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### Research

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#### Health-care investments for the urban populations, Bangladesh and India



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#### Introduction

Cities promote national economic growth and prosperity, innovation and overall national welfare. The United Nations (UN) has pointed out that modern cities exhibit contrasts between wealth and poverty, opportunity and deprivation and vibrant potential and systemic decay.<sup>1</sup> Cities have natural advantages in providing all kinds of services, not least because they are national economic drivers, with access to proportionately greater financing mechanisms than rural areas. Their size allows for a greater variety of services and economies of scale compared with sparsely populated areas. However, they also face challenges, for example, in establishing new health facilities where real estate is expensive and scarce, and in incorporating the long-neglected urban poor into comprehensive planning.<sup>2</sup>

According to the UN, the proportion of the world's population living in urban areas will increase, from an estimated 55% in 2018 to an estimated 68% by 2050.<sup>3</sup> Bangladesh and India are experiencing some of the highest urban population growth rates in the world. The UN projects that the urban population will grow from 48 million in 2011 to 84 million in 2030 in Bangladesh. In India, the projected population increase

is from 377 million to 612 million.<sup>3</sup> This increase will be largely due to internal migration and natural population growth. Slums will account for an ever-greater proportion of urban inhabitants. In 2015, 62 cities in Bangladesh and India had more than 1 million population and five had more than 10 million; by 2030, 77 cities will exceed a population of 1 million and eight will exceed 10 million.<sup>3</sup>

To meet the health needs of the growing urban population, health-care services need to expand. Currently, both countries have a mix of public and private health-care provision. In India, publicly-financed health services have been provided exclusively by public sector facilities, with little formal attention to either regulating the private sector or to delivering publicly-financed services through private providers.<sup>4</sup> The Bangladeshi government has for the past two decades used some public financing to fund services through the nongovernmental organizations. In both countries, health infrastructure and services have steadily improved, but are still inadequate to serve the population need. Scarce efforts to improve urban health have been made over the last several decades, either by national governments or external partners.<sup>5,6</sup>

To assess the cost and benefit of providing interventions for major public health, prevention and treatment needs for populations in Bangladesh and India, we identified interventions from the nine volumes of the third edition of the *Disease control priorities*.<sup>7</sup> The 208 interventions identified constitute a package of essential health services covering the most common causes of visits to doctors and admission to hospitals during the life course. This package includes almost all of the 218 interventions included in *Disease control priorities*, omitting only those that are not relevant to South Asian populations, e.g. prevention and treatment of African trypanosomiasis. Box 1 presents some examples of the interventions; the full list is available in the data repository.<sup>8</sup> Here we estimate the costs, mortality reduction and the benefit–cost ratio of providing this package for the urban populations in Bangladesh and India.

### **Box 1. Examples of interventions included in the suggested urban package of essential health services for Bangladesh and India**

#### **Maternal, perinatal and childhood conditions**

- Management of labour and delivery in low-risk women by skilled attendants, including basic neonatal resuscitation following delivery, and in high-risk women, including operative delivery.
- Childhood immunizations, including DPT, polio, BCG, measles, hepatitis B, *Haemophilus influenzae* type B and rubella vaccines.

#### **Infectious diseases**

- Active case finding of high-risk individuals (e.g. people living with HIV) with tuberculosis symptoms and linkage to care.
- In all malaria-endemic areas, diagnosis with rapid test or microscopy followed by treatment with artemisinin-based combination therapy (or current first-line combination). Where rapid test and microscopy are unavailable, patients with febrile illness receive presumptive treatment with artemisinin-based combination therapy and patients with severe illness receive in addition antibiotics.

### **Noncommunicable diseases (such as cardiovascular disease, cancer, mental health, rehabilitation and palliative care)**

- Substantial increases in the excise taxes on manufactured cigarettes.
- Opportunistic screening for hypertension for all adults and initiation of treatment among individuals with severe hypertension and/or multiple risk factors.
- Long term management of ischaemic heart disease, stroke and peripheral vascular disease with aspirin,  $\beta$  blockers, blood pressure lowering pills, and statins (as indicated) to reduce risk of further events.
- Management of acute exacerbations of asthma and COPD using systemic steroids, inhaled  $\beta$ -agonists, and if indicated, oral antibiotics and oxygen therapy.
- Early detection and treatment of early-stage breast, cervical, breast, and childhood cancers.
- Management of depression and anxiety disorders with psychological and generic antidepressant therapy.
- Rehabilitation programmes for cardiac and pulmonary conditions.
- Essential palliative care and pain control measures, including oral immediate release morphine, and medicines for associated symptoms.

### **Injuries**

- Trauma related surgical procedures, such as laparotomy and amputations.
- Rehabilitation for patients following acute injury or illness.
- Gender-based violence care, including counselling, provision of emergency contraception and rape-response referral.

BCG: bacillus Calmette–Guérin; COPD: chronic obstructive pulmonary disease; DPT: diphtheria, pertussis and tetanus; HIV: human immunodeficiency virus.

