



Maryland Population Research Center

WORKING PAPER

**"Flies Without Borders: Lessons from Chennai
on improving India's municipal public health services"**

PWP-MPRC-2017-005

September 2017



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Flies Without Borders:* **Lessons from Chennai on improving India's municipal public health services**

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Abstract

India's fast-growing cities face three key challenges in improving public health outcomes. The first is the persistence of weak links in the chain – notably slums badly under-served with basic civic services – that can pose public health threats to all. Richer residents corner public resources like water and sanitation services, but their children's health indicators suggest they are deeply affected by contagion from the broader urban environment. The second challenge relates to devolution of services to elected bodies. Devolution works poorly for intangible – and highly technical – services like public health where success is measured by the *lack* of (adverse) events. The third challenge is high fragmentation of services that directly affect health outcomes.

Within India, some cities have addressed these challenges more effectively than others. This paper explores the management of municipal public health services in two major Indian metropolises with sharply contrasting health and sanitation indicators. It explains how Chennai mitigates these challenges through active service outreach to vulnerable populations, and a considered approach to devolution that distributes responsibilities appropriately between line agencies, technical personnel, and elected representatives – while services in Delhi are quite constrained. These policy lessons are pertinent to other Indian cities and beyond.

Keywords: Public health, Sanitation, Urban, Local government, India, Governance, Devolution

Acknowledgements: Valuable suggestions from Pranab Bardhan, Shashank Bhide, Jean Dreze, K.P. Krishnan, Peter Miovic, Dilip Mookherjee, and J. Radhakrishnan are gratefully acknowledged.

*We thank “Doctors Without Borders” for inspiring the title of this paper.

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Flies Without Borders: lessons from Chennai on improving India's municipal public health services

'Public health is the science and the art of preventing disease...through organized community efforts for the sanitation of the environment, the control of community infections, the education of the individual in principles of personal hygiene, the organization of medical and nursing service for the early diagnosis and preventive treatment of disease....' (Winslow 1920:30).

Introduction

India has a very high burden of diseases related to poor environmental sanitation, which has many negative consequences.¹ Urban areas are subject to especial public health risks, even though they have better sanitary infrastructure and access to medical care than rural areas. Their high population density greatly facilitates the spread of disease, especially when compounded by underprivileged groups living in insanitary conditions and with inadequate access to quality health care. Effective municipal services can do much to reduce these risks. For example, they can reduce mosquito breeding sites by collecting solid waste and maintaining drainage systems, and reduce exposure to water-borne diseases by improving water and sewerage facilities.

Municipal governance and service delivery in India is widely recognized to be inadequate.² Rapid urbanization adds further stress on the system. We argue that there are two key sets of obstacles to improving municipal public health and sanitation:

- (a) ***“Weak links in the chain”***: *Very uneven distribution of public resources, especially to slums* such that poorer residents have inadequate access to water, solid waste, drainage, sewerage/toilets. Sanitary conditions for slum dwellers actually *worsened* between 2008 and 2012 (Figure 2). There are also distinctions between categories of slums – the terminology differing between reports but always resulting in high vulnerability in some pockets of cities.

This runs counter to the first principle of public health service provision – that public health outcomes are driven by the weakest links in the chain, so services need to be designed with a population-wide approach focused especially on the most vulnerable links in the chain. This requires identifying the weak links – such as underserved populations or weak infrastructure – that could pose public health threats, and planning services to address them.

Without this approach, the whole population is exposed to the risk of disease, including those who are able to appropriate public resources. Slums are typically located near more upscale areas³ where work can be found – in homes, offices, factories, or the informal sector. The broader urban population is exposed to the diseases that slum residents suffer as a consequence of the insanitary conditions in which they are forced to live.

Child stunting illustrates how richer households can suffer from the effects of poor sanitation. Child stunting is very high in India: 48 percent of boys and of girls were stunted in 2005-06.⁴ Yet the most striking feature of the Indian data is the high levels of stunting amongst the *wealthiest* quintile of households, compared to lower-income countries in regions such as Latin America or Sri Lanka which have better public health systems (Figure 1). There is almost no child stunting in the top wealth quintile in these countries, while in India 25% are

stunted.⁵ Studies indicate a strong relationship between increases in height and decreases in disease burden.⁶

Children in the top wealth quintile are unlikely to be stunted because of shortage of food or medical care.⁷ However, they are exposed to contaminated environments outside their homes if not at home. Access to medical care ensures low mortality amongst these privileged children, but repeated infections expose them to stunting – which is associated with lower cognitive ability, earnings, and longevity.⁸ This happens even if a child does not appear ill:

‘Subclinical infections, resulting from exposure to contaminated environments and poor hygiene, are associated with stunting, owing to nutrient malabsorption and reduced ability of the gut to function as a barrier against disease-causing organisms’ (WHO 2014:2).

Recognition of the need to focus on the weakest links in the chain in order to protect the elites was a key motivation for municipal governments in the West to invest in improving sanitary conditions in their crowded and dirty slums.⁹

‘The knowledge that the diseases of the workers who sewed clothes in their filthy tenement homes or who processed food could be spread to decent, clean, and respectable citizens served as a powerful incentive to the reform of public health.’ (Duffy 1971:809).

The Government of India’s ‘Swacch Bharat’ sanitation campaign offers hope that sanitation and public health may get more of the importance they deserve in public policy.

(b) ***Governance arrangements that impair the accountability of service providers***, including:

- Devolution of service delivery that transfers funds and responsibilities to elected local bodies, without strong arrangements for holding them accountable for effective financial management or service delivery.

Public health services are especially vulnerable to such devolution, for at least two reasons. First, their success is defined by a *lack* of (adverse) events. It is far easier for elected representatives to reap credit with their constituents by opening a hospital. Second, decision-making for public health services is highly technical in nature, and needs to shift in response to ever-shifting disease conditions. This is difficult to achieve if key decisions must be approved by non-technical people.

- Fragmentation of services with inadequate coordination arrangements. Public health outcomes depend on the provision of multiple services – in particular water supply, solid waste, drainage, and sewerage. Poor drainage or uncollected garbage can seriously hamper efforts at mosquito control efforts. Many other sectors are also involved here, such as those responsible for leveling roads and drains.

Poor coordination of these services is detrimental to protecting population health. This also demoralizes public health staff and citizens seeking to improve health conditions.

This paper illustrates how these issues can affect municipal public health services, and how some of their negative impacts on health outcomes can be mitigated. It looks at the organization of these services in Chennai and Delhi, two of India’s major metropolitan cities. The paper focuses largely on Chennai, which offers some lessons on ways to mitigate these constraints on public health services. Examples from Delhi illustrate how severely these issues can hinder service delivery.

Service delivery in the Municipal Corporation of Delhi (MCD) is quite sharply affected by these problems. It is also affected by factors unique to Delhi, notably (a) the complex administrative relationship between the central government, Delhi's State government, and the MCD, and (b) that Delhi is surrounded by the National Capital Region which has heavy traffic to and from Delhi, but is administered by three other states. The MCD was also split in 2012 into three bodies (for North, South, and East Delhi) – but organized as before, so the MCD discussed here refers to both the pre-2012 and the trifurcated MCD. Problems arising from these unique aspects of Delhi are not discussed here. This paper explores problems with the MCD's public health services arising from the issues summarized above, which apply across much of the country.

The functioning of the Chennai Municipal Corporation (CMC) illustrates how Indian municipalities can mitigate some of the systemic handicaps they face. The Tamil Nadu state administration keeps some pressure on CMC public health service delivery by (a) professional management within the CMC, and (b) technical support and monitoring by the State Health Department. That these efforts are helpful is suggested by Chennai's relatively good health and sanitation outcomes compared to other major metropolitan cities (Figures 3 and 4, Table 1).

This paper summarizes lessons from Chennai, which are reproducible in other Indian municipalities. These help to mitigate the health impact of poor slum sanitation and devolution of service delivery. However, more needs to be done to address the issue of service fragmentation, in particular by giving the CMC's public health department greater authority and responsibility to assure better sanitation and public health engineering in the city.

This paper focuses on municipal public health services, complementing earlier papers that discussed public health management in Tamil Nadu's districts.¹⁰ It is based on extended field interviews and secondary data, as described in Appendix 1. Section 1 discusses the issue of unequal resource distribution, and how the CMC mitigates its health impact. Section 2 discusses the problems arising from devolution and fragmentation of service delivery, followed by a discussion of how some of these problems are mitigated in the CMC. Section 3 concludes.

