0)	-	-
2002	46,279 (27.4)	−5.448 (−7.621, −3.275)	<0.001
2008	45,064 (26.7)	−8.372 (−10.570, −6.175)	<0.001
2012	28,635 (17.0)	−5.654 (−7.870, −3.438)	<0.001
Number of households in the slum (*per each 100-household increase*)	1.84 (0.09)	−0.148 (−0.218, −0.079)	<0.001
Number of households in the slum, quadratic term	32.80 (6.05)	0.0002 (0.0001, 0.0003)	<0.001
Land type			
State or city government	66,737 (39.5)	-	-
Central government	8,155 (4.8)	6.785 (3.480, 10.089)	<0.001
Private	64,407 (38.1)	−3.182 (−4.880, −1.483)	<0.001
Other or not known	29,600 (17.5)	1.293 (−0.780, 3.366)	0.222
Slum location			
Central area	126,126 (74.7)	-	-
Fringe area	42,775 (25.3)	8.439 (6.816, 10.063)	<0.001
Area surrounding slum			
Residential	127,836 (75.7)	-	-
Commercial	8,355 (5.0)	0.076 (−3.299, 3.451)	0.965
Industrial	11,842 (7.0)	4.219 (1.252, 7.186)	0.005
Other, including more slum settlements	20,867 (12.4)	2.347 (0.365, 4.328)	0.020
Community association for slum improvement			
Yes	49,585 (29.4)	-	-
No	119,315 (70.6)	4.291 (2.622, 5.961)	<0.001
Constant	-	51.422 (45.641, 57.202)	<0.001
State random effects			
Andhra Pradesh	23,703 (14.0)	−5.027 (−6.367, −3.688)	<0.001
Bihar	7,322 (4.3)	16.844 (14.309, 19.379)	<0.001
Delhi	10,029 (5.9)	−6.997 (−9.274, −4.719)	<0.001
Gujarat	10,266 (6.1)	1.413 (−0.356, 3.182)	1.000
Karnataka	11,437 (6.8)	−5.227 (−7.092, −3.361)	<0.001

	Descriptive statistics Continuous variables: Mean (SE) Categorical variables: Estimated N (%)	Multivariable findings (Estimated *N*=168,901) β-coefficient (95%CI)	p-value[*]
Madhya Pradesh	11,661(6.9)	2.725 (1.081, 4.369)	0.212
Maharashtra	52,045 (30.8)	−9.079 (−10.037, −8.122)	<0.001
Orissa	4,574 (2.7)	13.213 (10.817, 15.609)	<0.001
Tamil Nadu	13,022 (7.7)	0.484 (−1.148, 2.117)	1.000
West Bengal	24,841 (14.7)	−8.349 (−9.659, −7.039)	<0.001
Variance of the random intercept (p-value)		73.911 (<0.001)	
Variation in BSDS attributable to the state variable (intra-class correlation)		19.43%	

CI=confidence interval

[*] p-values for random effects are corrected for multiple comparisons (multiplied by the number of comparisons and capped at 1.00). Confidence intervals for random effects are corrected to allow multiple comparisons between states (Goldstein and Healy 1995).

Table 6

Predictors of Receiving Financial Support from Government Slum Improvement Schemes in a Multilevel Logistic Regression Model Using Data from the 2012 NSS

Predictors	Multivariable findings (*N*=706, Estimated *N*=28,635) Odds ratio (CI)	p-value[a]
Notified		
Yes	-	
No	0.379 (0.246, 0.584)	<0.001
BSDS		
Low (30)	-	
Medium (31–60)	1.013 (0.671, 1.529)	0.951
High (>60)	0.723 (0.390, 1.341	0.304
Number of households in the slum		
<100	-	
101–300	0.933 (0.526,1.655)	0.814
301–800	1.251 (0.702, 2.228)	0.447
>800	0.854 (0.449, 1.622)	0.629
Land type		
Public local government	-	
Public central government	0.321 (0.088, 1.166)	0.084
Private	0.875 (0.584, 1.312)	0.519
Other or not known	0.941 (0.529, 1.674)	0.836
Slum location		
Central area	-	
Fringe area	1.019 (0.686, 1.515)	0.925
Type of area surrounding slum		
Residential	-	
Commercial	0.395 (0.129, 1.208)	0.103
Industrial	0.699 (0.270–1.811)	0.461
Other, including more slum settlements	1.145 (0.770–1.703)	0.505
Community association for slum improvement		
Yes	-	
No	0.709 (0.457–1.101)	0.125
Constant	0.791 (0.366, 1.710)	0.551
State random effects		
Andhra Pradesh	1.244 (0.956, 1.618)	1.000
Bihar	0.835 (0.516, 1.350)	1.000
Delhi[b]	-	-
Gujarat	1.131 (0.769, 1.665)	1.000
Karnataka	1.638 (1.177, 2.279)	0.380

Predictors	Multivariable findings (*N*=706, Estimated *N*=28,635) Odds ratio (CI)	p-value[a]
Madhya Pradesh	0.995 (0.743, 1.332)	1.000
Maharashtra	0.786 (0.610, 1.014)	1.000
Orissa	0.752 (0.447, 1.264)	1.000
Tamil Nadu	0.621 (0.422, 0.912)	1.000
West Bengal	2.192 (1.638, 2.934)	0.002
Standard deviation of the random intercept	0.477 (0.232, 0.980)	-
Variation attributable to state variable (intra-class correlation coefficient)	0.065	-

CI=confidence interval

[a] p-values for random effects are corrected for multiple comparisons (multiplied by the number of comparisons; capped at 1.00). Confidence intervals for the random effects are corrected to allow multiple comparisons between states (Goldstein and Healy 1995).

[b] Delhi slums did not report receiving any financial support in the 2012 NSS.