Tuberculosis, Tenements, Trojans, and Tin-cans
UVA Global Health Case Competition, 2013
Jose Jara quietly took in the magnificent sight of a setting sun above the Arabian Sea as he nursed his drink, a welcome respite from the city’s perennial humidity. The sky was a dramatic shade of red, the colour of a traditional Indian bride’s Sari, and the waves glinted as they caressed the southern shore of Mumbai, India’s financial capital and home to Bollywood. He was standing in the magnificent balcony garden of Antilia, residence of the richest man in India, Mukesh Ambani. It is considered the most expensive home in the world. He stifled a yawn as he turned away from the panoramic vista and made his way back towards the August gathering. Three days in the country and his circadian rhythm hadn’t quite recovered yet.

The NGO meet-and-greet event, organized by Mr. Ambani, was studded with Indian government officials, NGO directors, and the heads of foreign aid agencies and departments, like himself. Jose believed this to be a good opportunity to meet the movers and shakers of Mumbai, indispensable connections for his 5-year contract in country. He had been assigned to head a pilot USAID urban health programme for Mumbai identifying key public health issues in the city and exploring innovative solutions for them. He had a budget of 16 million US dollars (USD) to dispense towards this objective over the next three years. Jose was not yet sure where to start solving the puzzle.

Spotting Dr. Anand Ketkar, Mumbai’s deputy minister for health, Jose made his way through the crowd towards the man who looked more like a tweedy college professor than an Indian politician and introduced himself. After the necessary niceties as to how Jose and his family were adjusting to the city, Ketkar wound the conversation towards a news story that had been keeping him preoccupied lately.

“You have obviously heard about the recent ‘Totally Drug Resistant’ Tuberculosis outrage. Our doctors in particular and the health care system in general looked preposterous. Well, the central government was rather upset about our international embarrassment and increased the TB budget by a solid 80%. Our department in Mumbai will receive 5.7 million USD. It’s a start. Having slums like Dharavi around makes this proposition particularly hard though. Have you been to Dharavi yet? No? How about I arrange a visit for you tomorrow? I’ll warn you: you will see one person living on top of another in utter squalor with bad food, worse water, and impossible sanitation. After your visit, I’d love to have your input on a strategy to decrease the incidence and communication of TB in Dharavi. Perhaps it would be useful to coordinate our efforts.”

Realizing that Mumbai’s TB menace was symptomatic of deeper public health issues, Jose agreed to the Dharavi visit, pleased to get such an early start to his assignment. He promised to collaborate with his colleagues at USAID to compile some meaningful and executable suggestions for the minister.

The sun had set and darkness was attempting to engulf the city. It was thwarted by the prosperity and splendour of Southern Mumbai, but Jose could discern distant patches of the city where the lighting seemed feeble... where night had prevailed. He realized that battling public health problems in Mumbai, this city of dreams and extremes, would take a lot of creativity and determination.

**Dharavi: an introduction**

Dharavi is a heart shaped settlement that used to be at the periphery of British Mumbai, but has since been engulfed. It now lies in the heart of the city (see Appendix I). It had the dubious honor of being the largest slum in Asia, with a population of approximately half a million crammed into 0.67 square miles, but four other slums in Mumbai surpassed Dharavi by 2011.

Over the years, Dharavi has metamorphosed from the sleepy fishing village it once was into a bustling slum with a surprisingly booming economy. Pottery and leather industries...
Tuberculosis, Tenements, Trojans and Tin-cans
UVA Global Health Case Competition, 2013

have been around for decades, but the rising economic entity in Dharavi is the recycling business. Most of the people in Dharavi come from outside Mumbai in search of jobs in the big city. Families live in tiny quarters; oftentimes, 14 or 15 people sleep together in one tiny room. The vast majority of these people are considered “illegal encroachers,” but those who migrated to Dharavi before 2000 have managed to secure legal status.

Prince Charles, on a 2009 visit to Dharavi, argued that “the district's use of local materials, its walkable neighbourhoods, and mix of employment and housing add up to an underlying intuitive grammar of design that is totally absent from the faceless slab blocks that are still being built around the world to warehouse the poor.”

Notwithstanding the squalor and the myriad infrastructural problems, Dharavi’s residents are optimistic about their futures and consider their slum to be a microcosm of India. To borrow from Katherine Boo, They speak of better lives casually as if “fortune were a cousin arriving on Sunday.”