Section 1: Very unequal allocation of resources

Economically and politically privileged groups in India – as in most countries – tend to corner public resources, so their areas receive better civic services.¹¹ For example, Delhi has huge disparities in the *planned* provision of water to different sub-populations, let alone its actual provision.¹² In 2013, a quarter of Delhi's population was being supplied water from tankers, at an average of 3.82 litres per day per capita, although the norm was 172.¹³ In 2014-15, only 6% of unauthorized slums had some sewerage facilities, rising to 14.6% by 2016-17.¹⁴ This sharply increases slum residents' exposure to disease, exacerbating vulnerabilities arising from crowding, poor housing, poverty, and lower access to health care.

1.1 Lessons from Chennai on mitigating some of the negative impact on health outcomes¹⁵

The CMC's Health Department seeks to mitigate this uneven allocation of resources by focusing their services especially on the most vulnerable. This is stated on their website:

‘The main aim of the Public Health Department in the Chennai Corporation... is to reduce health inequalities throughout the city of Chennai targeting resources, programs, and attending to high need neighborhoods in the city.’¹⁶

The Health Department manages the Urban Primary Health Centres (UPHCs), and uses them systematically to provide active medical outreach to vulnerable populations with a view to (a) helping the individual, (b) dealing with cases of communicable disease before they cause an outbreak, and (c) improving their disease surveillance data so that they can analyze disease patterns and tailor their services accordingly.

They send teams to slums to provide general medical care and to conduct routine “fever screenings” for vector-borne diseases, typhoid, etc., and seasonal diseases such as conjunctivitis. The frequency of these health camps depends on needs. For example, during the monsoons they hold two camps daily until the “fever” cases decline, and in healthier seasons they hold two camps a month. This supplements the health care they provide to slum residents who visit the UPHCs directly. UPHCs are typically located close to slums.

The two branches of the CMC’s Health Department (medical and public health) work in tandem for these camps. Sanitary Inspectors (from public health) arrange the camps’ location. Along with Basic Health Workers (from public health) and Female Health Visitors (from medical services), the Sanitary Inspectors conduct health education on communicable disease prevention, mosquito breeding, personal/domestic hygiene, and environmental sanitation.

The public health staff conduct vector control in the slums. They also test the water quality and general environmental sanitation conditions, and inform the Water and Sewerage Board (MetroWater) and the Engineering Department respectively of shortfalls. They would be far better placed to protect population health if they had more authority to require other departments to improve environmental sanitation in slums and more broadly across the city.

Similar active screening and treatment is conducted in the Homeless Shelters. The CMC’s Public Health Department is the nodal agency for the shelters, and the Zonal Health Officers are responsible for ensuring that the shelters in their area are well run.¹⁷

Active outreach is also conducted for maternal and child health (MCH) services including contraception, antenatal care, delivery, postnatal care, and immunization. The Family Welfare staff under the Zonal Medical Officer have a program to visit slums every month on fixed dates, so that women know when to expect them for services. They enumerate marriages, pregnancies, births, deaths, who is eligible for family planning, and new people who have moved to the slum. In their home visits for MCH care, they look for cases of fever, vector-borne and diarrhoeal diseases, and any re-emergence of diseases like polio. These cases are followed up by the medical staff, and referred to the public health staff for tracing contacts and preventive measures.

Another way of protecting the health of the poor is to sell subsidized meals. The CMC does this through a chain of very popular outlets,¹⁸ whose hygiene and staff health are checked by the Health Department. The State government has also provided free schools meals for decades.¹⁹

By contrast, the MCD’s health dispensaries and MCH centres do little active outreach, confining themselves to serving those who come to the clinic. The Delhi State Government’s clinics do likewise. There is some slum outreach through the Mobile Health Scheme, but they serve low

proportions of the slum population except for pulse polio immunization.²⁰ The difference between Chennai and Delhi's slum health outreach is evident in the MCH service coverage and in the child stunting rates (Figures 3 and 4).

Delhi's health clinics confine themselves to reporting cases of the notifiable diseases on the central government's list (unlike the wide range of diseases tracked in Chennai for planning services), and report only cases that come to their clinics instead of actively searching for cases. Delhi's homeless shelters are run by the Slum Board, with no effort to systematically screen residents' health. All this affects public health service planning in Delhi.

Section 2: Governance arrangements that impair accountability

Some quite severe handicaps to effective service delivery arise from governance arrangements that apply across most states. The key arrangements that impair accountability in public health service delivery are summarized in below, followed by a discussion of how some of these problems are mitigated in the CMC.

2.1 Impairing Accountability: Devolution of service delivery to elected local bodies²¹

The 74th Constitutional Amendment of 1992 tasked states to devolve power for several functions (including sanitation and health) to urban local bodies. This sought to transfer “funds, functions, and functionaries” from line agencies to elected representatives.²² The Commissioner remains the Chief Executive of the Corporation, but the Mayor and Councillors were empowered to exercise control over the Commissioner's powers and functions, and over the other staff.²³

Devolution can improve the delivery of many types of service, especially those that are easily monitored locally such as teacher attendance and availability of water supply.²⁴ However, several problems arise with devolution of public health service delivery,²⁵ including:

- a) Elected representatives have little incentive to provide relatively intangible services such as public health except when faced with an outbreak that gets media attention or citizen outcry. Even in response to an outcry, for example over dengue, politicians typically demand visible measures such as “fogging” whole neighborhoods with insecticide spray rather than the more effective approach of controlling larval density. By contrast, they have clear incentives to improve medical services, which are highly visible and offer easy political credit.²⁶

Devolution of funds and responsibilities without strong accountability mechanisms can make for poor management of finances and service quality, and reduce focus on providing public goods.²⁷ Local politicians are primarily accountable to their parties. They are less directly accountable to their constituents, except at the time of the next election. However, elections take place only every few years – and public health takes a back seat amongst election issues in most countries, especially where citizens have little experience of healthier environments.

Under these circumstances, devolution to local bodies can diminish technical /professional inputs into service delivery. This can be very discouraging to staff performance. Even in a country like Sri Lanka, where citizens have come to expect good public health services, the

1987 devolution to the province level made it harder for line agency staff to maintain professional standards.²⁸

- b) Some areas of service delivery are highly technical in nature, and require management by trained professionals rather than lay politicians.²⁹ Public health requires a high level of technical expertise, to assess evolving threats and design effective responses to them. Professionalization of the sector is important for sustaining institutional capacity. And as Mansuri and Rao (2012:177) note: “When externalities are significant, it is particularly important that standards and rules be set at a higher level”.

Interestingly, two small privileged enclaves of Delhi rejected such devolution. The New Delhi Municipal Council (NDMC), home to the central government that had promoted devolution, explicitly stated that such arrangements would be inefficient:

‘Efficient function of the Municipal services in this area is critical for the internal image of the country.... it was felt that any scheme for the governance of this area based on conventional pattern of representative local self-government, would be unworkable and out of place since the pre-eminent character of this area is that of the seat of the Central Government.’³⁰

The NDMC Council is managed by Indian Administrative Service (IAS) officers nominated by the Central Government, with some inputs from local elected representatives and civilian professionals.³¹ The Delhi Cantonment area is run by the Army, with some inputs from local elected representatives. These small enclaves of Delhi are well-resourced, which certainly helps, but their governance structure is critical for achieving good outcomes. The NDMC and Delhi Cantonment rank very high in the urban sanitation surveys, while the MCD that serves 96% of Delhi’s population languishes far behind (Table 1).

Devolution has been carried out in both the MCD and the CMC, with elected representatives formally in charge, while IAS officers manage the staff. However, their governance and accountability arrangements differ substantially, with the CMC retaining far more professional control of service delivery.

In the MCD, the elected representatives (Councillors) take charge at every level, from the Headquarters down to the Ward where grassroots service delivery takes place. At each of these levels, they take all the major decisions while the technical and field staff work under them. There are few accountability mechanisms within the MCD, and scant checks on the Councillors’ powers. A randomized control trial in Delhi slums found faint evidence that politicians respond to citizens’ reporting of problems with sanitary services.³² With enough political pressure, Councillors can have IAS officers transferred,³³ so the latter are constrained in monitoring and supporting their staff. The MCD’s technical staff is thus left to adjust as best they can to the wishes of the elected politicians.

