Child Health and Immunization Status
in an Unregistered Mumbai Slum

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This thesis has been read and approved by:

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# Table of Contents

Acknowledgements .................................................................................................................. 2

Abstract .................................................................................................................................. 4

Introduction ............................................................................................................................. 5

I. Urbanization and the growth of slums .................................................................................. 6
   India: Growing Cities and Urban Slums ............................................................................... 7

II. Child Health & Immunization Coverage in India ............................................................... 10

II. Shortcomings of Urban Health Delivery Systems ............................................................. 12
   Barriers to Access .............................................................................................................. 12
   Acceptability of Health Interventions and Health Education .......................................... 13

IV. The Case of Kaula Bandar ............................................................................................... 14
   Methods ............................................................................................................................... 14
   Results: Kaula Bandar Ethnography and Demographics ..................................................... 15
      KB Demographics .......................................................................................................... 17
      Child Health and Mother’s Health Seeking Behavior ...................................................... 18
      Mother’s Health Knowledge about Immunization ......................................................... 20
      The Health Impact of Tenure ......................................................................................... 22

Quantitative Findings ........................................................................................................... 23
   Methods ............................................................................................................................... 23
   1) Outcome: Immunization Status ..................................................................................... 24
   2) Outcome: Mortality ......................................................................................................... 25
   3) Outcome: Mother’s Health Knowledge about Immunization ....................................... 25

V. The Way Forward ................................................................................................................ 26
   The Economic Benefits of Immunization ......................................................................... 26
   Structuring an Effective Intervention ............................................................................... 27
   Incentives: The “Last Mile” .............................................................................................. 29

V. Conclusion .......................................................................................................................... 30

Works Cited ............................................................................................................................ 31

Exhibit 1: Child Health Survey Data ..................................................................................... 35

Exhibit 2: The Notification Process and the Impact of Tenure on Health ............................. 37
Abstract

As of 2007, more than half of the world’s population was living in urban areas, with about one-third (fully 1 billion people) living in urban slums. India alone is home to roughly 170 million slum dwellers, one-third of whom are children under five years of age. The squalid, congested living environment of such slums includes limited access to basic services such as piped water and improved sanitation—whose absence increases the risk of infectious disease among children. This thesis uses the case of an unregistered urban slum, Kaula Bandar (KB), in Mumbai, India, to examine the determinants of child mortality and immunization coverage using primary quantitative and qualitative data from a household survey (n=226 households) and focus groups. Results indicate that although immunization services are widely available in urban centers, a “knowledge-action gap” keeps immunization rates low—and child mortality high—in slum communities. In particular, lack of knowledge about the protective benefits of immunization, lack of trusted channels of influence, and systemic barriers to accessing health services (such as cost, provider discrimination, and distrust of the system by non-tenured slum dwellers at risk of losing their homes) leave the majority of urban slum-dwelling children unprotected from vaccine-preventable diseases. A quantitative analysis of the determinants of child mortality, immunization status, and mother’s health knowledge of immunization reveals that unvaccinated children in KB are 3.2 times more likely to die before the age of 5 than vaccinated children. Data on health determinants and outcomes from children in government-registered slums are compared with those from unregistered communities, revealing profound disparities not just between urban non-slum and urban slum populations, but also within the slum gradient. For example, roughly 29% of children in KB are fully immunized, compared with 69% of children in registered slums receiving outside services. Similarly, the infant mortality rate in KB (58 per 1,000 live births) is more than double that of registered slums (25 per 1,000 live births). Lastly, to account for the unique constraints faced by urban-slum dwellers, the thesis proposes contextually appropriate interventions that could increase vaccination rates and put India on the path toward universal immunization coverage.
Introduction

As of 2007, more than half of the world’s population was living in urban areas, and one in three city-dwellers was living in an urban slum (UN-HABITAT, 2008/9). There are approximately 1 billion slum dwellers in the world (UN-HABITAT 2006/7), and this number is projected to grow to 1.4 billion by the year 2020 (UN-HABITAT, 2008/9). The growth of cities has had positive implications for many urban citizens: on average, urban areas present greater employment opportunities, increased access to health services, higher-quality educational opportunities, and modern amenities and technologies. These features have contributed to greater economic and health outcomes among urban dwellers, including lower infant and child mortality rates compared to rural regions (NFHS-3, 2005/6).

Amid the prosperity of the greater urban landscape, however, exists a plethora of slums that have not necessarily reaped the benefits of greater contemporary city living. The stark living conditions in slums—characterized by extreme population density, poor sanitation, and a lack of access to basic health services—encourage a host of health challenges. According to UN-HABITAT, “[s]lum dwellers die earlier, experience more hunger, have less education, have fewer chances of employment in the formal sector and suffer more from ill-health than the rest of the inhabitants of cities” (UN-HABITAT, 2008/9). This environment is highly conducive to the development and spread of infectious diseases, especially among immunonaïve populations such as children. Research demonstrates that children living in slums shoulder a disproportionate burden of disease compared to their adult counterparts (Cornia, 1987), and the long-term consequences of these childhood illness can be devastating – including permanent stunting, physical disability, and life-long impaired cognition (Cornia, 1987).

Although child immunization has averted more than 2.1 million deaths annually and countless episodes of illness and disability, 20% of children worldwide, especially those living on less than $1 a day, remain unvaccinated (UNICEF 2009). Childhood immunization provides an opportunity to mitigate childhood morbidity and mortality in urban slums through the prevention of a host of infectious diseases. Immunization has resulted in large-scale reduction in child morbidity and mortality, encouraging many to categorize it as one of the greatest achievements in the history of public health (CDC, 1999). Still, despite the promise of childhood vaccination, coverage among urban Indian children remains low, with only 69% of children aged 12-23 months considered as fully vaccinated in Mumbai (NFHS-3, 2005/6). Data suggest that coverage rates among urban poor children largely living in slums are approximately 40%, even lower than the urban average of 58%. (Ghei et al, 2010). Figure 1 shows large differences in immunization status between urban poor and non-poor, and also that urban and rural rates are very similar.

![Figure 1: India’s Child Immunization Status (Urban Health Resource Center, 2007)](image)
In India alone, there are 169 million slum dwellers (IIPS, 2009) and the country is home to 17% of the world’s slum dwellers (UN-HABITAT 2008/9). As the number and size of India’s slums continues to grow, the number of children living in conditions conducive to infectious disease will also increase. This upward trajectory encourages concentrated efforts to increase coverage of childhood immunization across the urban landscape.

This thesis will use the case of an unregistered urban slum, Kaula Bandar (KB) in Mumbai to examine the determinants of child health and immunization status. It will examine the impact of:

- Barriers to accessing health information and services
- Relevance and acceptability of existing health interventions
- Land tenure
- Household factors (income, level of education, religion, age, etc.)
- Health knowledge and health-seeking behavior.

Drawing on primary data collected from a household survey in Summer 2009, this thesis will assess child health status in KB using the following indicators: child mortality rates, immunization status of children under five years old, and mother’s health knowledge and health seeking behavior. The case of KB will also be used to examine the role of tenure status in determining immunization coverage; specifically, data on health outcomes in KB, an unregistered slum, will be compared to outcomes from registered slums based on census data, and data from the National Family and Health Survey (NFHS-3, 2005/6). Lastly, through an analysis of barriers to accessing services, this thesis will offer contextually appropriate interventions to scale-up childhood immunization and improve child health in India’s urban slums.

I. Urbanization and the growth of slums

The United Nations defines slums as “communities characterized by insecure residential status, poor structural quality of housing, overcrowding, and inadequate access to safe water, sanitation, and other infrastructure” (UN-HABITAT, 2003). From 2000 to 2030, the world’s urban population is projected to grow at an annual growth rate of 1.8%, nearly double the rate of total population growth. In less-developed areas, the urban growth rate currently averages 2.3% (UN Population Division, 2005), and for slums, the rate is dramatically higher, at up to 6% per year (Chatterjee, 2002). 95% of this growth in the next 40 years will be in developing country cities (UN-HABITAT, 2008/9). The rapid growth of slums represents “a fundamental transformation of the physical and social environment of urban life and human health” (Unger & Riley, 2007).

Whereas only two centuries ago, urban areas were hotbeds of infectious disease and high mortality, today’s cities are—on average—healthier than rural areas (UN-HABITAT, 2006/7). The modernization of cities brings increased affluence, widespread availability of goods and services, high quality education and infrastructure, and greater employment opportunities for both women and men (Ibid). In a report on urban health in eight Indian cities, the International Institute of Population Sciences notes that, “It was often assumed that the heavy concentration of health facilities and personnel in urban areas, particularly in the private sector, would automatically take care of the increasing urban population and its health needs” (IIPS, 2009). However, because the majority of urban growth has occurred in developing countries that are already struggling to meet the basic needs of their populations, there are not enough physicians, drugs and facilities to meet the demand of the large number of patients.
Because slums are often centers of high mobility and migration, a continuous influx of new pools of infectious agents—combined with high population density—puts slum dwellers at high risk of contracting communicable diseases (Agarwal, Sangar & Ghei, 2005). Numerous social determinants cause poor health in slums as well, including “hidden and hard-to-reach slum pockets, a weak social fabric, social exclusion, class discrimination toward slum dwellers, a lack of coordination among various stakeholders and a paucity of political will and consciousness to address the health needs of India’s most marginalized” (Agarwal, et al. 2005).