Healthcare issues in India and Dharavi

The Indian health system, like Mumbai, is dichotomous in the extreme. During the British rule infrastructure was concentrated in the four major cities (Chennai, Mumbai, New Delhi, and Calcutta) of the country. Not much has changed in the 65 years since independence. While the major hospitals in New Delhi and Mumbai are advanced enough to attract medical tourists from wealthy countries, healthcare in the villages is primitive. This is significant considering 70% of India’s population lives in the villages. Primary and tertiary health care institutes in the villages are inadequate and people often travel hundreds of kilometers to big hospitals like All India Institute of Medicine in New Delhi or Hinduja hospital in Mumbai for advanced treatment. India does worse on indices like infant and maternal mortality than its poorer neighbours like Bangladesh and Sri Lanka. Moreover, India has twice the number of stunted children as Sub-Saharan Africa (see Appendix II). The central government established the National Rural Health Mission (NRHM) to address this inequity in 2005.

As India’s urban population grows, a new vulnerable population has been identified: the urban poor. They migrate from rural India and live unaccounted for in slums. Urban slum advocacy groups like Pukar insist that despite being extremely industrious and contributing meaningfully to India’s accelerating economy, these slum dwellers are neglected by the government. They cite the example of Mumbai where an estimated 6 million slum dwellers, who live in slums like Dharavi, do not receive services as basic as water and sanitation. The urban poor delay seeking treatment, mainly for financial reasons, and present too late with wholly preventable late-stage complications of diseases. For these Indians, the universal health care promised to them by the government is a theoretical concept. Similar conditions plague the urban poor across the globe. Given the success of NRHM, the central government launched the National Urban Health Mission, an insurance scheme for the urban poor, in 2012 to decrease the burden of disease among the hitherto underserved urban poor.

Infectious diseases claim millions of lives in India. Hundreds of thousands of Indian children die of diarrhea and millions more are left stunted physically and intellectually. India has 2.4 million cases of HIV (see Appendix III). Malaria, Hepatitis C, and Tuberculosis also wreak tremendous havoc. On a positive note, India is on the brink of becoming Polio-free.

Tuberculosis is primarily a pulmonary disease caused by Mycobacterium tuberculosis and it spreads via the microdroplets produced when patients cough. However, it can spread to other parts of the body like the brain, bones, and the gastrointestinal system with tragic consequences. According to Nerges Mistry, “TB is a disease of poverty and marginality, and the UN-HABITAT definition of a slum could double as a pro-tuberculotic checklist:
Tuberculosis, Tenements, Trojans and Tin-cans
UVA Global Health Case Competition, 2013

overcrowding, inadequate safe water and sanitation, poor housing fabric, and insecurity of tenure. Given its large slum population that lives in cramped and unhygienic conditions, it is not surprising that India has an estimated 21-30% of the global burden of Tuberculosis. The large number of HIV positive individuals and severely malnourished people are also at a significantly increased risk for tuberculosis. Worse, India has a high percentage of multi-drug resistant (MDR) tuberculosis cases that are fuelled by several factors. International guidelines are frequently abandoned in favour of personal experience and beliefs by physicians; laboratories capable of testing drug resistance are scarce and underutilised; and there is poor compliance with the multi-drug antimycobacterial regimen.

The emergence of a “totally drug resistant strain” in Mumbai’s slums in 2012 was horrifying for public health officials and embarrassing for the ministry of health. The government of India has been trying to showcase India as an attractive market for investment and a future economic superpower. Government officials have argued that news of superbugs like totally drug-resistant M. tuberculosis and Klebsiella pneumoniae with the New Delhi beta-lactamase serves to decrease medical tourism to India and “spoils India’s reputation” in the International community. In response, the government has increased funding to the Revised National Tuberculosis Control Programme (RNTCP) by 80% to Rs. 7.1 billion (approximately 140 million USD) for 2012-2013. Other measures are also being implemented. If drug resistance is allowed to propagate, the progress made in India’s battle against tuberculosis will be lost.

While infectious diseases take an unaffordable toll on India’s human capital, noncommunicable chronic diseases (NCDs) like coronary artery disease, hypertension, metabolic syndrome, non-infectious lung diseases, and cancer account for 53% of mortality in India and 44% of DALYs (see appendix II). According to some projections in 2007, India stands to lose 237 billion USD over the next decade due to NCDs. Despite the magnitude of the problem and its preventability using behavioural and pharmaceutical approaches, this problem has been largely ignored. Cardiovascular disease is the biggest culprit; it is fuelled, in part, by the changing diet among the urban poor and rural rich.