In response to Delhi’s evident service shortfalls, efforts have been made to devolve responsibilities further to communities. Resident Welfare Associations are asked to monitor service delivery, but it is hardly possible for them to find the time and technical expertise to do this. Another thrust is to organize Mohalla Sabha meetings, where politicians ask citizens to tell municipal staff what they should do.³⁴ This followed a central government initiative to strengthen community participation in municipal services, with the model Nagara Raj Bill of 2006 adopted by many states.³⁵ It is not clear that this has improved public health and sanitation

services in Delhi. By contrast, the CMC emphasizes that protecting public health is a core function of the state:

‘among all the objects sought to be secured by Governmental laws, none is more important than the preservation of the Public Health and an imperative obligation rests upon the civic body through its agencies to take all necessary steps to promote this object’³⁶

In Tamil Nadu state as a whole, line agency staff are not devolved to be managed by local bodies.³⁷ This helps maintain technical and managerial standards. Moreover, the CMC Act empowers the state government to remove elected representatives for misdemeanours, to dissolve the entire Council for incompetence, and to suspend/cancel any of their decisions/actions.³⁸ The MCD Act is vaguer on these issues.³⁹

Tamil Nadu offers broader lessons on the appropriate distribution of responsibilities and powers. Elected representatives in the districts tend to be given monitoring roles that they are well-placed to play,⁴⁰ though they have a broader role in the CMC. Professional administrators form the top management, but have technical people manage technical issues. For example, the State Health Department is headed by an IAS officer, but immediately below him technical Directorates manage the Department’s work. The latter are accorded high independent status — for example, the Director of Public Health is the technical advisor on public health matters to the Health Secretary and the Health Ministry. This contrasts sharply with the Central Health Ministry and many State Health Departments, where technical staff are buried in relatively low positions.

2.2 Impairing Accountability: Fragmentation of service delivery⁴¹

Fragmentation of services is a well-known problem in municipal governance. In principle, fragmentation need not create problems, if each authority is careful to discharge its responsibilities, and there are strong arrangements for monitoring by, and accountability to, a higher authority – but many studies show that this is not the case in Indian municipalities.⁴²

Fragmentation poses especial problems in public health, given the high degree of service coordination needed for good outcomes. Such coordination is facilitated in the developed world by enabling public health authorities to monitor services provided by many other actors – such as those managing drainage – to ensure that they do not threaten public health.⁴³ Such mandates would be very helpful for public health departments in India.

Some of the common ways in which public health departments in Indian municipalities are separated from other key inputs to public health include:

- Separation of public health from those handling key sanitary inputs such as solid waste, drains, and sewerage. Issues related to public health engineering were separated from the Health Department in most states, including Delhi and Tamil Nadu. The CMC makes some attempt to resolve this by having a Deputy Commissioner and Assistant Commissioners oversee both Health and Solid Waste Management, holding joint meetings to review and coordinate their work. The MCD health department has little such inter-sectoral coordination.
- In many cities, including Delhi and Chennai, water supply and sewerage are managed by Boards based outside the Municipal Corporation. The Municipal Commissioner serves on the Board of Directors, but there is no representation from the Health Department of either

the municipality or the state.⁴⁴ There are arrangements for joint water testing by field staff of the Board and the Corporations.

- Separate Boards for handling slums (Slum Boards) have been established in many cities, including in Delhi and Chennai. This has the unfortunate side effect of separating slum planning from the rest of urban planning. Slum Boards are primarily charged with clearing slums and resettling the populations into approved housing.⁴⁵ They are not well-placed for additional charges such as running homeless shelters in Delhi: having these managed by Zonal Health Officers in Chennai greatly enhances their management and integration into public health services.
- Delhi's Department of Food Safety was separated from its Health Department, following the central government's 2004 revision of the Prevention of Food Adulteration Act.⁴⁶ Tamil Nadu's Food Safety Administration is based in the Health Department, with a senior member of the State Public Health Directorate as the Director (Food Safety).
- Large municipalities have several other agencies whose work directly affects public health conditions. These include the agencies in charge of city planning, and the Public Works Department which constructs and maintains major infrastructure. The health sector has limited input into the work of these agencies.⁴⁷

The MCD's Health Department is undermined also by internal fragmentation: its public health, veterinary health, and medical services are managed by three separate Directorates.

- Veterinary Health is not under the Municipal Health Officer, except human vaccine for rabies. The CMC's City Health Officer manages Veterinary Services – controlling zoonotic diseases, slaughterhouse hygiene and meat safety.
- Medical and public health services in the MCD do not work closely with each other, as described in Section 1. By contrast in the CMC, these two services work in close cooperation with each other at headquarters and in the field (Sections 1 and 2.3(b)).

2.3 Lessons from Chennai on mitigating the negative impact of these governance arrangements

(a) Management by professional managerial and technical cadres⁴⁸

The CMC headquarters is managed by the Commissioner and Deputy Commissioners, who are professional managers from the Indian Administrative Service (IAS). Junior managers (Regional Deputy Commissioner and Assistant Commissioners) oversee services in the CMC's 3 Regions and 15 Zones. Below these professional administrators, technical staff manage service delivery.

All IAS officers in Tamil Nadu are sensitized to the complex requirements of public health services, as from the outset of their careers in the districts they attend the inter-sectoral meetings where State Public Health Directorate staff discuss plans for responding to seasonal health threats, emergencies, and disasters, and highlight the inter-sectoral coordination they require. These issues are discussed at all levels of the State administration.

Health services come under the Deputy Commissioner of Health and Solid Waste Management. Below her are the City Health Officer who manages the public health services, and the City Medical Officer who manages the medical services. At the Zonal level are the Zonal Health Officers, the Zonal Medical Officers, and all their field staff.

Keeping the public health and medical services separately staffed ensures that public health services are not ignored in favour of medical care. Importantly, though, these two sets of staff work very closely together to protect population health (Section 2.3b). The Health Officers are from the public health cadre, i.e. they are medical doctors trained in and charged entirely with public health administration. The Medical Officers are medical staff.

Regular coordination meetings to monitor and review the work are held at every level of the CMC hierarchy, using videoconferencing to include all staff. Monitoring is facilitated by the fact that the field staff responsibilities are clearly delineated at a micro level, as described below.

The coordination meetings begin by discussing the minutes of the previous meeting, to check that outstanding issues have been resolved. The work of the units is then reviewed, and monitoring and supervision strengthened to help resolve problems. Complaints received are discussed, and needed actions recorded for follow-up at the next review meeting. Meetings chaired by the administrative heads focus on general review of services and complaints, while those chaired by technical heads provide technical support and oversight of field operations.

- The commissioner holds weekly meetings with all department heads, down to zonal staff including the Zonal Health Officers and Zonal Medical Officers. Amongst other business, they review which complaints are still unresolved, and instructions given for resolving them within seven days.
- Some meetings include staff from the health and solid waste departments. The Deputy Commissioner holds fortnightly meetings that include all these staff down to the zonal heads of the units. The meetings held by the Regional Deputy Commissioner and by the Assistant Commissioner also include the health and solid waste staff.
- Some meetings are just for the health staff. The City Health Officer and the City Medical Officer of the CMC headquarters hold weekly meetings of their staff, first separately and then jointly. The Zonal Health Officers and Zonal Medical Officers hold joint meetings fortnightly to review and coordinate their work. The Zonal Medical Officers holds weekly meetings to review the work of the Urban Primary Health Centres, and inspects them jointly with the Zonal Health Officers.

Complaints are collated and acted on. The CMC has a Public Relations Officer who scans the media for complaints about municipal services. Citizens can register complaints on the Online Grievance Redressal Mechanism, or by ordinary mail. People can also send instant photos of poor solid waste management to the Sanitary Inspector or Zonal Health Officer, who forwards them to the solid waste staff for action. If no action is taken, they inform their superior or submit the complaint on the online Grievance Redressal Mechanism.