Unger and Riley point out that health services available in slums “are often comprised of an inconsistent patchwork of public, private, and charity-based providers. Inadequate or inappropriate care at these places permits the progression of preventable diseases” (Unger & Riley, 2007). Given barriers to accessing health services such as cost and proximity, many slum dwellers often wait until healthcare is absolutely necessary before seeking help. Riley, et al, add that, “the formal health sector encounters slum residents only when they develop late-stage complications of preventable chronic diseases (Riley et al, 2007).

According to the International Institute of Population Sciences (IIPS), “not all slums are created equal, and striking variability exists across these growing communities” (IIPS, 2009). The five “shelter deprivations” UN-HABITAT uses as indicators of slum status – sanitation (proper disposal of household and industrial waste, and sewage systems), access to water, adequate living space, durable housing and the security of tenure – differ greatly within and between slum communities (UN-HABITAT 2006/7).

One of the greatest difficulties in improving slum health is to provide services in areas where residents are illegally occupying private land. According to UN-HABITAT, up to one-third of the world’s urban population is constantly threatened by forced eviction and insecurity of tenure. Many of the largest slums in the world, such as Kibera in Kenya, Khayelitsha in South Africa, Orangi Town in Pakistan, and Dharavi in India, began as illegal settlements (People of Kibera, 2010, Slum Rehabilitation Authority, 2007). Land tenure and land security issues can create insurmountable bureaucratic obstacles to the provision of basic rights, amenities and health services, since communities are frequently bulldozed. Governments fear “legitimizing” the illegal occupation of private land by providing basic services. The uncertainty of land rights significantly deters investments in housing, sanitation, infrastructure and health services in slum communities.

**India: Growing Cities and Urban Slums**

India’s rapid industrialization, recurring famines, droughts, and crop failures have spurred large-scale migration to urban areas, where the burgeoning middle class and affluent elites provide prolific employment opportunities in India’s massive service and manufacturing industries. Figure 2 charts a steady increase in the size of India’s urban population over the past century. In fact, 2009 was the first year that India’s manufacturing output overtook agricultural output (Economist, 2009). Areas of high population density are also those where jobs tend to cluster, drawing hundreds of thousands of migrants each year to urban hubs. Yet a 2010 study on the determinants of health in urban slums argues that, “[t]he continued influx of individuals to a community severely limited by tenure disputes suggests that many migrants encouraged by the promise and profit of cities are actually encountering a potential
Upon arrival, many destitute rural migrants find that they cannot afford the astronomical housing costs of megacities such as Mumbai, and resort to taking up residence in unregistered urban slums (Sadiq, 2008). There is a severe shortage of legal, affordable housing for those at the lowest end of the wealth spectrum in the largest cities (Ibid).

What little affordable housing is available tends to be located outside of city centers, such that the cost of long, arduous commutes is introduced (upwards of three hours daily). The lack of urban planning leaves affordable areas such as KB isolated with limited access to transportation, schools and services. Thus in Mumbai, the second largest city in the world with a population of almost 14 million residents, 56% of Mumbaikars\(^1\) live in slums (IIPS, 2009). Of Mumbai’s poor (those in the lowest wealth quartile), almost 80% live in slums, which cover only 6% of the city’s land (IIPS, 2009). Figure 3 outlines India’s slum conditions.

The International Institute of Population Sciences (IIPS), the body that conducts India’s National Family and Health Survey (NFHS), defines slums according to characteristics

\(^1\) Residents of Mumbai
such as “dilapidated and infirm housing structures, poor ventilation, acute overcrowding, faulty alignment of streets, inadequate lighting, paucity of safe drinking water, water-logging during rains, absence of toilet facilities, and non-availability of basic physical and social services (IIPS, 2009).

The official Indian Census defines slums as “a compact area with a population of at least 300 or about 60-70 households of poorly built, congested tenements, in an unhygienic environment usually with inadequate infrastructure and lacking in proper sanitary and drinking water facilities” (IIPS, 2009). However, the legal definition of slums differs from state to state. Both definitions are vague, making it difficult to enumerate slum populations or compare health outcomes between slums and with the urban non-slum poor. The distinction between urban poor and urban slum dwellers (as defined below) is important because there are large disparities in health and living conditions between the two populations.

It is often assumed that slum dwellers live below the poverty line. However, while “slums and poverty are closely related and mutually reinforcing, the relationship is not always direct or simple” (UN Human Settlements Program, 2003). In cities such as Delhi and Mumbai, some slum dwellers present income levels that put them well above the poverty line (Singh, 2001). Nevertheless, slums have the highest concentrations of poor people and the worst living conditions in urban areas (IIPS, 2009).

A slum is considered to be government-recognized, legal, and permanent when it is “notified” to be a registered slum by a “competent administrative authority” (IIPS, 2009). Designating particular slums as “notified” allows for government investment in civic and municipal services such as water, trash removal, and properly piped water. However, unregistered slums inhabited by migrant workers, new rural migrants, or long-term slum residents who find it difficult to find formal housing within their earning capacity, are not enumerated within census figures and have extremely low reach of services and civic facilities (IIPS, 2009). For the purposes of this thesis, “notified slums” will refer to registered, permanent slums that receive government services such as piped water, sanitation and anganwadi centers.2 “Unregistered slums” will refer to non-tenured, informal, unauthorized colonies occupying private or otherwise non-residential land, resettlement colonies, squatter settlements, etc. Exhibit 2 provides a diagrammatic illustration of the notification process and the impact of tenure on health.

A forthcoming manuscript by PUKAR and HSPH on the determinants of urban health in KB found that, “[i]n India, tenure (i.e. legal land ownership) strongly shapes the contours of the slum gradient, which often begins with squatter communities and ends with formal legalization” (PUKAR, 2010). Slums that have existed for many years often become “notified” slums, (i.e. they become permanent, officially registered by government authorities). However, a constant influx of migrants from rural areas has increased the number of illegal, “unregistered” settlements. In fact, NFHS-3 found that approximately one-quarter of Indian city dwellers did not feel secure from eviction (NFHS-3, 2005/6).

Given that residents of untenured slums are ineligible to receive municipal services from the government, they must instead seek out alternative sources. To obtain these basic necessities, slum dwellers pay astronomical prices and often receive poor quality, intermittent services. Because of the constant threat of forced eviction, household investment remains low. “This results in a poor standard of living, which can reinforce and ingrain the cycle of poverty” (PUKAR & HSPH, 2010). If these

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2 Anganwadi centers are community-based functionaries of the Integrated Child Development Scheme (ICDS) a Government of India program started in 1975, to provide child education health and nutrition services (Ghei et al, 2010).
communities were able to obtain land tenure and its accompanying services, their daily costs of living and their disease burden would fall, and household investment would increase, accelerating their escape from the poverty cycle (ibid).

HSPH and PUKAR argue that “[p]olicy interventions that move settlements to the ‘legal’ end of the slum spectrum can disrupt the poverty cycle by assuaging land security fears and ushering in municipal services such as piped water and toilets. Together, land security and improvements in basic amenities can promote household investment, as people anticipate and plan for more permanent stays in their households and communities.” (PUKAR & HSPH, 2010).

In India’s recent past, destructive “slum-clearing” policies have hastened the push for residents of illegal settlements to achieve legal status and receive services. For example, in its efforts to make Mumbai a “world class city” the Maharashtra state government enacted a slum-clearing campaign in 2004 and 2005 that tore down more than 90,000 shanties. (UN-HABITAT, 2006/7). However, urban slum growth rates suggest that the number of unregistered settlements will only continue to grow, making this approach untenable and unsustainable. The government of India (GOI) often resettles slum dwellers to tenements on the fringes of cities, destroying close-knit slum communities and dividing large, joint family residences into nuclear units residing in separate flats. Unsurprisingly, it is very common for resettled slum dwellers to sell their new property and return to the slums (Mehta, 2004). The civil society organization Asha interviewed resettled slum dwellers in 2006, who reported that “on the one hand they were happy to have secure tenure and access to basic services but on the other hand the resettlement location offered fewer employment opportunities and led to increased travel costs.” (Asha, 2006).

II. Child Health & Immunization Coverage in India

High infant and child mortality and morbidity are revealing indicators of the pervasive, negative health outcomes of overcrowding, poor environmental conditions, sub-standard housing conditions, and the lack of access to quality, affordable health care. Child health— and immunization status in particular—are a useful lens through which to assess overall slum population health.