Compared to physical ailments, there exist enormous, likely greater, inequalities in the distribution of mental health services across the globe. It is no different in India. Poverty, violence, gender inequality, and conflict in slums are risk factors for mental disorders. There is also an intimate association between mental health and physical health problems. The global burden of all disease attributed to neuropsychiatric illness by DALYs (disability-adjusted life-years) is around 14% (See Appendix IV). Depression, substance/alcohol abuse, bipolar affective disease, schizophrenia, and dementia account for the majority of the burden. There is no accessible quantitative data and very little qualitative information on the status, functioning, disability, de-facto care, or complications suffered by the mentally ill in Dharavi.

In India, there are an estimated 2 psychiatrists per million people and they are primarily in large hospitals in urban centers. A google search for mental health providers in Mumbai showed twelve listed mental health practitioners, none of whom are based within the slum itself. Allied mental health care providers such as psychologists, nurses, and social workers are similarly in short supply. Thirty years ago, the Indian government introduced the National Mental Health Programme (NMHP) to expand the capabilities of primary care services across the nation to include mental health, but the implementation has been limited. The de-facto caretakers of the mentally ill in India generally are the family, traditional healers, and alternative medical providers of varying legitimacy. Going to a psychiatrist is prohibitively expensive for most residents of Dharavi. There may also be differences in the manifestations, as well as social and psychocultural considerations in mental disease in eastern cultures.
Historically, public expenditure on health has been below 1% of India’s GDP. As of 2012, 71% of Indians paid out-of-pocket for healthcare at private facilities. The private health sector is working innovatively and frugally to extend quality care to poorer Indians. Even so, illness creates financial shocks for families and often drives them into a vicious cycle of poverty and disease. To address this problem, the government introduced a nationwide health insurance scheme called Rashtria Swasthya Bima Yojana (RSBY) that covers 120 million poor Indians for Rs.30,000 worth of healthcare costs annually. The paperless system uses a biometric identity card which prevents fraud and simplifies the process for illiterate Indians. A similar system, called the Rajiv Gandhi Jeevandayee Yojna, was started in Maharashtra in 2012. It covers families for Rs. 150,000 annually and even allows them to get free kidney transplants. In the 12th five year economic plan, which was approved in October 2012, public investment in health care has been increased to 2.5%, but this is still half of the WHO recommendation. The implementation of public health plans in India has been problematic; the impact of these recent programs remains to be seen.

Women’s social and medical issues in Dharavi

Though few metrics exist for Dharavi, the disparities between men and women’s lives more broadly in India are mirrored in the slum. Cultural expectations that women bear children, take care of the family, and maintain the home place significant restraints on women’s educational attainment as well as their financial and physical autonomy.

Education not only facilitates future employment, but also prevents girls from falling prey to common traps, including early marriage and childbirth, intimate partner violence (IPV), and poverty. Unfortunately, Indian families have historically prioritized male education over female education, and economic barriers exacerbate gender-based educational disparities. Despite the guarantee of primary education for all Indian children (ages 6-14), girls lag behind boys in primary school enrollment and attendance, and 40% of girls under the age of 14 do not attend primary school at all. This gender disparity continues through secondary and tertiary education. Once enrolled, girls must still navigate the manifold challenges posed by the poor quality of education, harassment from teachers and classmates, inadequate toilet facilities, and cultural pressure to marry instead of study.

India ranked 123 of the 135 countries surveyed with regard to the economic participation and opportunity afforded to women. In every city except for Mumbai, poor women are more likely to be employed than women in any other economic group. In Dharavi, women are often employed in the service and production industries, assuming they have employment at all. Studies have shown that when women control an increased share of household resources, this money is more often devoted to key investments like improving children’s health and education.

India also ranks as one of the worst countries (134 out of 135 countries surveyed) in terms of the health and survival of its female population compared to its male population. In a 2010 study of 103 deaths among reproductive age women in the Maharashtra state, 93.2% of all deaths were attributed to non-maternal causes. Of these, 46.8% of women had symptoms suggestive of anemia, the leading causes being malnutrition, parasites, and infectious diseases. Unsurprisingly, tuberculosis was the most common infectious disease. Suicide is the principle cause of death in the category of injury and poisoning, which contributes to 20.8% of all deaths. Cancer was responsible for 10.6% of deaths due to non-communicable disease. Recent data has also implicated cardiovascular disease as a significant cause of death among both men and women in India, killing 3 million individuals annually.