While far from perfect, this system of handling complaints is a serious one. It contrasts sharply with the situation in Delhi, where citizens' complaints and almost daily newspaper reports

detailing poor health and sanitary conditions are not acted upon. The Delhi High Court sometimes intervenes and orders the MCD to act, but even this may be ignored.⁴⁹

Other standard management procedures in the CMC include recruiting staff only to fill posts that have been sanctioned and included in the budget. Recruitment is through the Employment Exchange, from whose lists the Commissioner sends a list of potential candidates for approval to the Appointments Committee (of elected representatives). By contrast in Delhi, staff recruitment especially at lower levels is treated largely as an instrument of political patronage. The ranks of field staff such as sweepers are bloated as a result, exacerbating the MCD's financial crisis.⁵⁰

The CMC Health staff are also helped by having their authority limited in other ways, reducing the potential lucrativeness of their functions. Drugs are procured externally by the Tamil Nadu Medical Services Corporation, which also instructs them on what insecticides to procure and from whom. Trade licensing is handled by the CMC's Revenue Department, with a "No Objection Certificate" required from the Public Health Department only for larger enterprises. CMC health staff report that in meetings chaired by elected representatives, the discussion is largely on departments such as Engineering, for which large contracts need to be approved.

Public health services in the CMC are also helped by being underpinned not only by the Municipal Act, but also by Tamil Nadu's Public Health Act. The latter offers a much more comprehensive legal basis for public health action than India's Municipal Acts. Unfortunately, most states lack a Public Health Act.

The CMC Health Department's clear understanding of public health is reflected in the mission statement on its website.⁵¹ This contrasts sharply with the largely ad hoc list of services that are listed on the health department websites of most Indian municipalities, including Delhi.⁵²

(b) Tight organization of public health services⁵³

The CMC's public health services are tightly organized on the ground. Chennai is divided into 3 Regions, each with an Additional City Health Officer and a Sanitary Officer. The main operational units are the 15 Zones headed by Zonal Health Officers. These are staffed with (a) Entomologists who conduct daily vector surveillance, (b) Sanitary Officers and Sanitary Inspectors whose tasks include conducting inspections, testing water quality, supervising the work of field staff, and collating vital registration and disease surveillance data. Each Zone has 3-4 Units, each supervised by a Sanitary Officer, and each Unit has 5 Divisions.

The Division is a major operational unit for public health services. These are headed by a Sanitary Inspector, and staffed with a Basic Health Worker and Sector Workers allocated to Sectors of about 500-800 households each. The Sector Workers are responsible for visiting each household once a week to check for vector breeding in and around homes, and take anti-larval measures. However, their staff size needs to be increased in response to rapid urban population growth. If these Workers come across cases of fever, they report these to the Sanitary Inspector.

Sanitary Inspectors inform the Solid Waste or the Engineering Department if they see insanitary conditions such as overflowing sewers, water accumulation, or garbage accumulation, and if no action is taken they can complain to the Deputy Commissioner. That Chennai ranked 13th of 423

cities surveyed for sanitary conditions in 2009-10 indicates that this system could work better (Table 1).

The public health and medical staff work very closely together on the ground. A few examples are their fortnightly joint review meetings, collaboration in disease surveillance and health camps, and joint inspections of the Urban Primary Health Centres. The collaboration runs throughout their work: for example, clusters of cases are referred by the medical staff to the Zonal Health Officer for the Sanitary Inspectors to trace contacts, and to address conditions that caused the outbreak.

The health department uses the CMC's powers to improve disease reporting, including from the private sector which is widely viewed elsewhere in India as delinquent on this. They point out that private health facilities need the CMC for their licensing, so they have an incentive to comply with disease reporting requirements.

(c) Professional support from the State Directorate of Public Health⁵⁴

Tamil Nadu's State Public Health Directorate plays an important role in providing technical support and oversight of the CMC's public health services. Its Director has overriding powers across the State, to monitor outbreaks, ask local bodies about their disease control measures, and make technical suggestions. S/he can also offer technical expertise as needed, and send manpower if an outbreak is not under control. In the case of the CMC, the Director communicates directly with the Commissioner, to send orders to the CMC and to review progress, and will sit in the review meetings. The Directorate backs up the CMC's public health work in many other ways, such as providing continuing training for CMC health staff, and help with emergencies.

This strong external technical support and oversight helps the CMC's public health staff to maintain professional standards in their work, counter-balancing the elected representatives' lay opinions and more politically-driven agendas. For example, they note that they can explain to their elected representatives that spraying insecticide in the air ("fogging") is largely ineffective. They felt that ideally the City Health Officer and Zonal Health Officers would be line agency staff serving a term with the CMC and therefore interested in maintaining credibility with their peer group – instead of serving in the CMC for their lifetime, with the constraints imposed by elected representatives.

The State Public Health Directorate also forms a technical peer group against which the CMC health staff can measure themselves. It is easy for the CMC public health staff to communicate with counterparts in the Directorate, as they have the same training. The senior staff are from the public health cadre (medical doctors trained in public health administration), just like their counterparts in the Directorate. The Health Inspectors are also trained like the Sanitary Inspectors, who are their counterparts in the Directorate.

Tamil Nadu's powerful technical Public Health Directorate contrasts sharply with other states, where such expertise is at best scattered, and independent oversight of public health conditions and services is at best weak. The Directorate raises awareness of public health issues across Tamil Nadu, sensitizing the state administration to these matters as described. Combined with the Directorate's health education outreach, this helps raise broad awareness of public health

issues and puts pressure on politicians to seek better services. This is reflected, for example, in local politicians reporting the location of stray cattle to the Zonal Health Officers and asking them to have them removed.

Delhi's Directorate of Health Services' Public Health Wing is small and dependent on project funds even for hiring its State Epidemiologist. It cannot offer the MCD much technical support. While most states have a larger public health unit, these typically lack the autonomy and mandate to provide the strong support that Tamil Nadu's State Directorate routinely provides.⁵⁵

Conclusions

Key organizational principles for effective public health and sanitation services include: (1) a focus on the weakest links in the chain, (2) management of services and budgets by professional managers and technical staff, with carefully structured oversight by elected representatives, and (3) coordination of the work of different actors.

Over the years, a series of policies have been adopted in India which handicap services to reduce the population's exposure to disease. One is to have "weak links in the chain" through unequal distribution of civic amenities. Slums are especially neglected and their poor sanitation hurts their residents and creates crucibles from which contagion can spread across the city.

Another major issue arises from the implementation of the 74th Constitutional Amendment tasking many basic services (including sanitation and health) to be devolved from line agencies to elected local bodies, without strong mechanisms for ensuring that these bodies are held accountable for services. In the case of the Municipal Corporation of Delhi, this results in budgetary disarray as personal and party interests override concerns about budgetary discipline. In view of weak service delivery, the central government encouraged states to formalize community oversight of services, again without specifying strong accountability mechanisms.

Such devolution can be damaging for services such as public health, which require a high level of technical knowledge to respond to the ever-shifting threats to the population's health. And the application of the technical expertise is greatly helped by having a strong State Public Health Directorate. Without this, even the understanding of what constitutes public health services can unravel, as it has in Delhi.

A third major handicap arises from increasing fragmentation of agencies, hindering coordination of services that are central to protecting health. Provision of water supply and sewers has been separated from many municipal corporations. Within the Corporations, the management of solid waste and drains has been separated from the health department – fairly completely in Delhi, but with more effort at coordination in Chennai. The revised Food Safety Act made it possible to place food safety outside the health department, as was done in Delhi State.

The Chennai Municipal Corporation (CMC) manages to avoid some of the negative fallout of these policies. It benefits from the Tamil Nadu state administration's efforts to maintain an effective distribution of responsibilities between line agencies, technical personnel, and elected representatives. This paper illustrates some of the ways in which this helps the CMC mitigate some of the systemic shortfalls that confront Indian municipalities. These include:

- **Considered approach to devolution and management:** Tamil Nadu state does not transfer all control over funds and line agency staff to local bodies. The CMC Act empowers the state government to sanction errant elected representatives. The CMC's work is overseen by elected representatives, but is managed by a few professional administrators from the Indian Administrative Service and by technical professionals below them. These managers hold regular meetings to review their staff's work. Such monitoring is facilitated by tight organization of services, with clearly-specified responsibilities.

The CMC field staff is helped to maintain professional standards by monitoring and support from the CMC's Headquarters and from the Tamil Nadu State Public Health Directorate. Public health and medical services are kept separate so that both sets of services can focus on their quite distinct tasks, but they work in close collaboration to maximize their joint product.

- **Clear understanding of and support for public health services:** Tamil Nadu has a strong State Public Health Directorate, whose head is empowered to monitor and support the CMC's public health services. It provides crucial support to the CMC.