Children are at particular risk of contracting debilitating— and often fatal— communicable diseases. In 2008 alone in India, out of 27 million live births, there were over 1.5 million neonatal deaths (WHO, 2008). According to NFHS-3, India’s urban under-five mortality rate (U5MR) was 74 deaths per 1,000 live births, compared to the average of 48 among India’s total population (IIPS, 2009). In Mumbai, the infant mortality rate (IMR) varies from 30-43 deaths per 1,000, which means that 3-4% of children die before reaching their first birthday (IIPS, 2009). The neonatal mortality rate (NMR), IMR and U5MR are much higher among the urban poor than the urban average, and are equally as poor as their rural counterparts (Agarwal et al., 2005).

<table>
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<tr>
<th>Table 1: Child and Infant Mortality in Mumbai Slums (IIPS, 2009)</th>
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<td><strong>Infant Mortality</strong></td>
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<td><strong>Under 5 Mortality</strong></td>
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Measles in particular is a major killer of slum-dwelling Indian children due to prolonged exposure to infected siblings in very small living spaces with several family members dwelling in a single-room household (Banerjee & Shitole, 2009/10). According to the NFHS-3, more than one in five poor households has at least seven persons sleeping per room (IIPS, 2009).

The WHO/UNICEF Expanded Programme on Immunization (EPI, provided by the Indian government) includes one dose of BCG vaccine to prevent tuberculosis, three doses of DPT vaccine to prevent diphtheria, pertussis, and tetanus, three doses of oral polio vaccine (OPV), and one dose of measles vaccine (WHO and UNICEF, 2005). A child should be fully immunized (i.e. should have received all the EPI vaccines) by age one.

The Indian government provides free immunization services to all children in government health facilities. However, rates amongst urban poor children remain lower than the urban average: roughly 69% of urban children in India ages 12-23 months are fully immunized (IIPS, 2009) compared to only 44% of urban poor children (Banerjee, A. & Duflo, 2008). This number likely overlooks the children living in unregistered slums, whose immunization coverage appears to be much lower based on data from KB.

The first immunization (BCG) is given at birth, and by inference it seems more likely that a hospital-born baby will be immunized for BCG than a home-delivered child. Among the urban poor, almost three-quarters of babies are delivered at home (Agarwal et al, 2005), a significant cause of lower immunization rates in this population, as will be demonstrated by primary data on KB in section IV.

In 2000, India’s National Population Policy pledged universal immunization coverage by the year 2010. However, according to Siddharth Agarwal, a leading expert on child health in Indian slums, “[a]lthough coverage has increased substantially in recent years, large numbers of slum-dwelling children remain incompletely immunized.” Also, dropout rates remain problematic for immunization programs that require multiple injections before the vaccine schedule can be completed. As of 1993, the Indian Ministry of Health and Family Welfare estimated that dropout rates for DPT and OPV were as high as 70% of participating children (Pande & Yazbeck, 2003). This is important given that the failure to complete vaccine regimens can leave children at risk and pave the way for resurgent epidemics of infectious disease.

The impact of the failure to achieve universal coverage on childhood mortality and morbidity from vaccine-preventable illness (VPI) is difficult to estimate. Since 71.8% of infant and child deaths occur at home, causes of death cannot be effectively determined (Awasthi et al., 2003). Additionally, in 2003, 94.5% of child hospital deaths did not have a death certificate and physicians oftentimes fail to diagnose their patients’ conditions (Ibid). Physicians frequently prescribe medications without providing a diagnosis, or any accompanying health information prevention, treatment or care (Banerjee & Shitole, 2009/10).

Based on this unreliable data, India’s Integrated Children Development Scheme (ICDS) system underreported deaths in 2003 by one-third (Awasthi et al., 2003). It is also difficult to find reliable data on infant and neonatal mortality rates, since data are collected statewide and are only disaggregated into urban vs. rural categories, excluding inter-population heterogeneity and significant disparities based on socioeconomic status, caste, ethnic background and place of residence (Vaid, et al. 2007).
II. Shortcomings of Urban Health Delivery Systems

India has fallen dismally short of its 2001 goal of universal immunization coverage by 2010. Therefore it is necessary to identify specific barriers to scaling up immunization coverage in urban slum environments in order to design and improve viable health interventions that will make universal access a realistic possibility. Challenges for uptake fall into two main categories: barriers to accessing health services by slum-dwellers, and a lack acceptability of immunization services due to the absence of adequate health education efforts.

Barriers to Access

Stark differences exist between the morbidity and mortality rates of disenfranchised Indians living in registered slums (such as Jogeshwari and Dharavi) versus those living in unregistered slums where there is little to no provision of health services, water, or sanitation. Many of these unregistered slums do not fall on the radar of government agencies or NGOs (some on purpose, to avoid the threat of forced eviction). The lack of adequate city planning and mapping leads to a concentration of health services in a small number of areas, and oftentimes duplication of services leads to repeated interventions in registered communities, while unregistered slums have a total lack of access (Agarwal, et al. 2005).

Investments in human resources for public health have not increased in response to urban growth. Given the immense volume of patients and the limited resources of government hospitals, health care providers are overwhelmed. In large Indian cities such as Mumbai and Delhi, government health care workers (for example, staff at anganwadi centers, community-based institutions that provide basic health services) face numerous challenges that decrease morale and harm recruitment efforts for new workers. Pay is low and opportunities for professional development or promotion are scarce. A general lack of effective management in many institutions results in ineffective outreach efforts and poor program outcomes. Long and arduous commutes on Indian cities’ poor public transport can take 3 hours or more out of a health worker’s day (Agarwal, et al. 2005).

Beyond the problem of too few trained health workers and facilities, other significant barriers prevent parents (most often mothers) from bringing their children to health clinics for treatment of illness, immunization, or routine check-ups. Clinic hours often coincide with working hours, have lengthy wait times, or are simply too far away and unaffordable. In urban slums, the preferred health provider is most often the closest one; parents often take children to NGO health providers (Awasthi et al., 2003), local pharmacists and chemists, bhagats (traditional healers) and local “doctors” who may not be qualified practitioners (Banerjee & Shitole, 2009/10). For treatment or immunizations that require multiple visits, mothers find it difficult to make repeat visits, or make this effort only for male children (Gaudin & Yazbeck, 2006).3 In joint-family situations, parents and in-laws can exhibit powerful resistance when it comes to a young mother spending time and household income on doctor visits and immunizations (Ibid).

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3 This was not the case in KB. Mothers showed a preference for female children and health outcomes for both genders were very similar.
Acceptability of Health Interventions and Health Education

Oftentimes specific urban slum-dwelling communities hold strong traditional and/or religious beliefs against immunization, or do not understand the benefits of immunization. For example approximately half of KB’s population consists of migrants from Bihar and Uttar Pradesh (U.P.) (Banerjee & Shitole, 2009/10). In these two areas there is a pervasive urban myth that the oral polio vaccine (OPV) causes sterility in men. Given India’s nefarious history of Sanjay Gandhi’s forced sterilization of poor people and ethnic/religious minorities (predominately Muslims) in the 1970’s, such fears are not historically baseless and gave rise to a distrust of the medical establishment by India’s poor (Gwatkin, 1979). However, the refusal to take OPV has a dangerous effect: India is one of only four countries where polio has not been eradicated in the world (WHO, 2006).

While patients can see and appreciate the direct benefit of curative health services to themselves and to their children, the long-term, preventive benefits of immunization to both the child and to the community are less tangible. Mothers often do not understand why they should put up with a cranky child with a sore arm for a week when s/he was healthy to begin with (Banerjee & Shitole, 2009/10). Additionally, service providers who have a negative and discriminatory attitude toward slum dwellers, or who cause injury or infection through poor vaccination procedures can inhibit women from completing their children’s series and bringing their siblings at all (Agarwal et al., 2005).

Agarwal also points out that “evidence suggests that poor uptake of immunization in urban areas is associated with mother’s unawareness about repeat visits to achieve complete immunization rather than overall vaccine awareness” (Agarwal, et al. 2005). As a result, half of urban poor children who begin their immunization series eventually drop out (Ibid).

For women who had their children in the village before migration to urban areas, unreliable health services are a major deterrent for accessing immunization services. Abhijit Banerjee and Esther Duflo of MIT’s Jameel Poverty Action Lab conducted a randomized controlled trial on child immunization to evaluate the impact of incentives on increasing uptake. Through weekly visits of health facilities, they found that 45% of the staff in charge of immunizations were absent on any given workday, and there was no predictable pattern to their absence (Banerjee, A & Duflo, 2008). Banerjee says, “[g]iven that a full immunization course requires at least five visits to a public health facility, the unreliability of the [health service providers] may deter families from taking their children to the sub-center to complete the full immunization schedule. (Banerjee, A & Duflo, 2008).

Because antibiotics are often given as injections in India rather than pills, it is common for marginalized women to fail to differentiate between injections to treat illness rather than vaccinations to prevent illness. Women who participated in focus groups reported that doctors in the two closest government hospitals openly discriminate against poor patients whom they assume are uneducated and will be “non-compliant.” Women said they were shouted at and blamed for children’s illnesses or infected injection wounds. They were told to boil their water, wash their hands, and to not urinate or defecate in common or open spaces. Given KB and other slums’ constraints, such public health messages are largely useless (Banerjee & Shitole, 2009/10).