Though the total fertility rate (TFR) in India has fallen by 19% over the past decade (3.2 in 2000 to 2.58 in 2011), this progress has been more marked in non-slum areas than in
areas like Dharavi\textsuperscript{9}. On average, the TFR is higher in slums by 0.2-0.5 children\textsuperscript{5}. High birth rates exacerbate crowding in slum areas, a risk factor for infectious disease in turn\textsuperscript{10,11}.

In 2005-2006, the contraceptive prevalence rate in India was 56%. Female sterilization is the most common family planning method, used by two-thirds of the women in India with negligible differences between rural and urban married women. Condoms and the rhythm method are also popular, though condoms are more common in urban settings and traditional methods are used slightly more often in rural areas. Contraceptive use increases with education and is higher among women who earn an income by as much as 10-11%. Women’s socio-economic status and scheduled caste/scheduled tribe (SC/ST) are also correlated with the type of contraceptive method used\textsuperscript{12}.

The Government of India recognizes that the birth rate is unsustainable and, since 2000, has taken measures to increase women’s access to contraception with the support of multilateral organizations. In 2001, the World Bank supported a project in the state of Andhra Pradesh, which used incentives such as property, wells, and loans to promote sterilization for poor people with more than 2 children; however, such targeted sterilizations generated considerable controversy\textsuperscript{13}. Recent efforts have instead focused on promoting reproductive health education and family planning options more generally. The Indian government revealed a new approach: enlisting 860,000 community workers to provide family planning education and services, with an emphasis on IUD insertion\textsuperscript{14}.

Sexually transmitted infections (STIs) constitute another relevant challenge to women’s reproductive health in India. A 2005 DHS survey found that 11% of women and 5% of men who had ever had sex had experienced an STI or an STI symptom in the 12 months preceding the survey\textsuperscript{12}.

Though IPV is often ignored as an issue, a 2005-2006 survey of 69,484 ever-married women in India found that 31% had experienced physical violence in the past 12 months and 8.3% had been victims of sexual violence. Employment and having a husband who drank alcohol increased the odds of experiencing physical and sexual violence\textsuperscript{14}. These findings suggest that women in Dharavi may be at increased risk of IPV since they do not have reliable employment, are often poorly educated, and alcohol abuse is a well-documented problem in the slum.

The Problem of Redeveloping Dharavi

Located a mere seven miles from the most expensive house in the world\textsuperscript{1}, Dharavi’s seemingly abysmal living conditions are an unwelcome visual symbol of extreme income inequality in India’s largest city. Packed onto land that was literally reclaimed from the swamp, residents brave squalid conditions, unreliable law enforcement, and rampant disease\textsuperscript{2}. The first thing most western visitors notice is the smell. With minimal public infrastructure, Dharavi’s streets run with waste day in and day out. Industrious residents have found ways to get running water nearly everywhere, but toilets are another matter. Some estimate that there are as many as several hundred residents per toilet\textsuperscript{3}. Residents brush their teeth, discard their waste, and do everything else on the street, spreading every disease that can be spread. Fifteen residents may pack into a one-room flat, sleeping on every inch of the barren floor at night.

The vast majority of housing is “illegal” – shacks built from any available material. Housing situations are unreliable and houses structurally unsound with little protection against fire and flood. Residents who try to improve their homes can be caught by police and extorted for bribes under building code violations. Fewer than 100 families own Dharavi and collect rents\textsuperscript{4}. Without deeds to their houses, there is no way for residents to use them as capital or gain financially from redevelopment efforts. Without legal status, they are at the mercy of utilities goons and the “land mafia”\textsuperscript{5}.”
The land Dharavi sits on, located at the center of the city between major transportation hubs, is potentially worth a fortune if its less desirable elements can be bulldozed. Under the government’s plan, developers can evict residents to build new streets and high-rise towers with market-rate condominiums and commercial offices in exchange for using a portion of those towers to provide free 225-300 sq. ft. one-room apartments to “legal” residents of Dharavi – all those holding the elusive residency cards. Developers and city leaders stand to gain billions from developing prime real estate and eliminating an unsightly spectacle from downtown. Modern infrastructure would allow city utilities and services to reach residents. Wider streets would open up the area to police, delivery trucks, and outsiders. In the long run, this may be the only way to limit the spread of infectious diseases.