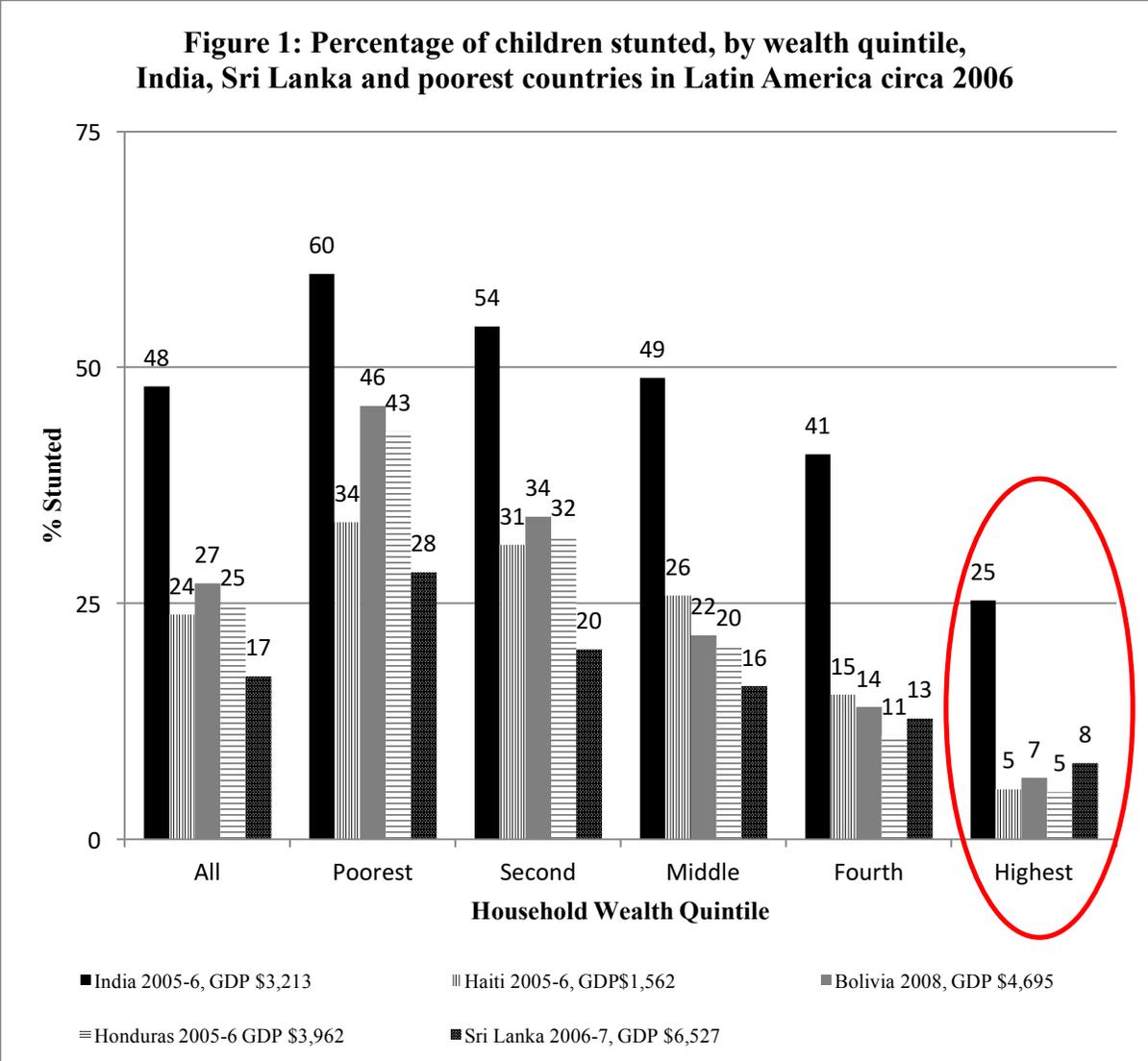
This Directorate is unusual in India in its strong capacity for public health administration, with a clear mandate and budget. Its staff are experienced in managing public health services. At all levels of the State administration, the Directorate staff participate in inter-sectoral meetings to discuss current and potential public health threats, raising administrators' awareness of the complexities involved in generating good public health outcomes. In most other states, State Public Health Directorates are too weak to do this.

- **Active approach to service delivery, especially to vulnerable populations.** The CMC's Health Department provides active outreach to vulnerable populations, including setting up camps in slums and visiting homeless shelters. They screen slum residents for diseases, to treat them, as well as to collect disease prevalence data to inform service planning and avert outbreaks. Such outreach is crucial given the high externalities of communicable diseases.

This approach goes far towards improving health outcomes in Chennai, as suggested by lower levels of child stunting than in other major Indian metropolises. Child stunting levels in Chennai's slums are much lower than among Delhi's *non-slum* population. Maternal and child health service coverage in slums is also very high in Chennai, and far lower in Delhi.

The CMC's approach is fairly successful in mitigating the negative impacts of devolution and of neglecting vulnerable groups. However, its health department needs to be given more authority to ensure better environmental sanitation in Chennai, to further improve health outcomes.

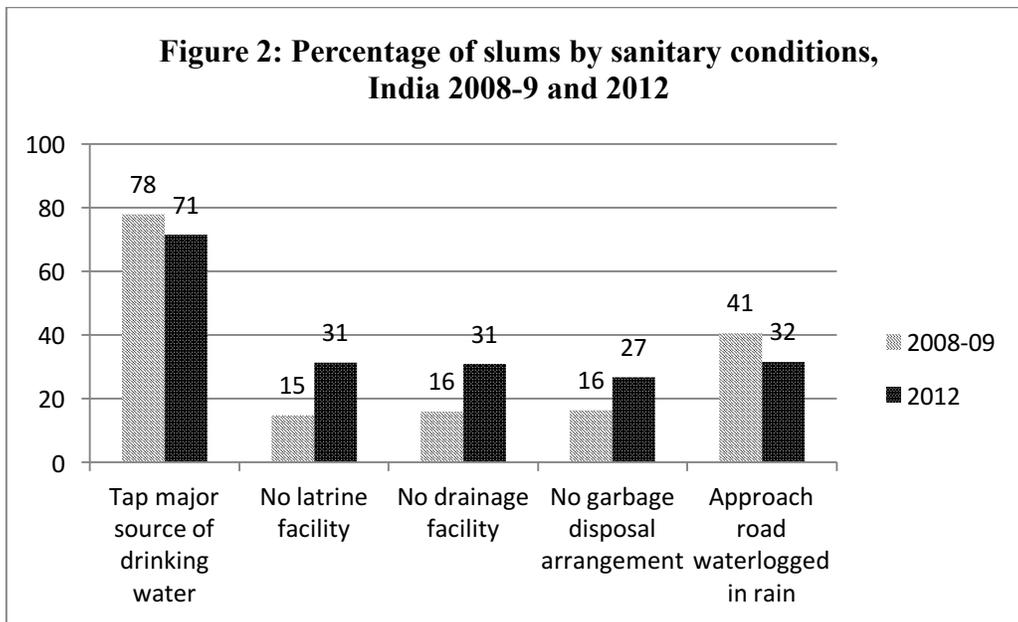
These lessons from Chennai can be used in other Indian cities, since they share the same overall administrative system. Chennai should not be dismissed as an irrelevant outlier, as was Kerala's success in improving human development indicators. Some might argue that Tamil Nadu is "different" because of its bureaucracy's strong work culture. This misses the point that a strong work culture can be generated by systematically applying standard management methods. Staff are motivated to work well if they are trained, supported in their work, given clear responsibilities and held accountable for them. It also helps to work in a team with a shared mission, such as to protect people's health. Conversely, work cultures unravel with pervasive lack of accountability and responsiveness from above, as is starkly evident in Delhi.