Others reported being turned away from immunization services because they did not have their child’s birth registration document (which is against government hospital policy (Jaju, 2009). The discriminatory attitude of health providers was identified as a major disincentive to availing of health services amongst
women in focus groups on barriers to accessing health services and challenges to the acceptability of immunization (Banerjee & Shitole, 2009/10).

IV. The Case of Kaula Bandar

To provide a comprehensive assessment of the determinants of child health and immunization status in both unregistered slums (using the example of KB) and registered slums, this thesis will draw upon three data sources:

1) The primary data source is a household survey on child health and immunization status in KB\(^4\), (a sub-study of the HSPH and PUKAR study on the determinants of urban health),

2) A 2008/9 household survey\(^5\) to demonstrate how the lack of land tenure and basic utilities impacts the health and wealth of the KB community,

3) The 2001 Census data on urban, notified slums (supplemented by NFHS-3 2005/6 findings on 8 Indian cities\(^6\))

Methods

The HSPH and PUKAR study assessed five domains:

- Child health & immunization,
- Maternal health,
- Water & sanitation,
- Health networks,
- Small enterprise.

This sub-study on child health and immunization was designed and administered amongst 226 households in KB, interviewing the mothers of 258 children under five years old. The women chosen to participate in the household survey reflect the broad spectrum of communities living in KB that define themselves according to religion, language/ethnic group and/or income level. The survey was conducted in Hindi/ Urdu, Tamil and Marathi, and obtained informed consent with signatures or thumbprints. Findings were supplemented with 17 filmed focus groups and one-on-one interviews. For child health histories, the recall period for questions about serious illnesses and frequently occurring symptoms was one year, to account for the small sample size.

\(^4\) Study designed, translated and administered by Joya Banerjee and Tejal Shitole. Data analysis by Joya Banerjee

\(^5\) By PUKAR, 2008/9, supported by the Ford Foundation

\(^6\) NFHS-3 team supervisors decided to include both notified and unregistered slums, based on the Census definition of slums provided on page 7. However, the NFHS-3 does not provide information on what percentage of the slums were unregistered, and therefore it is not possible to draw accurate conclusions on the impact of land tenure on health status from these data. NFHS-3 used very similar methodology to the Census, choosing representative samples of 2,000 from 8 Indian cities (1,000 slum and 1,000 non-slum individuals each representing a household). State weights corrected for oversampling, so that indicators based on these data were representative at the city level, as well as for slum and non-slum areas within cities.
Survey participants were selected using representative sampling based on the geographical location of their household in the slum, which is divided into distinct ethnic communities, self-defined by inhabitants according to language, religion, homeland and other characteristics peculiar to the cultural groups in India. For example, Muslim families from Bihar occupied one main section of the slum, while Tamil boat repairmen whose families had been in KB for decades occupied another. The slum sits upon a wharf and has one main road, with narrow, perpendicular lanes that denote separate communities (Figure 6). Participants were chosen from every other lane, and based on which mothers were available for interviews on days the survey was being conducted (including non-work week days and times).

The study’s objectives were:

• To ascertain the determinants of child morbidity and mortality,
• To assess the health knowledge and health-seeking behavior of KB mothers,
• To collect demographic information on each household (focusing primarily on the mother),
• To obtain histories of the health of children under five.

Methods for the quantitative component of the study are on page 23.

Results: Kaula Bandar Ethnography and Demographics

KB is an unregistered slum settlement on the eastern waterfront of Mumbai, home to 18,000-25,000 residents (PUKAR, 2008/9). The KB community is made up primarily of Tamil boat-repairing families, some of whom have been there for over 40 years, and migrant laborers (who are much more recent arrivals, mostly from Bihar and U.P.) (Banerjee & Shitole, 2009/10). Seventy percent of KB residents report that they initially came to the area in search of employment (PUKAR, 2008/9). The wharf that they live on (pictured in Figure 6) is owned by the Bombay Port Trust (BPT). The BPT has been trying to forcibly remove residents for four decades.

Figures 4-6: Situating Kaula Bandar (Google Maps, 2010)
Because KB residents are occupying BPT’s land illegally, they have no access to clean water, sanitation, electricity or basic health services guaranteed to all Mumbaikars that own or rent their homes legally. Thousands of tiny one-room homes sit perched one atop another amidst lanes so narrow they often require inhabitants to walk single file. KB has an extremely high population density (Table 2), a factor that greatly increases the risk of contracting communicable disease. Consequently, tuberculosis, measles and other communicable diseases are very common amongst both children and adults.

Table 2. Population density comparison

<table>
<thead>
<tr>
<th></th>
<th>Population</th>
<th>Land area (km²)</th>
<th>Population density (people per km²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kaula Bandar</td>
<td>18,000-25,000</td>
<td>0.08</td>
<td>230,769 - 320,512</td>
</tr>
<tr>
<td>Mumbai</td>
<td>13,830,884</td>
<td>603</td>
<td>22,937</td>
</tr>
<tr>
<td>New York City</td>
<td>8,363,710</td>
<td>789.4</td>
<td>10,452</td>
</tr>
</tbody>
</table>

The use of unwieldy and flammable materials in the building of homes puts the KB community at great risk of fire damage. In February of 2010, a fire swept through the community and destroyed 251 homes. The lack of piped water and the inaccessibility of slum homes meant that the fire brigade took hours to arrive and to douse the flames.

To obtain water for bathing, drinking, cooking and cleaning, homes would tap into the Bombay Municipal Corporation (BMC, the local agency responsible for providing basic amenities to Mumbaikars) water supply pipes. However, approximately 20 years ago, the BMC became aware of the illegal usage of water by the community. They subsequently destroyed the underground piping by going to each home in KB and uprooting the piping system (PEKAR & HSPH, 2010). However, five households were missed, and currently these five supply water to the entire KB community through an intricate system of rubber tubing— at excessive costs. For tenured Mumbaikars, the BMC charges a monthly fee of Rs. 30$\textsuperscript{7}$ per household for access to a proper water tap. However, in KB, an average resident pays between Rs. 150-299$\textsuperscript{8}$, a 5-10 fold difference (PEKAR & HSPH, 2010). The fire brigade pipes are old and damaged, allowing the surrounding seawater, garbage, fecal waste and other toxins to leak into the piped water. Only 59.6% of households used any method of water purification such as boiling, water purification tablets or drops, etc.

Only 3% of KB households had access to a toilet in their home, and the majority of survey respondents reported that there are less than five public toilets in the community, for between 18,000-25,000 people (PEKAR, 2009). Observed data suggest that residents make frequent use of the surrounding sea as a toilet and garbage-dumping site. The rubber tubing system that supplies water to KB homes runs directly through this contaminated seawater. The lack of drainage and sewage systems exacerbate the spread of water-borne illnesses and communicable diseases, especially during monsoon flooding season (Banerjee & Shitole, 2009/10).

---

$\textsuperscript{7}$ $0.66$ USD
$\textsuperscript{8}$ $3.31-6.60$ USD
Because the majority of KB’s tightly packed homes lack windows or proper ventilation, and Mumbai temperatures can reach over 40°C (104°F) during the city’s hottest seasons, children frequently swim in the surrounding, contaminated seawater to cool off. They have nowhere else to play except for a small, abandoned boat yard full of rusty pipes. Consequently, skin infections, parasites and tetanus are common childhood causes of morbidity.

**KB Demographics**

The majority of families surveyed were Muslims, an observation closely supported by the PUKAR 2008/9 survey as well, which found that 51% of respondents were Muslim, 42.9% were Hindu, 3.8% Christian, and 2.1% other (Figure 7).

When asked to report which languages they speak, some respondents distinguished Hindi from Urdu, but it was later discovered that some considered them to be the same language. Therefore Figure 8 masks the true number of Urdu speakers who may have reported being Hindi speakers, since Hindi is one of the two lingua francas of Mumbai (the other being English).

Figure 9 shows that the majority of respondents earned between Rs. 3,000- 5,000 per month and substantial percentage, 12%, earn above Rs. 5,000 per month. The per day equivalent would be Rs. 100- 167, signifying that the average KB resident earns above the global poverty line of Rs 57 per day, or $1.25 per day (PPP). When women from these families were

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9 All subsequent findings in this section are from the child health study by Banerjee & Shitole, 2009/10.
10 Urdu is considered to be a more pure form of Hindi, and is spoken predominately in Muslim communities. The two use different alphabets but are essentially the same language, barring some dissimilar vocabulary.
11 $67.79- $112.86 USD per month
12 112.86 USD
13 $2.26- $3.76 USD
asked why they do not use their higher earnings to seek out improved living conditions in other locales, some participants responded that they did not wish to leave their family or tight-knit community.