But while supporters of the plan argue it can only help Dharavi’s residents, many residents disagree and have consistently staged protests to stop redevelopment of the area. This is because, for its nearly one million residents, Dharavi is a pocket of opportunity in the heart of the “world’s most expensive city.” The same filth, lack of services, and crowded living conditions bemoaned by Western philanthropists and Indian officials make it possible for impoverished residents to find work deep in Mumbai. Residents who can scarcely afford to ride India’s public transit from slums on the outskirts of the city (a brutally long commute), much less purchase a motorized vehicle, are within reach of low-level service jobs across Mumbai. A booming informal economy within Dharavi produces textiles, pottery, and other manufactured goods. Dharavi’s homegrown recycling industry employs a quarter million residents and processes enough garbage to keep the city from “choking to death on its own waste.”

Dharavi’s low-rise density and organic network of alleys and streets make the area easy to navigate for pedestrians, allowing for rapid exchange and intense economic activity. Rooms serve as bedrooms at night and household factories during the day. Unemployment in Dharavi is lower than in many Western countries. A family can bring in 15,000 rupees (about $270) a month – far more than they could make in impoverished agricultural areas – while paying less than ten dollars in rent. Wages have risen steadily and new businesses and services crop up constantly as newcomers look for ways to earn their keep. By contrast, the concrete high-rise apartments built by developers are ill-suited to productive activity. They break up existing economic networks and communities, displacing businesses, industries, and local support networks. Relocated residents find it difficult to live and work in their new environment. Crime is worse and maintenance more difficult than on shacks made of local materials. Modern-style development separates uses, pushing industries further away and making it difficult for the relocated residents to find jobs nearby. Development patterns are based on access to transportation modes like automobiles and trains, which are beyond the reach of the very poor. Many of those given a free apartment opt for a one-time cash payoff by selling the apartment to a middle class family and returning to the street-level shacks or leaving the city. An even larger problem is that most of the displaced Dharavi residents won’t receive one of these free flats, forcing them out of the area and back into rural poverty or fringe slums and causing Dharavi’s crucial industries to collapse.

Mumbai’s leaders hope to find a way to help Dharavi’s residents benefit from the redevelopment scheme. Though painful, they see it as the only way to force a chaotically developing India into a brighter 21st century. For Dharavi’s residents, a clean place to sleep is not enough – they need a place built for the types of industries that provide them with opportunities to move up. A number of interesting alternative plans have been sketched out, but with little political traction. In the meantime, the original redevelopment project continues to move forward, albeit slowly.
Dharavi’s Economic Landscape

Although Dharavi is a visual eyesore and has intense struggles, it is also an economic miracle unlike any other. In 2005 Dharavi had some 100,000 people producing goods worth over $500 million a year. Today sources seem to suggest over twice that figure, and over 1 million people live packed in an area about two-thirds the size of New York’s Central Park. These large figures, as well as their questionable accuracy suggest that Dharavi is much less a slum than it is an unregulated industrial empire and a pure demonstration of Indian entrepreneurship and tenacity. Hundreds of thousands of Dharavi citizens partake in the vibrant industrial complex that exists within the slum. Because Dharavi operates almost entirely unregulated, its industries are able to avoid difficulties such as licenses and permissions, which has been a boon for growth in Dharavi.

Many of Dharavi’s entrepreneurs believe that the lack of regulation supports growth. Dharavi has one of the largest shadow economies in the world. There are billions of dollars of undocumented goods floating in and out of the slum annually. Looking towards redevelopment the government faces the daunting challenge of legitimizing property and land ownership rights. Dharavi’s residents complain that this process would be costly, bureaucratic, and disruptive to their way of life, but if regulators do not tackle the problem of land legalization soon, they fear that the inevitable waves of urban migration will lead to slum expansions.

The primary industries in Dharavi are embroidery, bakery, soap making, leather tanning, pottery, and recycling. For a long time Dharavi was known for pottery, but recently stronger industries have emerged such as leather exports to Europe and the Middle East. The industry that has come to dominate recently is recycling. The industry employs approximately 200,000 people slum dwellers and has turned Dharavi into the recycling hub of Mumbai. Dharavi residents scour the streets and trash cans of Mumbai in search of plastics, cardboard, computers, paint cans, oil drums, etc. The factories in Dharavi re-sell the re-processed products to major companies and make hundreds of millions of dollars in profits.