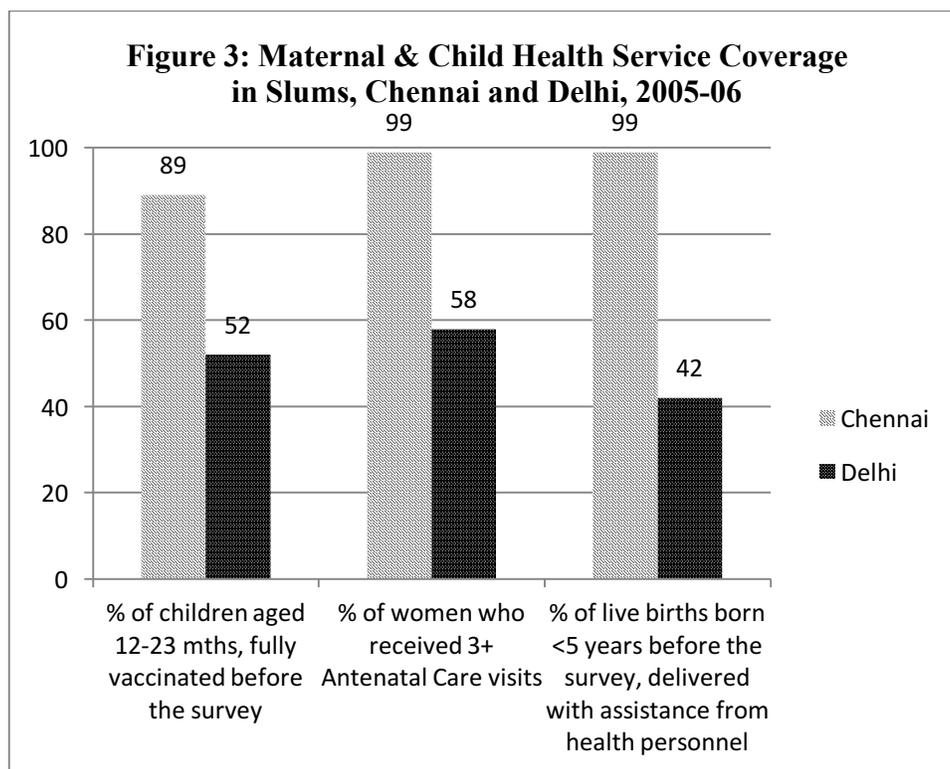
Notes:

1. The countries selected are from countries with surveys around 2005-06, for easy comparison with the last DHS (NFHS) survey data available for India. These are all low or low-middle income countries, as classified by the World Bank (2005:291).
2. GDP per capita in 2005, PPP (constant 2011 international \$). Source: World Bank, World Devt Indicators <http://data.worldbank.org/indicator/NY.GDP.PCAP.PP.KD>
3. Child stunting data from the DHS surveys (IIPS 2007, Cayemites et al 2007, Coa et al 2009, DCS 2009, Secretaria de Salud 2006). Stunting is defined as a height-for-age which is -2 or more Standard Deviations below the 2006 WHO reference population median in their child growth standards.*
4. The DHS Household Wealth Quintiles are estimated from a list of household assets.

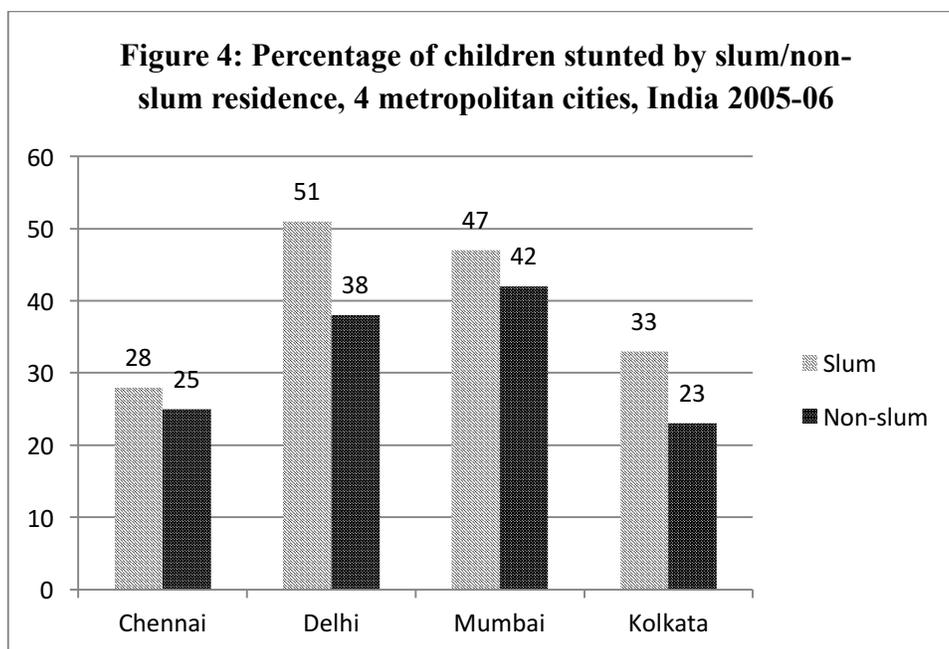
* Studies find similar genetic potential for growth in height across populations (Natale and Rajagopalan 2014:6). *Cross-population* differences in height seem related largely to non-genetic, environmental factors, while genetic factors play more of a role in *intra-population* differences (NCD-RisC 2016:1).



Source: NSSO (2013)



Source: Gupta et al (2009: Figures 3.5, 3.8 and 3.9), derived from India's NFHS-3 survey.



Source: Arnold et al (2009:12), derived from India's NFHS-3 survey.

Table 1. Sanitation rankings of metropolitan cities

	2009-10 Rank Order <i>(among 423 cities, using 19 parameters of sanitation)</i>	2014-15 Rank Order <i>(among 476 cities, using 2 parameters: open defecation and solid waste management)</i>
Delhi:		
Municipal Corporation of Delhi	168	398
Delhi Cantonment	5	-
New Delhi Municipal Corporation	4	16
Chennai	13	61
Kolkata	25	56
Mumbai:		
Navi Mumbai	11	-
Greater Mumbai	45	140

Source: Government of India. National Urban Sanitation Policy (NUSP) for the 2009-2010 rankings, and Swachh Bharat for the 2014-15 rankings.⁵⁶

Subsequent Swachh rankings are not directly comparable to these surveys, as they give half the weight to self-assessed performance by municipal bodies (50% weight in 2016 and 45% in 2017), 25-30% weight to direct observation, and the rest to citizens' reports.⁵⁷

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Appendix 1: Methodology

We conducted detailed case studies of the Municipal Corporations of Chennai and Delhi – two of India’s major municipalities – focusing on the organization of public health and environmental sanitation services. The goal is understand how better management of health and sanitation services results in better public health outcomes, and draw broader lessons from this for policy. The analysis integrates theories and evidence from four different fields: Public Health, Public Economics, Local Government, and Urban Studies to understand the challenges of running effective sanitation programs in big cities.

Our analysis draws on data collected through a mix of qualitative and quantitative methods:

1. *Qualitative data:* Extensive field interviews were conducted in Chennai and Delhi, to learn about their governance, management methods, and service delivery arrangements.⁵⁸ In both cities we interviewed people from the State Health Department, and from the Municipal Corporation departments in charge of public health, solid waste management, and drains. This included staff from Headquarters down to the ground-level field staff of these departments. We also interviewed people who had earlier served in the state government or the municipal corporation. In all a total of 68 people were interviewed for this study between November 2013 and April 2017, many of them on multiple occasions. The total of 153 interviews are listed in Table A.1 below. Many of the issues discussed are potentially sensitive in nature, so to preserve the confidentiality of our respondents we have only identified them by broad classifications and the city where they work. Qualitative and secondary data previously collected on public health arrangements in Tamil Nadu and other states also helped inform this analysis.
2. *Secondary sources of information:* Data and other information posted on the websites of these and other municipal corporations in India were examined. The legal underpinnings of these entities were examined, for the light they throw on their governance arrangements. Other secondary sources include published government reports of the central and state governments, and peer-reviewed academic literature.
3. *Survey data:* Data from national slum surveys and sanitation surveys were analyzed to examine sanitary conditions in slums and in major metropolitan cities. To analyze differentials in child stunting by wealth quintile, we used data from the Indian National Family Health Survey (NFHS) and from the Demographic and Health Surveys (DHS). The NFHS and DHS surveys are directly comparable as they were conducted using the same methods and core questionnaires. The DHS surveys analyzed are from some lower-income countries that conducted surveys around 2005-06, which is when the last NFHS survey (NFHS-3) was conducted for which a detailed report has been published. The NFHS-3 also analyzed differences between slums and non-slums of some metropolitan cities in maternal and child health indicators, and these data are presented here to contrast outcomes in Delhi with those of Chennai. The specific sources of data used are indicated in each figure and table.