The average KB home has 6.15 residents (Table 3) and is approximately 2.5m x 2.5m (8’ x 8’). Bathing and cooking (over kerosene fires) are conducted inside the home or immediately outside, in the lanes, causing frequent respiratory infections in children.

<table>
<thead>
<tr>
<th>Table 3: Household Composition</th>
</tr>
</thead>
<tbody>
<tr>
<td># of people per household</td>
</tr>
<tr>
<td># of children per household</td>
</tr>
<tr>
<td># of children per Hindu household</td>
</tr>
<tr>
<td># of children per Muslim household</td>
</tr>
</tbody>
</table>

The greater number of children per Muslim household could be explained by the much higher total fertility rates (TFR) and lower levels of female education (which are significantly correlated with fertility rates) (Bloom & Canning, 2006) in the states where most Muslim families migrated from. In Bihar, the TFR is 4.3 and 74.6% of urban poor women have no education. In U.P., the TFR is 4.1 births per 1,000 women and 67.7% of women have no education (Urban Health Resource Center, 2007). Overall, almost half of women in KB have no education (Figure 10).

One surprising finding is that only 10.9% of women are employed, even counting home-based production or service work. The recent proliferation of media about another Mumbai slum, Dharavi, has created the common impression that there are thousands of micro-industries booming in India’s slums. The survey instrument asked, “Do you have a job for which you earn money?” and interviewers gave examples that included in-home work such as tailoring. Of the 10.85% who are employed, women reported working as servants, tailors, cooks, and shopkeepers.

Child Health and Mother’s Health Seeking Behavior

In KB only 29% of children are fully vaccinated, compared to 69.8% of children in Mumbai as a whole, and 68.7% in notified slums (IIPS, 2009). Free vaccination is available at government hospitals that are reachable by train or taxi. The cost of transport to the closest hospitals (Rs. 415 for a one-way, second-class train ride, and approximately Rs. 40-6016 by taxi to JJ Hospital or Cama Hospital, respectively) was

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14 Where the film Slumdog Millionaire was filmed
15 $0.09 USD
16 $0.89-$1.34 USD
considered to be a disincentive for some mothers to seeking care in a health care facility, certainly to making multiple visits to complete the entire immunization schedule.

Women reported seeing local doctors in KB for most of their children's healthcare needs, and only taking them to hospitals (most often government hospitals) in serious conditions (such as excessive vomiting and diarrhea, persistent fevers and coughs, etc.) Table 3 provides a breakdown of which healthcare facilities are most commonly utilized. It is unclear what training the doctors in KB have, but interviews with them revealed that they do not offer immunizations, but do treat common child health issues. Women reported that the most common serious illnesses their children have experienced are:

- Pneumonia and other respiratory infections,
- Tuberculosis,
- Malaria,
- Typhoid,
- Tetanus,
- Jaundice,
- Measles.

**Table 4: Mother’s Health Seeking Behavior**

<table>
<thead>
<tr>
<th>Source of Healthcare</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doctor in KB</td>
<td>44.2</td>
</tr>
<tr>
<td>Doctor outside KB</td>
<td>8.5</td>
</tr>
<tr>
<td>Private hospital</td>
<td>7.8</td>
</tr>
<tr>
<td>Government hospital</td>
<td>16.7</td>
</tr>
<tr>
<td>Bhagat (traditional healer)</td>
<td>0.8</td>
</tr>
<tr>
<td>Treat at home</td>
<td>3.5</td>
</tr>
<tr>
<td>No treatment sought</td>
<td>17.4</td>
</tr>
<tr>
<td>No response</td>
<td>1.2</td>
</tr>
</tbody>
</table>

It is important to consider that both women and physicians (in KB and at four government hospitals) reported that physicians do not normally discuss diagnoses with women, because they assume they are uneducated and will not understand. They merely assess the child’s symptoms and prescribe medication, which women pick up from the “medico” or “chemist” (small pharmacies where certification status of pharmacists is unknown). The medication comes in the form of loose pills wrapped in foil or plastic, with no identifying information. Side effects from interactions are consequently common.

Women judge the effectiveness of a provider based on the time it takes for their children to recover. If they are dissatisfied with the length of the recovery period, they see another doctor and give their child a different medication. Table 4 shows a strong preference for doctors in KB, and in focus groups women cited the reason for the preference as low cost and proximity. Women also said that doctors in government hospitals see them only for a few minutes and do not convey any preventive or curative health information. With regard to immunization, some physicians instructed women that the injections given were for the prevention of illness, and that it was very important to save the child’s vaccination card (but did not explain why it was important). Only 29% of women still have their child’s vaccination
card (and therefore data on immunization are largely based on mother’s recall of <5 years). Women may have lost their cards because:

- Many women are migrants and return to their ancestral villages for a few months each year,
- They were not informed about the purpose or importance of the card by a health care provider,
- Cards were lost during forced evictions, fires, or monsoon flooding.

Based on barriers to accessing health services that were identified in the literature review, women were asked why a KB woman might not seek care from a doctor when her child is ill. Less than 3% cited the cost of services, the loss of daily wages due to missed work, hours the facility was open, the physical distance to the health facility, or family resistance. 95% did not give a reason, and in focus groups women claimed that they always seek immediate care when their child is ill (has no appetite, is listless, fatigued, etc.) It is questionable whether this is accurate, given the access rates in several other studies on health in Indian slums (Vaid, et al., 2007, Agarwal et al., 2005, Banerjee A & Duflo, 2008). The responses may be due to the sensitive nature of the question: women may feel guilty for not seeking care, regardless of whether or not the barrier was outside of their control.

Health care providers did seem to be initiating dialogue with mothers on the importance of immunization, given that 51.6% of women report that they brought their child to be vaccinated based on a doctor’s suggestion (Figure 11). In interviews with physicians at local government hospitals, all those who were interviewed said that they always instruct women to immunize their children, at every visit. NGOs and government public messages about immunization appear sometimes on hoardings (billboards), buses, on radio and television and seem to be effective.

**Figure 11**

![Source of Suggestion to Immunize](image)

**Mother’s Health Knowledge about Immunization**

Fifty-seven percent of women could correctly identify the purpose of immunization: to prevent disease/to protect their child from infection. But 43% did not know or had incorrect knowledge (many women thought it was for curative purposes rather than preventive). According Banerjee and Duflo’s randomized controlled trial on immunization in India, one reason for the incorrect knowledge may be that “a parent may confuse immunization with other injections (injection of antibiotics is a frequent treatment in India) and may not realize the difference between different injections” (Banerjee, A & Duflo, 2008). Predictors of mother’s health knowledge will be discussed in greater detail beginning on page 23 in the quantitative findings section.
Only 29.1% of children were fully immunized in KB (Figure 12). Child immunization status seemed to depend largely on the convenience factor for mothers, meaning that if the service was provided, for free, without the mother having to travel or take time out of her day, immunization rates would be high. For example, 88.8% of children were given BCG, a vaccine given at birth, a time when a woman delivering in a health facility has access to immunization services. Similarly, Oral Polio Vaccine (OPV) rates are the highest out of any vaccination, at 95%. This is because the government Pulse Polio door-to-door campaign is highly effective and reaches almost every household in KB, with workers going from lane-to-lane giving drops to each child, and returning to the home if the child was not present initially. Compare these rates to Measles with 31.78% coverage, a vaccine given between 9-12 months that requires the mother to visit a health facility.

Some KB mothers reported that the local Dockyard Hospital has been organizing immunization camps in KB. There are mixed feelings about the camps: many women reported that the injection sites on their children became swollen and infected. Several developed cysts that required costly operations (at approximately Rs. 1,000\(^\text{17}\), one-third of monthly income). This might suggest improper sanitizing practices or perhaps the re-use of needles. However, in focus groups, women by and large seemed to know the importance of using a new needle for each patient, and that HIV infection could result from using the same needle on multiple patients. Many women reported watching to make sure the doctor used a new needle during immunization procedures.

\(^{17}\) $22.36 USD
On every indicator in Table 5 except for deliveries assisted by health personnel, KB fared much worse than both notified slums, and in most cases worse than the poorest quartile as well. The numbers suggest that KB’s population is unusually disenfranchised compared to those living in notified slums and the urban poor, especially with regard to education, tenure, infant mortality rate, and the incidence of diarrhea.