Dharavi’s entrepreneurs have limited access to easy capital. Thus far, most offerings by banks have been highly experimental. For example, the State Bank of India set up its second microfinance branch which offers small sized loans ranging from Rs 10,000 to Rs 50,000 in the summer of 2010. Big banks appear uncharacteristically cautious considering that the major lending models in India such as Grameen Bank, have always focused on lending to the rural poor, and have largely ignored the urban populations. That said, other companies such as Hindusthan Microfinance Pvt. And Swaadhar FinAccess are also working to extend their networks of financial services to poor citizens of Mumbai. Most Dharavi citizens are excited to partake in micro-lending, as it is a favorable alternative to borrowing from predatory informal sources.

It is unknown how the recently begun redevelopment efforts will affect Dharavi’s economy and, with it, the lives and health of its residents. Entrepreneurs fear that the Dharavi Redevelopment Plan (DRP) would greatly limit its future as many of the factories would be transformed into housing and much of the unlicensed businesses would face red tape, rendering them unviable. They argue that, if the current plan were executed, monolithic piles of trash would begin to form in the streets of Mumbai. Government authorities do not concur with their assessment. Another redevelopment plan called “Vision Mumbai” is also in the works, but it hasn’t received a glowing endorsement from Dharavi residents either. Many fear that the redevelopment will provide office buildings and shopping districts for the rich, and will ignoring the pleas of Dharavi’s citizens.

The transformation of Dharavi from a poverty stricken slum into an industrial empire is an economic miracle, where neglected and poverty stricken citizens have come together in
a common spirit of entrepreneurship to create an industrial empire in the middle of one of the world’s largest slums. Protecting the economic vitality of Dharavi’s residents is desideratum in order to help them escape the poverty trap and its tragic health sequelae.

**Communal Friction and Heterogeneity in Dharavi**

Religious difference is the most recognized aspect of cultural diversity in Dharavi, and in India as a whole. Discussions about Hindu-Muslim relations dominate since the two groups are the most populous, most vocal, and have had the most shocking conflicts in the past. Believers of both faiths have suffered tragic losses. The origins of conflict lie in medieval Indian history when Muslim dynasties ruled India, but have been exacerbated by the blood-soaked partition of British India into India and Pakistan in 1947.

More recently, the demolition of a historic mosque, the Babri Masjid in Ayodhya, and the consequent Mumbai bomb blasts of 1992-1993 have significantly influenced communal attitudes in Mumbai. In 2002, the burning of a train compartment full of Hindu pilgrims at the Godhra train station in the state of Gujarat resulted in widespread violence against Muslims in the entire state. As a result of this communal violence in Mumbai and across the country, both Muslims and Hindus in Dharavi have self-segregated into separate neighbourhoods, seeking security through like-minded neighbours.

Hindu fundamentalism has a strong voice in Indian politics. Fundamentalist Hindu political parties and organizations like the Vishwa Hindu Parishad (VHP) and the Rashtriya Swayamsevak Sangh have accused the Indian government of encouraging tension and conflict through state-mandated policies, such as the intentional “othering” of Muslims and Hindus in state-sponsored advertisements or campaigns.

Shiv Sena (translation: Shiva’s army), a prominent Hindu nationalist party in Mumbai, has sought to further the cause of Maharashtrian Hindus over those of non-Hindus and migrant workers from other Indian states. Shiv Sainiks (as the members of the party are known) have frequently resorted to violent demonstrations and have been accused of encouraging tension between the two religious groups for political gain. The Shiv Sena has great political clout in Dharavi and other Mumbai slums.

Muslims and Hindus are not the only groups to experience conflict in India. Hindus, Muslims, Sikhs, Christians and Buddhists have all experienced in recent and distant history conflict, violence and tension due to religious difference and animosities. Additionally, conflicts also persist between castes, economic classes and regional difference. Honour killings continue to occur in slums when inter-caste marriages occur. Surprisingly, Dharavi also experiences conflict and tension between economic classes. Although the area is most often described as a slum, there is great diversity in economic class.

Communal tensions and suspicions have historically created obstacles in the path of public health interventions such as the small pox and polio vaccination campaign. Therefore, the heterogeneity of the slum demands sophistication and sensitivity on the part of policy-makers interested in urban health.

**Summary**

Jose reclined in the backseat of Dr. Ketkar’s ministry car. As the ever-humid Mumbai air blew his hair into his eyes, he reflected on the multitude of sights, sounds, and smells he had encountered in his pilgrimage to the slum. While he feels pressure from Dr. Ketkar to focus on Tuberculosis, all of Dharavi’s problems screamed to him with similar urgency.