Table A.1: List of interviews conducted

DELHI		CHENNAI	
State Health Department, Directorate of Public Health, and national public health institutions (18 interviews, with 8 people)		State Health Department, and Directorate of Public Health (15 interviews, with 7 people)	
Date of Interview	Topics	Date of Interview	Topics
11-15 Nov-2013 17 March- 4 April 2014 18-25 Oct 2014 9-14 Nov 2015	The relationship between the federal, state and the MCD health services: what support given, etc The role of the national public health institutions in supporting state and municipal public health services	27 Oct -1 Nov 2014 16-21 Nov 2015 20-25 March 2017	The relationship between the state health services and the CMC: what support given, etc
Municipal Corporation staff, from Headquarters and field offices (58 interviews, with 27 people)		Municipal Corporation staff, from Headquarters and field offices (29 interviews, with 19 people)	
11-15 Nov 2013 17 March- 4 April 2014 18-25 Oct 2014 9-14 Nov 2015 1-7 April 2017	Organizational structure, detailed nature of services provided, supervision and accountability arrangements, role of local elected representatives	27 Oct -1 Nov 2014 16-21 Nov 2015 20-25 March 2017	Organizational structure, detailed nature of services provided, supervision and accountability arrangements, role of local elected representatives
Other: Central Health Ministry staff, other IAS officers, public health researchers, etc. (21 interviews, with 10 people)		Other: IAS officers, public health researchers, etc. (12 interviews, with 4 people)	
11-15 Nov-2013 17 March- 4 April 2014 18-25 Oct 2014 9-14 Nov 2015 1-7 April 2017	Background information on the state and central government health sectors, and on the functioning of the municipal corporation. Details of specific research on public health issues.	27 Oct -1 Nov 2014 16-21 Nov 2015 20-25 March 2017	Background information on the state and central government health sectors, and on the functioning of the municipal corporation. Details of specific research on public health issues.

Endnotes

We are deeply grateful to many people in Chennai and Delhi for their patience and help. At the Tamil Nadu Health Department we especially thank Dr J. Radhakrishnan (Health Secretary), Dr Kolandaswamy (Director, Directorate of Public Health), Dr Vanaja (Additional Director, Directorate of Public Health), and Dr Balasubramanian (Joint Director Epidemics, Directorate of Public Health), and Dr P. Umanath (Managing Director, Tamil Nadu Medical Service Corporation). At the Chennai Municipal Corporation we especially thank Dr Vijayalakshmi (Deputy Commissioner Health & Solid Waste Management), Dr Sentil Nathan (City Health Officer), Dr Jagadeesan (earlier Acting City Health Officer), Dr Gopinath (Chief Medical Officer), Dr Manohari (Additional Chief Medical Officer), Dr Mahalaxmi (Zonal Health Officer), Mr Rajendran (Executive Engineer, Storm Water Drains), and Ms Rajeshwari (Engineer, Solid Waste Management). In Delhi we especially thank Dr Charan Singh (Additional Director Public Health, Delhi State), Debashree Mukherjee (earlier CEO, Delhi Jal Board), Anshu Prakash (earlier Joint Secretary, Ministry of Health), Virendra Prakash (Chief Secretary, Delhi, retired), Dr A.C. Dhariwal (Director, National Vector Borne Diseases Control Programme of India), Dr P.K. Sharma (Medical Officer of Health and Director Health Services, New Delhi Municipal Council), Col Ghosh (Commanding Officer, Station Health Organization, Delhi Cantonment), and many staff of the Municipal Corporation of Delhi (South, North, and East zones), and the Delhi State Directorate of Public Health.

This study was partly funded by grants from the World Bank, through its Research Support Budget [RF-P158512-RESE-BBRSB-Governance of Environmental Sanitation], and its South Asia Food and Nutrition Security Initiative (SAFANSI).

All views expressed in this paper are the personal views of the authors and do not necessarily represent the views of the World Bank or its member countries, or of the Government of India or any state government.

¹ Prüss-Ustün et al (2014), Hammer and Spears (2016).

² See for example Ahluwalia (2017), and the papers in Ruet and Tawa Lama-Rewal eds (2009).

³ In Delhi, “About 74.46% slums are surrounded by residential areas, 3.36% by industrial areas, 0.66% by commercial areas and rest by other type of areas” (Government of Delhi 2015a, report on the NSSO 2012 survey). In India overall, “As per the latest 69th Round survey (2012) an estimated 66.4% of slums were surrounded by residential area. 9.5% of slums were surrounded by industries and about 6.7% of slums were surrounded by commercial establishments (Government of India 2015:53).”

⁴ See the NFHS-3 survey report (IIPS 2007: Table 10.1). Jayachandran and Pande (2017) find that if the firstborn child is male, he is somewhat less likely to be stunted than other sons and daughters.

⁵ The preliminary results of the 2015-2016 NFHS-4 survey show that child stunting in the top wealth quintile dropped slightly to 22%, since the 2005-06 survey. <http://rchiips.org/NFHS/pdf/NFHS4/India.pdf>, accessed 23 May 2017.

⁶ Bozzoli et al(2009), Hatton (2014), Grasgruber et al (2014), Crimmins and Finch (2006), and Tanner (1992). Average heights have also been found to decrease when conditions deteriorate, as in parts of sub-Saharan Africa today (NCD-RisC (2016: Figure 8), Floud et al (2011). Grasgruber et al (2014:86) note this also in the European country of Lithuania when it was placed under economic stress after the collapse of the USSR.

⁷ Child stunting can result from poor maternal health/nutrition; inadequate child feeding; infection; and limited access to effective health care (WHO 2014:2, NCD-RisC 2016:1). Of these, infection is the most applicable to children in the top wealth quintile.

⁸ Case and Paxson (2008), Hoddinott et al.(2013), Guven and Lee (2015), NCD-RisC (2016), and UNICEF (2017).

⁹ This included efforts to upgrade housing to reduce crowding and install water, drainage, and sewer systems for slum dwellers. A large literature on this includes Chadwick’s (1842) pioneering report (summarized in Rosen 1958:190-191), Lubove (1962), Rosen (1958), and Duffy (1990).

¹⁰ Das Gupta et al (2010).

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- ¹¹ Chaplin (2011).
- ¹² This is noted by the Government of Delhi (2000: chapter 13). “Delhi Jal Board has estimated that if the norm of 60 gpcd (gallons per capita per day) for planned colonies, 34 gpcd for Regularised-unauthorized colonies and 11 gpcd for other areas is adopted, the water requirement for the present population of Delhi will be about 440 MGD as against present capacity of 591 MGD”. The report also notes that actual distribution of water within the MCD territory varies widely between areas.
- ¹³ CAG (2013:5)
- ¹⁴ Government of Delhi (2015b:199), Government of Delhi (2017:199).
- ¹⁵ In this section, the description of services in Chennai draws on 29 interviews conducted between October 2014 and March 2017, with headquarters and field staff of the CMC Health Department (from both the public health and the medical branches). For Delhi, it draws on 28 interviews conducted between November 2013 and April 2017, with staff of the Delhi State Government’s Health Department and with headquarters and field staff of the MCD Health Department. All information from the interviews was double-checked in March-April 2017. Secondary sources used are indicated in the text and accompanying endnotes.
- ¹⁶ <http://www.chennaicorporation.gov.in/healthdirectory/pdf/PublicHealthDepartment.pdf>, accessed 19 January 2017
- ¹⁷ Corporation of Chennai. 2014. Standard Operating Procedure for Institutionalising Basic Services for the Urban Homeless H.D.C.NO./B1/3249 /2014, <http://www.ihrn.org.in/knowledgebase/Policy-Analysis-and-Documents/Corporation-of-Chennai-Standard-Operating-Procedure-for-Institutionalising-Basic-Services-for-the-Urban-Homeless> (accessed 19 January 2017).
- ¹⁸ Rajendran (2013) observed that it was especially popular amongst slum residents and labourers.
- ¹⁹ “Tamil Nadu has served nourishing school meals with clock-like regularity for more than 20 years” (Dreze and Goyal 2003:4678).
- ²⁰ CGDR (2011: Tables 3.18 and 3.19).
- ²¹ This sub-section draws on secondary sources, as indicated in the text. The description of arrangements in Delhi draws on 38 interviews conducted between March 2014 and April 2017, with headquarters and field staff of the municipal health departments of the MCD, the New Delhi Municipal Council, and the Delhi Cantonment, as well as with senior staff of the central Health Ministry. The description of arrangements in Chennai draws on 34 interviews conducted between October 2014 and March 2017, with headquarters and field staff of the Tamil Nadu State Health Department and the CMC Health Department. The information on Tamil Nadu and other states is supplemented with information from an earlier study (Das Gupta et al 2010). All information from the interviews in Chennai and Delhi was double-checked in March-April 2017.
- ²² See the 74th Constitutional Amendment <http://indiacode.nic.in/coiweb/amend/amend74.htm>, and Government of India (n.d.:485).
- ²³ See the MCD and CMC Acts, amended in line with the 74th Constitutional Amendment.
- ²⁴ Batley and McLoughlin (2015:278), Mansuri and Rao (2013).
- ²⁵ Khaleghian and Das Gupta (2005).
- ²⁶ Batley and McLoughlin (2015:278).
- ²⁷ Mansuri and Rao (2013), Bardhan (2002), Bardhan and Mookherjee (2016). The need for stronger mechanisms of financial accountability has been raised in successive reports by the central government, e.g. “The proposed transfer of funds to the PRIs by the Central and state governments must be accompanied by efforts at strengthening their accounting and auditing procedures” (Government of India, Planning Commission, n.d.:487). See also Government of India (2011: ch.3).
- ²⁸ Das Gupta et al (2013)