### The Health Impact of Tenure

To assess the validity of these findings, and to compare KB— an unregistered slum— to notified slums, data from KB are compared to Census data on the same health indicators in Table 6. It is important to note that the Census is carried out only once every decade, and so the data are from 2001. Where available, NFHS-3 data from 2005/6 (using similar methodology to the Census) is used to supplement Census findings, which may be outdated. Census data were disaggregated into city, slum, non-slum and

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Table 5: Comparison of KB to Notified Slums and Poorest Wealth Quartile

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Kaula Bandar (unregistered)</th>
<th>Census (notified slums)</th>
<th>Census (poorest quartile)</th>
<th>NFHS-3 (both)</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of women employed</td>
<td>10.9%</td>
<td>27.1%</td>
<td>27%</td>
<td>27.9%</td>
</tr>
<tr>
<td>% of women with no education</td>
<td>45.4%</td>
<td>19.3%</td>
<td>46.2%</td>
<td>19.9%</td>
</tr>
<tr>
<td>% of women with &lt;5 years education</td>
<td>n/a</td>
<td>17.7%</td>
<td>17.4%</td>
<td>18.1%</td>
</tr>
<tr>
<td>% of women with 5-9 years education</td>
<td>n/a</td>
<td>38.7%</td>
<td>31.2%</td>
<td>39.4%</td>
</tr>
<tr>
<td>% of women with 10+ years education</td>
<td>n/a</td>
<td>24%</td>
<td>4%</td>
<td>22.2%</td>
</tr>
<tr>
<td>% of population with tenure status</td>
<td>0%</td>
<td>72%</td>
<td>51.4%</td>
<td>68.7%</td>
</tr>
<tr>
<td>Crude Birth Rate (per 1,000 people per year)</td>
<td>2.9</td>
<td>1.9</td>
<td>3.2</td>
<td>n/a</td>
</tr>
<tr>
<td>Infant Mortality Rate (per 1,000 live births)</td>
<td>58.1</td>
<td>24.9</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>% of deliveries assisted by health personnel</td>
<td>88.7%</td>
<td>82.2%</td>
<td>74.2%</td>
<td>n/a</td>
</tr>
<tr>
<td>% babies delivered in a health facility</td>
<td>77.1%</td>
<td>83.3%</td>
<td>72.9%</td>
<td>n/a</td>
</tr>
<tr>
<td>% using a public health facility</td>
<td>16.7%</td>
<td>25.4%</td>
<td>42.4%</td>
<td>n/a</td>
</tr>
<tr>
<td>% using a private health facility</td>
<td>7.8%</td>
<td>74.4</td>
<td>56.4%</td>
<td>n/a</td>
</tr>
<tr>
<td>% of households with piped drinking water</td>
<td>0%</td>
<td>99.7%</td>
<td>98.8%</td>
<td>99.7%</td>
</tr>
<tr>
<td>% children with acute respiratory infection</td>
<td>6.2%</td>
<td>1.6%</td>
<td>0.0%</td>
<td>n/a</td>
</tr>
<tr>
<td>% children with fever</td>
<td>81%</td>
<td>9.8%</td>
<td>4.9%</td>
<td>n/a</td>
</tr>
<tr>
<td>% children with diarrhea</td>
<td>53.8%</td>
<td>6.8%</td>
<td>6.9%</td>
<td>n/a</td>
</tr>
</tbody>
</table>

---

18 Some indicators are highlighted because the recall period (past 1 year) may make these data incomparable to those from the Census (2 weeks). The survey instrument asked women about common illnesses within the past year; 2 weeks would not be representative of KB given the small sample size. However, observational data and the quality of KB’s conditions suggest that these data may very well be accurate.
poorest wealth quartile. For the purposes of accurate comparison, only slum and poorest wealth quartile are included here.

Table 6 reveals striking discrepancies in immunization coverage. These could be due to the fact that notified slums have health interventions specifically for children and mothers, such as the Integrated Child Development Scheme (ICDS) which operates through 40,000 *anganwadi* centers nationwide, where community health workers offer immunization, child health services and antenatal care (IIPS, 2009). There are also many urban health centers in—or in close proximity to—notified slums. There is a proliferation of slum-focused NGOs, especially in Dharavi, that provide health information and services, and encourage immunization.

The one inconsistent finding is that OPV incidence in KB is much higher than in notified slums. This could be due to the geometric layout of KB (Figures 4-6) which makes it easier to visit every home in a slum, compared to other slums such as Dharavi with serpentine lanes and an un-planned layout for an ever-growing number of homes.

### Quantitative Findings

#### Methods

A predictive logistic regression model was built from the retrospective cohort study data using backwards elimination (p <0.10)\(^\text{19}\).

The outcomes under study were:

1) Immunization status,
2) Under 5, infant and neonatal mortality,
3) Mother’s health knowledge and health-seeking behavior.

The covariates assessed in the model were:

- Child’s immunization status (dichotomous),
- Mother’s age (continuous),
- Education status (dichotomous),
- Religion (Hindu, Muslim, Christian, other),
- Employment status (dichotomous),
- Income (<Rs. 3000, 3000-5000, 5000+),\(^\text{20}\)
- Number of people per household (continuous),
- Number of children per household (continuous),

\(^\text{19}\) P < 0.10 was used over P < 0.05 due to the small sample size to preserve power.

\(^\text{20}\) Rs. 3,000 = $67.79- USD, Rs. 5,000 = $112.86 USD.
• Duration of residence in KB (continuous),
• Birth place city hospital, village hospital, and with/without a *dai.*

1) Outcome: Immunization Status

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Estimate</th>
<th>Likelihood Ratio 95% Confidence Limits</th>
<th>Pr &gt; ChiSq</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0.6467</td>
<td>-1.5047 - 2.8183</td>
<td>0.5537</td>
</tr>
<tr>
<td>Language: Other</td>
<td>-0.6222</td>
<td>-2.0043 - 0.8590</td>
<td>0.3842</td>
</tr>
<tr>
<td>Language: Urdu</td>
<td>-1.9730</td>
<td>-3.5340 - -0.4711</td>
<td>0.0102</td>
</tr>
<tr>
<td>Not employed</td>
<td>2.2913</td>
<td>0.8493 - 3.7545</td>
<td>0.0016</td>
</tr>
<tr>
<td>Not born in city hospital</td>
<td>-2.2980</td>
<td>-3.6995 - -1.0877</td>
<td>0.0005</td>
</tr>
<tr>
<td># People in the house</td>
<td>0.3341</td>
<td>0.0636 - 0.6526</td>
<td>0.0253</td>
</tr>
</tbody>
</table>

Table 7 shows that significant predictors of immunization status are the covariates *language,* employment status, birth location and the number of people in the household.

- **Language:** Urdu speakers are 1.97 times less likely to get immunized compared to Hindi speakers, holding all other variables constant. *(Hindi = reference group)* This may be because most Urdu speakers have migrated from resource-poor areas such as U.P. and Bihar which have notoriously low health and education outcomes— particularly for women, who are more marginalized in these regions than in other parts of the country *(Urban Health Resource Center, 2005/6).*

- **Employment:** Women who are not employed are 2.29 time more likely to have immunized their children compared to those who are employed, holding all other variables constant. In focus groups, when asked to explain this finding, women responded that those who are employed do not have time to take their children to the hospital, wait in long queues, and sacrifice a day’s wages.

- **Birth location:** Children born in a village hospital or at home (village or urban) are 2.30 times less likely to be immunized than children born in a city hospital (government or private). Village hospitals have inconsistent quality of care, unreliable procurement, high rates of absenteeism among personnel, and frequent shortages of supplies. Based on responses in focus groups with

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21 A skilled birth attendant.
22 Language group data was included to examine behavioral patterns within distinct ethnic groups, which are demarcated largely by language in India. However, the survey asked participants which languages they speak (multiple options were possible), and not what their primary language is. Thus if a Tamil resident learned Hindi during his or her time in Mumbai, it would appear as though there are more Hindi speakers than there actually are, and this could bias the findings.
23 See discussion of language groups in previous section “KB Demographics”
KB mothers, women who deliver at home are less likely to make the visit to a hospital later to immunize their children.

- **Number of people in the house**: Per increase of one person in the household, a mother is 0.33 times more likely to get her child immunized, holding all other variables constant. (6.15 = reference group with a standard deviation of 2.58) It is unclear why this might be; perhaps with each successive child a mother is more likely to learn of immunization through doctor visits or from family and neighbors. However, this contradicts the later finding that per increase of one child in the household, a mother is 0.39 times less likely to have correct knowledge of the purpose and benefits of immunization.

2) **Outcome: Mortality**

**Table 8: Prediction of child mortality status**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Estimate</th>
<th>Likelihood Ratio 95% Confidence Limits</th>
<th>Pr &gt; ChiSq</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-1.7337</td>
<td>0.0473 - 3.4830</td>
<td>0.0447</td>
</tr>
<tr>
<td>Immunization status (dichotomous)</td>
<td>-3.2177</td>
<td>1.9683 - 4.5386</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Number of children</td>
<td>0.3949</td>
<td>-0.7568 - 0.0254</td>
<td>0.0311</td>
</tr>
</tbody>
</table>

Table 8 shows that mortality was measured by the probability of surviving to the age of 5. Significant covariates were **immunization status and number of children**.

- **Immunization status**: Children who are fully immunized are 3.22 times less likely to die before the age of 5, holding all other variables constant.
- **Number of children**: Per increase of one child in the household, a child is 0.39 times more likely to die before the age of 5, holding all other variables constant. More children per household increases the likelihood that highly contagious diseases, such as measles, could spread rapidly.