As a multi-disciplinary consultant team advising Jose, you must prioritize urban health issues in Dharavi and build an innovative, effective, implementable, and financially sound plan to address them that Jose can present to Dr. Ketkar when he meets him in four days.
References from Dharavi: An Introduction

References from Healthcare Issues in Dharavi and India
Tuberculosis, Tenements, Trojans and Tin-cans
UVA Global Health Case Competition, 2013

21. Nair, N. Free Treatment Still Elusive for Many under New Healthcare Scheme. Mid-day
25. Patel, V. & Shidhaye, R. Depression Fact Sheet for India. South Asia Network for
27. Vikram, P. et al. Treatment and Prevention of Mental Disorders in Low-income and
30. Cegielski, J.P. & McMurray, D.N. The Relationship between Malnutrition and
Tuberculosis: Evidence from Studies in Humans and Experimental Animals. International

References from Women’s Social and Medical Issues in Dharavi
3. Walker, A. In Rural India, Improved Sanitation and Iron Supplements Help Girls Stay in
Health Survey (NFHS-3), India, 2005-06. International Institute for Population Sciences
(2009).
6. Quisumbing, A. & Maluccio, J. Resources at Marriage and Intra-household Allocation:
Evidence from Bangladesh, Ethiopia, Indonesia, and South Africa. Oxford Bulletin of
Ministerial Conference on Housing and Human Settlements. New Delhi, 16 December 2006.
Health Survey (NFHS-3), 2005-06. India 1 (2007).

**References from The Redevelopment Problem**

Tuberculosis, Tenements, Trojans and Tin-cans
UVA Global Health Case Competition, 2013


References from Dharavi’s Economic Landscape

References from Communal Friction and Heterogeneity in Dharavi
**Tuberculosis, Tenements, Trojans and Tin-cans**
UVA Global Health Case Competition, 2013


**Case Writers:**
1. Colleen Laurence, MPH, *School of Continuing and Professional Studies*
2. Mariko Hanson, *School of Continuing and Professional Studies*
3. David Jiang, *School of Medicine*
4. Luke Juday, *School of Architecture*
5. Christopher Rannefors, *McIntire School of Commerce*
6. Amanda Below, *School of Public Health*
7. Pranay Sinha, *School of Medicine*

Title-page photo: Slum under a bridge by Pranay Sinha (2010).

The writers are extremely grateful to Dr. Rebecca Dillingham and Dr. Mohammed Ali for their insight.
Appendix I

Mumbai is located in Western India. Dharavi (marked by ‘A’) is located in the center of Mumbai. (Source: maps.google.com)
Appendix II

India

2010 total population: 1 224 614 327
Income group: Lower middle

<table>
<thead>
<tr>
<th>NCD mortality</th>
<th>males</th>
<th>females</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008 estimates</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total NCD deaths (000s)</td>
<td>2967.6</td>
<td>2273.8</td>
<td></td>
</tr>
<tr>
<td>NCD deaths under age 60</td>
<td>38.0</td>
<td>32.1</td>
<td></td>
</tr>
<tr>
<td>(percent of all NCD deaths)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age-standardized death rate per 100 000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All NCDs</td>
<td>781.7</td>
<td>571.9</td>
<td></td>
</tr>
<tr>
<td>Cancers</td>
<td>78.8</td>
<td>71.8</td>
<td></td>
</tr>
<tr>
<td>Chronic respiratory diseases</td>
<td>178.4</td>
<td>125.5</td>
<td></td>
</tr>
<tr>
<td>Cardiovascular diseases and diabetes</td>
<td>986.3</td>
<td>283.0</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Behavioural risk factors</th>
<th>males</th>
<th>females</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008 estimated prevalence (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current daily tobacco smoking</td>
<td>25.1</td>
<td>2.0</td>
<td>13.9</td>
</tr>
<tr>
<td>Physical inactivity</td>
<td>10.8</td>
<td>17.3</td>
<td>14.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Metabolic risk factors</th>
<th>males</th>
<th>females</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008 estimated prevalence (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Raised blood pressure</td>
<td>33.2</td>
<td>31.7</td>
<td>32.5</td>
</tr>
<tr>
<td>Raised blood glucose</td>
<td>10.0</td>
<td>10.0</td>
<td>10.0</td>
</tr>
<tr>
<td>Overweight</td>
<td>9.9</td>
<td>12.2</td>
<td>11.0</td>
</tr>
<tr>
<td>Obesity</td>
<td>1.3</td>
<td>2.4</td>
<td>1.9</td>
</tr>
<tr>
<td>Raised cholesterol</td>
<td>25.8</td>
<td>28.3</td>
<td>27.1</td>
</tr>
</tbody>
</table>

Proportional mortality (% of total deaths, all ages)

NCDs are estimated to account for 53% of all deaths.