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- ²⁹ Khwaja (2004) studied the effect of community participation in development projects in Northern Pakistan. He finds that “while community participation improves project outcomes in nontechnical decisions, increasing community participation in technical decisions actually leads to worse project outcomes.”
- ³⁰ New Delhi Municipal Council website <https://www.ndmc.gov.in/ndmc/introduction.aspx>, accessed 27 February 2017
- ³¹ New Delhi Municipal Council website <https://www.ndmc.gov.in/ndmc/introduction.aspx>, accessed 27 February 2017
- ³² Banerjee et al (2013)
- ³³ Sharma (2006:133)
- ³⁴ See description of Mohalla Sabhas at http://www.lokrajandolan.org/images/mohalla_sabhas_a_how_to_guide.pdf (accessed 12 July 2016), and at <http://mohallasabha.delhi.gov.in/> (accessed 25 May 2017),
- ³⁵ This is the Nagara Raj Bill https://www.uclg-cisdp.org/sites/default/files/India%20Nagar%20Raj%20Bill_2010_en_final_0.pdf (accessed 16 June 2017).
- ³⁶ CMC website <http://www.chennaicorporation.gov.in/departments/health/publicHealthDept.htm>, accessed 20 January 2016, citing a classic statement by the US Public Health Service (US Treasury Department 1922).
- ³⁷ See the Tamil Nadu Panchayats Act, 1994 http://www.tnrd.gov.in/pract/pract_draft.pdf (accessed 20 April 2017), Government of India (2012: Annexure). As Besley and Ghatak (2007:136) point out ‘Bureaucrats are unlike politicians in that they can be held to formal contracts and standard management methods’.
- ³⁸ Sections 34,43A,44,53 of the CMC Act.
- ³⁹ The MCD Act seems to allow only for dissolution of the whole Council (not removal of individual Councillors), for non-performance or overstepping their powers (Section 490). Sections 9,80 and 462 prohibits Councillors from having conflicts of interest, without clear sanctions other than that they are subject to national criminal laws.
- ⁴⁰ This is very clearly laid out in the Tamil Nadu Panchayats Act, 1994 http://www.tnrd.gov.in/pract/pract_draft.pdf (accessed 20 April 2017)
- ⁴¹ In this section, the description of services in Chennai draws on 37 interviews conducted between October 2014 and March 2017, with headquarters and field staff of the CMC Health Department and the Tamil Nadu State Public Health Directorate. The description for Delhi draws on 49 interviews conducted between March 2014 and April 2017, with staff of the Delhi State Government’s Health Department, with senior staff of the Jal Board, with headquarters and field staff of the MCD Health Department. Both the discussion of Chennai and Delhi also draw on 10 interviews conducted between March 2014 and April 2017 with staff of national health agencies such as the NCDC and the Ministry of Health. All information from the interviews in Chennai and Delhi was double-checked in March-April 2017. Secondary sources used are indicated in the text.
- ⁴² Ruet and Tawa Lama-Rewal (2009), Tiwari et al (2015).
- ⁴³ See for example Scutchfield and Keck eds (2003:ch8,23), Novick and Morrow (2008), and WHO (1978).
- ⁴⁴ See the Chennai Metrowater Board of Governors <http://www.chennaietrowater.tn.nic.in/boardofdirectors.html>, and Delhi Jal Board http://www.delhi.gov.in/wps/wcm/connect/DOIT_DJB/djb/home/information/djb+act/chapter+-+ii (accessed 19 January 2017)
- ⁴⁵ See the description of the Slum Board in Chennai <http://www.tnscb.org/>, <http://www.tnscb.org/wp-content/uploads/POLICY%20NOTE%202016-%2017%20English.pdf>, and in Delhi <http://delhishelterboard.in/main/> (accessed 19 January 2017)
- ⁴⁶ See http://www.delhi.gov.in/wps/wcm/connect/doiit_pfa/PFA/Home/Organisation+Setup (accessed 19 January 2017)
- ⁴⁷ See the organization of the Chennai Metropolitan Development Authority <http://www.cmdachennai.gov.in/aboutcmda.html>, http://dda.org.in/ddanew/organizational_chart.aspx, and the

Delhi Development Authority https://www.dda.org.in/planning/docs/list_of_authority_members.pdf (accessed 19 January 2017)

⁴⁸ In this section, the description of services in Chennai draws on 30 interviews conducted between October 2014 and March 2017, with the senior management of the CMC and with headquarters and field staff of the CMC Health Department. It also draws on an earlier study in Tamil Nadu (Das Gupta et al 2010). For Delhi, it draws on 41 interviews conducted between November 2013 and April 2017, with staff of the Delhi State Government's Health Department and with headquarters and field staff of the MCD Health Department. All information from the interviews were double-checked in March-April 2017. Secondary sources used are indicated in the text.

⁴⁹ Sharma (2006:193,207).

⁵⁰ Sharma (2006:126, 223).

⁵¹ See the website of the CMC Public Health Department <http://www.chennaicorporation.gov.in/departments/health/publicHealthDept.htm> (accessed 20 January 2016).

⁵² See the website of the MCD Health Department http://mcdonline.gov.in/tri/sdmc_mcdportal/healthindex.php (accessed 30 May 2017).

⁵³ In this section, the description of services in Chennai draws on 32 interviews conducted between October 2014 and March 2017, with headquarters and field staff of the CMC Health Department (primarily from the public health, but also corroborated by staff from the medical branch). All information from the interviews was double-checked in March 2017. Secondary sources used are indicated in the text.

⁵⁴ In this section, the description of services in Chennai draws on 35 interviews conducted between October 2014 and March 2017, with staff of the Tamil Nadu State Directorate of Public Health, and with headquarters and field staff of the CMC Health Department (primarily from the public health branch). For Delhi, it draws on 26 interviews conducted between November 2013 and April 2017, with staff of the Delhi State Government's Health Department, and of the Ministry of Health and national health agencies. All information from the interviews were double-checked in March-April 2017. The information on Tamil Nadu and other states is supplemented with information from an earlier study (Das Gupta et al 2010). Secondary sources used are indicated in the text.

⁵⁵ Das Gupta et al. (2010).

⁵⁶ The 2009-10 rankings are at <http://pib.nic.in/archieve/others/2010/may/d2010051103.pdf>, and the 2014-15 rankings at <http://pib.nic.in/newsite/PrintRelease.aspx?relid=124639>. The parameters used in the 2009-10 survey, are at <https://www.zaragoza.es/contenidos/medioambiente/onu/1186-eng.pdf> (all accessed 25 May 2017).

⁵⁷ The methods used in the 2016 and 2017 surveys are at http://swachh-survekshan.in/SS_2016_report.pdf, http://swachh-survekshan.in/SS_2017_Report.pdf (accessed 25 May 2017).

⁵⁸ A partial list of people interviewed is before endnote 1.