3) **Outcome: Mother’s Health Knowledge about Immunization**

**Table 9: Prediction of mother’s knowledge about the purpose and benefits of immunization**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Estimate</th>
<th>Likelihood Ratio 95% Confidence Limits</th>
<th>Pr &gt; ChiSq</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0.0579</td>
<td>-1.4363 - 1.5249</td>
<td>0.9386</td>
</tr>
<tr>
<td>Mother’s age</td>
<td>0.0583</td>
<td>-0.0053 - 0.1253</td>
<td>0.0786</td>
</tr>
<tr>
<td>Income: &lt; 3000</td>
<td>-0.4890</td>
<td>-1.2675 - 0.2864</td>
<td>0.2155</td>
</tr>
<tr>
<td>Income: 3000-5000</td>
<td>-0.6149</td>
<td>-1.2110 - 0.0315</td>
<td>0.0405</td>
</tr>
<tr>
<td>Number of children</td>
<td>-0.3252</td>
<td>-0.5473 - 0.1143</td>
<td>0.0031</td>
</tr>
</tbody>
</table>
Table 9 shows that the probability of having correct knowledge about the purpose of immunization is predicted by **mother's age**, **income** (reference= highest income group), and **number of children**.

- **Age**: Per 1 year increase in the age of the mother, the mother will be 1.06 times more likely to have correct knowledge, holding all other variables constant. For instance, a mother aged 30 year will be 5*0.06 times more likely to have correct knowledge than a mother aged 25.
- **Income**: A mother in the lowest income group will be 0.49 times less likely to have correct knowledge compared to a mother in the highest income group, holding all other variables constant. Women with the lowest incomes were also those most likely to have no education. However, education was not a significant predictor in this model, suggesting that the provision and understanding of health information may not be dependent on the level of education.
- **Number of children**: Per increase of one child in the household, a mother is 0.39 times less likely to have correct knowledge, holding all other variables constant. This may be a reflection of the correlation between high fertility and low female education, especially amongst migrants from Bihar and UP, as earlier discussed.

V. The Way Forward

**The Economic Benefits of Immunization**

Given the growth rates of India’s urban slums, significant political will is needed to get India on track towards universal immunization. The economic benefits of immunization could make a powerful case for dramatically increasing investment in child immunization. It is far less expensive to invest in child health through immunization and the provision of basic services, than it is to care for a large adult population with low overall health status and few employment opportunities (Bloom *et al.*, 2004). Prevention of disease is cheaper than treatment— in developing countries, health care workers and facilities are inadequate, drugs are costly, and supply chains weak, driving up the cost of treatment.

Till Bärnighausen, *et al*, point out that current economic evaluations of vaccination programs focus on the benefits of avoided health-care costs, such as the value of the time a parent must spend caring for a child who is sick from a vaccine-preventable illness. They argue that an accurate cost-benefit analysis would also take into account lifetime productivity gains afforded by childhood vaccination such as increased school attendance, fewer physical handicaps and cognitive impairment, and increased worker productivity (Bärnighausen *et al*, 2007).

Most importantly, preventing childhood disease through immunization produces an enormous, long-term economic benefit at the national level. Healthy children have higher school attendance rates, perform better on cognitive function tests, and are likely to grow up to be more productive workers who miss fewer days of work due to illness (Bloom *et al*, 2004).
Structuring an Effective Intervention

Given the unprecedented growth of India’s slums, it is imperative that the GOI devote increased resources specifically toward the health of urban slum dwellers. Interventions should take into consideration the specific challenges faced by urban slum dwellers without tenure, which may be distinct from the more general category of urban poor. Unger and Riley argue that “[a]ppropriate interventions and treatments are only effective once provided in the context of accessible and utilized health care services (Unger & Riley, 2007).

India is making progress by including slum dwellers and other marginalized urban dwellers in its eleventh Five Year Plan (2007-2012). The plan includes the introduction of the National Urban Health Mission (NUHM) for inclusive growth, covering all cities with a population of more than 100,000 (IIPS, 2009). It must now assess the relevance and impact of current health programs affecting slum dwellers, and craft new interventions that better meet the population’s unique needs. Earlier plans since 2001 shifted away from slum-clearing policies, instead focusing on slums as an integral part of the urban landscape. The policies recognized slums as contributors to city economies through both their labor market contributions and informal production activities (Asha, 2006). Instead of treating slums as a problem to be solved, new policies were based on the premise that local bodies should accommodate slums and recognize their contributions through providing affordable housing and services.

India has already showed that it is capable of implementing a large-scale health intervention in a slum population with near-universal coverage. India’s “Pulse Polio Campaign” offering door-to-door oral polio vaccination, reached 94.96% of children in KB. Such success points to the real possibility that universal access can be within India’s reach if adequate resources are mobilized now. It is clear that new health care facilities, and drug and vaccine stockpiles are needed to meet the growing demand of urban slum populations. As the findings from KB demonstrated, the expansion of primary health care infrastructure into areas now overlooked will improve the immunization status of slum-dwelling children and, by corollary, long-term overall population health and productivity. (Agarwal et al., 2005).

In order to create acceptability of—and demand for—immunization services, slum dwellers must be provided with a clear understanding of the benefits of vaccines, the importance of following through with all scheduled doses, information on potential side effects, the understanding that others in their community are taking advantage of the free service, and incentives to overcome barriers to accessing health services. Interventions must be cost effective, geared toward changing behavior in the target population, and must be measurable and scalable.

There are five necessary steps to work towards universal vaccine coverage in India:

1) Identify all slums (notified and unregistered) using mapping and vulnerability assessment as a planning tool. By understanding which areas are endemically weak and assessing adequacy of infrastructure, it will become clear where new facilities are needed, and primary level facilities can be re-defined to reach left-out areas (Agarwal et al., 2005).

2) Strengthened and regular immunization services, particularly for areas with poor access. Immunization strategies must focus on providing the complete series and making sure that women know why it is crucial for them to return, rather than simply immunizing as many children as possible without regard to follow-up.
3) Because of the unique role women play in safeguarding the health of their children, slum-dwelling women should be trained as community health and outreach workers. Community participation is well known to increase behavior change and the acceptance of many different types of health interventions through the creation of local ownership. It can increase trust and awareness of the benefits of immunization programs, and this knowledge is likely to spread to other households and communities given the close-knit nature of slum communities. Community health workers should emphasize the importance of retaining vaccine cards, proof of vaccination and dates when they were given (evidence that is crucial to evaluating the efficacy of an intervention).

The KB child health study found highly correlated patterns of health-seeking behavior, health knowledge, and incidence of communicable disease based on which lane houses are situated in (Banerjee & Shitole, 2009/10). Thus KB’s “lane-based behavior” may be a highly effective distribution channel for immunization health information. 56% of KB women already know the purpose of immunization and these women can be mobilized as a powerful resource in efforts to increase health education.

4) Simply offering immunization series is not enough. A comprehensive intervention requires proximate health facilities, affordable services, adequate supplies, vaccine efficacy, correct administration, post administration counseling, follow up with left-out children and drop-outs, and safe disposal of vaccine syringes; but also by measuring the intervention’s impact on slum-dwelling children’s morbidity and mortality from vaccine-preventable diseases, through a system of rigorous monitoring and evaluation. This will require improved disease surveillance, especially in areas of low reach. (Agarwal, et al. 2005)

Agarwal suggests holding regular immunization/outreach camps that are publicized well, and occur in a convenient, fixed location on a regular schedule (Agarwal, et al. 2005). Camps must obtain the support of local stakeholders such as slum corporators, religious leaders, teachers, male head of households and mother in laws in order to have wide local buy-in and to ensure that all potential barriers are addressed in a culturally appropriate, relevant manner. Slum schools and madressahs, community worship areas such as temples and masjids, anganwadi centers, and private doctor’s clinics are convenient and trusted locations to host such camps. Agarwal also suggests that health care workers can distribute pictorial cards or leaflets indicating the appropriate ages for different vaccines and reinforcing the significance of timely immunization when children visit health services for consultation. These will encourage families to get their children immunized even when they migrate to other areas.

5) For any of this to be effective, there must be a convergence of stakeholders in order to build political momentum and to manage resources effectively. The wide range of stakeholders who can influence the success of an immunization intervention should not be underestimated. Stakeholders could include government officials, private providers, community outreach workers, NGOs, faith-based organizations, donor agencies, religious leaders, teachers, and the slum-dwellers themselves. Traditional birth attendants, dais, could be particularly helpful in identifying the homes where they have recently-delivered newborns (de Quadros, 2008).

To reduce the duplication of services and to ensure coordination between multiple stakeholders at the city level, all stakeholder groups should meet regularly to identify each other’s complementary roles and capacities. They should work together to create a time-bound plan for scaling immunization services with measurable outcomes and a rigorous monitoring and evaluation component.
**Incentives: The “Last Mile”**

Banerjee and Duflo conducted a randomized controlled trial in India (n=1640) in which they examined the efficacy of non-cash incentives (instead of cash giving one kilo of daal or lentils and a set of bowls) on immunization rates. One group out of three hamlets involved in the trail received well publicized, regularly occurring immunization camps. The second received the camps as well as the small, non-cash incentive of daal, worth Rs. 40.24 The third group was the control and did not receive camps or incentives (Banerjee A & Duflo, 2008).