<table>
<thead>
<tr>
<th>Demographic data</th>
<th>Year</th>
<th>Estimate</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total population (thousands)</td>
<td>2007</td>
<td>1 169 016</td>
<td>UN Population Division</td>
</tr>
<tr>
<td>Population aged 15-49 (thousands)</td>
<td>2007</td>
<td>613 757</td>
<td>UN Population Division</td>
</tr>
<tr>
<td>Female population aged 15-24 (thousands)</td>
<td>2007</td>
<td>107 866</td>
<td>UN Population Division</td>
</tr>
<tr>
<td>Annual population growth rate (%)</td>
<td>2005-2010</td>
<td>1.4</td>
<td>UN Population Division</td>
</tr>
<tr>
<td>% of population in urban areas</td>
<td>2007</td>
<td>29</td>
<td>UN Population Division</td>
</tr>
<tr>
<td>Crude birth rate (births per 1000 pop.)</td>
<td>2007</td>
<td>23.2</td>
<td>UN Population Division</td>
</tr>
<tr>
<td>Crude death rate (deaths per 1000 pop.)</td>
<td>2007</td>
<td>8.3</td>
<td>UN Population Division</td>
</tr>
<tr>
<td>Life expectancy at birth (years)</td>
<td>2006</td>
<td>63</td>
<td>World Health Statistics 2008, WHO</td>
</tr>
<tr>
<td>Total fertility rate (per woman)</td>
<td>2006</td>
<td>2.9</td>
<td>WHO Statistical Information System (WHOSIS)</td>
</tr>
<tr>
<td>Infant mortality rate (per 1000 live births)</td>
<td>2006</td>
<td>57</td>
<td>World Health Statistics 2008, WHO</td>
</tr>
<tr>
<td>Under 5 mortality rate (per 1000 live births)</td>
<td>2006</td>
<td>76</td>
<td>World Health Statistics 2008, WHO</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Socio-economic data</th>
<th>Year</th>
<th>Estimate</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross national income, ppp, per capita (int.$)</td>
<td>2006</td>
<td>2 460</td>
<td>World Bank</td>
</tr>
<tr>
<td>Per capita total expenditure on health (int.$)</td>
<td>2005</td>
<td>100</td>
<td>World Health Statistics 2008, WHO</td>
</tr>
<tr>
<td>General government expenditure on health as % of total government expenditure on health (int.$)</td>
<td>2005</td>
<td>3.5</td>
<td>World Health Statistics 2008, WHO</td>
</tr>
<tr>
<td>Adult literacy rate, both sexes (%)</td>
<td>2006</td>
<td>64</td>
<td>UNESCO</td>
</tr>
<tr>
<td>Adult literacy rate, male (%)</td>
<td>2006</td>
<td>76.4</td>
<td>UNESCO</td>
</tr>
<tr>
<td>Adult literacy rate, female (%)</td>
<td>2006</td>
<td>53.4</td>
<td>UNESCO</td>
</tr>
<tr>
<td>Net primary school enrolment ratio, male (%)</td>
<td>2006</td>
<td>90</td>
<td>UNESCO</td>
</tr>
<tr>
<td>Net primary school enrolment ratio, female (%)</td>
<td>2006</td>
<td>87</td>
<td>UNESCO</td>
</tr>
<tr>
<td>Human Development Index (ranking)</td>
<td>2007/2008</td>
<td>128</td>
<td>UNDP</td>
</tr>
<tr>
<td>Human Poverty Index (ranking)</td>
<td>2007/2008</td>
<td>62</td>
<td>UNDP</td>
</tr>
</tbody>
</table>

Information from the World health Organization (www.who.int)
Appendix III

Information from the World health Organization (www.who.int)
Tuberculosis, Tenements, Trojans and Tin-cans
UVA Global Health Case Competition, 2013

Appendix IV

Table 1. Source: No health without mental health, Lancet 2007

Figure 1. Source: No health without mental health, Lancet 2007
Figure 1. Human resources for mental health (psychiatrists, psychologists, nurses, and social workers) per 100,000 population. Redrawn from WHO Mental Health Atlas, with permission of WHO.

Figure 2. Source: Resources for mental health, Lancet 2007

Figure 3. Source: Resources for mental health, Lancet 2007