Duflo underscored the importance of incentives in an interview in which she said, “even when you fully fix the supply problem and immunization services are available, you still need to nudge people a bit. You need to provide an incentive for the parent to bring the child and you need to provide an incentive for the service provider to be there as well” (Duflo & Banerjee, 2008). Banerjee and Duflo tested the hypothesis that “improving reliability of services improves immunization rates, and small, non-financial incentives have large positive impacts on the uptake of immunization services in resource-poor areas” (Ibid). Banerjee notes that:

> In intervention A, even when access was good and a social worker constantly reminded parents of the benefits of immunization, more than 80 percent did not get their children fully immunized. More than 75 percent obtained the first shot without the incentive, but then stopped attending the camps only after 2 or 3 shots. This shows that the parents do not have strong objections to immunization, but that they are not persuaded enough about its benefits to overcome the natural tendency to delay a slightly costly activity (Ibid).

A number of previous studies have shown that uptake of preventive behaviors is very sensitive to small incentives or small costs, suggesting that incentives can play a role in promoting preventive health services (Kremer, 2007; Cohen, 2007; Thornton, 2005). However, other researchers have suggested that in resource poor settings, ensuring a reliable supply of health services and educating parents about the benefits of preventive care are more important than providing incentives. (Morris, et al., 2004)

Banerjee and Duflo’s findings support the case for providing incentives: While control hamlets had a full immunization rate of 6.2%, hamlets in which a reliable camp was held showed rates of 16.6%, and adding the incentive pushed rates to 38.3%, a statistically significant increase. Moreover, while a camp without incentives increased immunization rates only in the hamlet where it took place, camps with incentives also increased rates in neighboring villages (Banerjee A & Duflo, 2008).

Similar incentive schemes have been highly successful in Mexico (former Minister of Health Julio Frenk’s conditional cash transfer program, Oportunidades, and New York Mayor Bloomberg’s Opportunity NYC program.

A participant in one of KB’s focus groups mentioned that in her home village in U.P., there is an incentive scheme that provides conditional cash transfers to families that bring their children in for immunizations and who complete the vaccine schedule. She said, “They give you money, so now everyone goes.” A cash (or non-cash) transfer could be a powerful incentive for KB women to immunize their children. In

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24 $0.88 USD
fact, women were partially incentivized to participate in the focus group discussions by receiving a kilo of rice each.

V. Conclusion

The link between immunization and child mortality is well known. However, prior studies on immunization in India did not establish how child mortality rates and immunization coverage differ even within the same social, medical and health care systems. Access to care within the same metropolis varies greatly depending on many factors that determine societal inequity including income, migration status, ethnic/religious group, geographic location, etc. India’s disease surveillance system must take into account these differences by consistently disaggregating its data in future censuses.

With increased investigation into utilization of immunization services, quality of care, follow up visits and impact on child morbidity and mortality, it will be further established that unregistered slums have far less access to services than notified slums receiving outside interventions. Equity in health access requires urgent attention to the improvement of both access and quality of care.

Focused, cost-effective and measurable immunization interventions that take into account the context, needs and desires of the target community will dramatically improve the immunization health status of slum-dwelling children. In the words of Unger and Riley, “slums are complex, and our efforts must match this complexity” (Unger & Riley, 2007). Meaningful involvement of community members will give communities local ownership and help make the program more relevant and likely to succeed. Immunization confers enormous health benefits on the individual; but also, overall, long-term population health and productivity will improve due to the decline in communicable disease. Vaccines have existed for decades, and yet vaccine-preventable diseases still kill hundreds of thousands of children in developing countries every year. With the rich and growing body of evidence around successful program interventions, there is no reason why India cannot attain universal coverage in the near future.
Works Cited


16. de Quadros, CA. (2008) “The whole is greater: how polio was eradicated from the western hemisphere.” In *Practice of International Health*, edited by Daniel Perlman and Ananya Roy, Oxford


27. Jaju, NB. (17 June, 2009) KJ Somaiya Hospital, Sion, Mumbai, India. (Interview by Joya Banerjee)


37. PUKAR (Partners in Urban Knowledge, Action and Research). (2008/9) Household survey of KB


### Exhibit 1: Child Health Survey Data

#### Table 10: Child Health Histories  
(n= 258 children under 5 years old in 226 households)

<table>
<thead>
<tr>
<th>Child’s Age</th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1 month</td>
<td>14</td>
<td>5.43%</td>
</tr>
<tr>
<td>1 month – 1 year</td>
<td>57</td>
<td>22.09%</td>
</tr>
<tr>
<td>2 years</td>
<td>58</td>
<td>22.48%</td>
</tr>
<tr>
<td>3 years</td>
<td>47</td>
<td>18.22%</td>
</tr>
<tr>
<td>4 years</td>
<td>45</td>
<td>17.44%</td>
</tr>
<tr>
<td>5 years</td>
<td>31</td>
<td>12.02%</td>
</tr>
<tr>
<td>Not reported</td>
<td>6</td>
<td>2.33%</td>
</tr>
</tbody>
</table>

**Sex of children under-5 from household surveyed**

<table>
<thead>
<tr>
<th>Sex</th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>129</td>
<td>50.00%</td>
</tr>
<tr>
<td>Male</td>
<td>129</td>
<td>50.00%</td>
</tr>
</tbody>
</table>

**Under-5 child deaths (# deaths of children (all ages) within a sample of 457)**

<table>
<thead>
<tr>
<th></th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neonatal deaths (&lt;1 month)</td>
<td>8</td>
<td>1.75%</td>
</tr>
<tr>
<td>Infant deaths (1 month- 1 year)</td>
<td>6</td>
<td>1.31%</td>
</tr>
</tbody>
</table>

**Birth Place**

<table>
<thead>
<tr>
<th>Birth Place</th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Village hospital</td>
<td>27</td>
<td>10.55%</td>
</tr>
<tr>
<td>Village at home w/dai**</td>
<td>20</td>
<td>7.81%</td>
</tr>
<tr>
<td>Village at home no dai</td>
<td>31</td>
<td>12.11%</td>
</tr>
<tr>
<td>KB at home w/ dai</td>
<td>3</td>
<td>1.17%</td>
</tr>
<tr>
<td>KB at home no dai</td>
<td>3</td>
<td>1.17%</td>
</tr>
<tr>
<td>Government hospital (city)</td>
<td>158</td>
<td>61.72%</td>
</tr>
<tr>
<td>Private hospital (city)</td>
<td>14</td>
<td>5.47%</td>
</tr>
</tbody>
</table>

*All reported under-5 deaths occurred only amongst neonates and infants  
**A dai is a skilled birth attendant (midwife)
**Table 11: Immunization Status**

<table>
<thead>
<tr>
<th>Immunizations</th>
<th>#</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>29</td>
<td>11.24%</td>
</tr>
<tr>
<td>Fully immunized</td>
<td>75</td>
<td>29.07%</td>
</tr>
<tr>
<td>Do not remember</td>
<td>105</td>
<td>40.70%</td>
</tr>
<tr>
<td>Has vaccination card (listing dates of each vaccine)</td>
<td>75</td>
<td>29.07%</td>
</tr>
<tr>
<td>No card (data based on recall)*</td>
<td>59</td>
<td>22.87%</td>
</tr>
<tr>
<td>OPV</td>
<td>245</td>
<td>94.96%</td>
</tr>
<tr>
<td>No OPV</td>
<td>13</td>
<td>5.03%</td>
</tr>
<tr>
<td>BCG</td>
<td>229</td>
<td>88.76%</td>
</tr>
<tr>
<td>DPT1 (6 weeks)</td>
<td>127</td>
<td>49.22%</td>
</tr>
<tr>
<td>DPT2 (10 weeks)</td>
<td>116</td>
<td>44.96%</td>
</tr>
<tr>
<td>DPT3 (14 weeks)</td>
<td>104</td>
<td>40.31%</td>
</tr>
<tr>
<td>Measles (9-12 months)</td>
<td>82</td>
<td>31.78%</td>
</tr>
</tbody>
</table>

(Taken from the forthcoming manuscript, PUKAR & HSPH 2010, as adapted from Mahadevia & Shah, 2009)

**Figure 13. The evolution of slum living**

- Squatters → Temporary dwellings → Slums with de facto tenure → Upgraded slums → Legalized slums

**Figure 13. Consequences of insecure tenure on health and well being**

- Poverty and high cost of formal land delivery system → Informal settlements → Insecure tenure
- High cost of informal supply of amenities ← Lack of basic amenities ← Fear of eviction
- Low household investment → Poor standard of living
- Insecure tenure
Figure 14. Consequences of insecure tenure on health and well being