Note: All 208 interventions included in the package are available from the data repository.<sup>8</sup>

## **Methods**

### **Demography and disease burden**

For both countries, we used population data from the 1991, 2001 and 2011 censuses,<sup>9, 10</sup> and the UN Population Division's (UNPD's) population projection for the year 2030.<sup>3</sup> For cause-specific mortality estimates in urban India, we used data from the Medical Certification of Cause of Death for the years before 2001,<sup>11</sup> and from the Million Death Study for 2001 and onward.<sup>12</sup> Cause-specific mortality data for all ages are not available for Bangladesh.

### **Cost of the package**

To estimate the cost of the package, we obtained cost estimates of each intervention for lower-middle income countries in 2012 United States

dollars (US\$), from the third edition of *Disease control priorities*.<sup>7. 13–20</sup> We used 2012 exchange rates from the World Development Indicators to convert costs into Bangladeshi Taka and Indian Rupees, the World Development Indicators consumer price index to convert to 2016 local costs, and finally converted back to US\$ using the 2016 exchange rate.<sup>21</sup> We based costs on a population of one million and an 80% coverage level for all included interventions. We calculated two cost estimates of the package, incremental and total costs. Incremental cost, that is, the additional cost that would be needed to provide 80% population coverage, was calculated as:(1)where  $P_i$  is the population in need of the intervention  $i$ ,  $\Delta c_i$  is the additional proportion of individuals that is needed to reach 80% coverage (that is, 80% minus current coverage level),  $c_i$  is the yearly cost per person of intervention  $i$ .

(1).

$$\sum_{(i=1)}^n P_i \times \Delta c_i \times c_i$$

The total cost for 80% coverage, that is the total costs of current spending plus incremental cost, was calculated as:(2)where  $t$  is the target coverage level of 80%.<sup>22</sup>

(2).

$$\sum_{(i=1)}^n P_i \times t \times c_i$$

To estimate the population in need of an intervention, we used national surveys, ministry reports and population-based registries to obtain incidence or prevalence data of relevant conditions. For various reproductive, maternal and child conditions, and gender-based violence, we used urban-specific data from the India National Family Health Survey,<sup>23</sup> Bangladesh Demographic and Health Survey,<sup>24</sup> and Bangladesh Report on Violence Against Women Survey.<sup>25</sup> For cancer incidence, we used 2012 data from the International Agency for Research on Cancer GLOBOCAN database for Bangladesh<sup>26</sup> and data for urban India (2012–2014) from the National Population-Based Cancer Registry.<sup>27</sup> For conditions where incidence and prevalence data were not reported by urban and rural sectors, we used national estimates from published literature, government reports, World Health Organization (WHO) reports and the Global Burden of Disease model-based estimates for South-Asia for 2016.<sup>28</sup> The earliest data were from 2011. Where epidemiological data were not available, we used estimates from the third edition of *Disease control priorities* for lower middle-income countries.<sup>22</sup>

For baseline coverage data, we used the Indian National Family Health Survey and the Demographic Health Survey in Bangladesh, which provide data on the urban population for most reproductive, maternal and child health, and household sanitation interventions.<sup>23. 24</sup> For other interventions, we used data from the published literature. For interventions similar to an intervention with available coverage data, we used that intervention as a proxy. We used WHO coverage estimates for malaria and tuberculosis diagnosis and treatment.<sup>29. 30</sup> For missing data (e.g. for mental health disorders) we used baseline coverage estimates for lower middle-income countries from the third edition of *Disease control priorities*.<sup>7. 22</sup>

To account for the costs of infrastructure, surveillance, regulation and other support activities, we added 40% of the total direct cost, that is,

personnel, drugs and equipment costs. This infrastructure excess was based on an earlier detailed costing analysis for India.<sup>4</sup> Using the above inputs, we estimated overall current annual spending, current annual spending per capita, and the incremental and total annual cost needed to achieve 80% coverage of the package. We also allocated the cost across major disease groups, and by platforms of health system (that is, population-based interventions, community services, health centres, first-level hospitals and referral and specialized hospitals) and the type of care provided (that is, urgent, recurrent for chronic diseases and others, such as childhood immunization).

### **Mortality reduction**

We estimated the number of premature deaths (before 70 years of age) averted by the package by first estimating the age and sex distributions for urban population in Bangladesh and India for 2030. We did so by applying the age and sex distributions of the urban population of the 2011 Bangladesh and India censuses to the UNPD urban population projection for 2030.<sup>3, 9, 10</sup> We projected 2030 baseline deaths using cause-specific mortality rates from the Million Death Study for urban India.<sup>12</sup> Such data were unavailable for Bangladesh, so we used the average cause-specific mortality rates in urban West Bengal and Assam, the major Indian states bordering Bangladesh, as proxies. We used the effect sizes of the package interventions on mortality reduction for lower-middle income countries from a published working paper,<sup>31</sup> assuming uniform effect sizes across all age groups and 80% efficiency in intervention delivery at baseline. We compared the estimated mortality reduction to the so-called 40x30 reduction target, which is a set of selected disease-specific targets to help achieve the sustainable development goal 3.<sup>32</sup> This reduction target aims for a 40% reduction in deaths among people younger than 70 years; a two-third reduction in child and maternal mortality and mortality due to human immunodeficiency virus infection, tuberculosis and malaria; and one-third reduction in premature deaths from other communicable diseases, injuries and noncommunicable diseases.<sup>32</sup>

### **Benefit–cost ratio**

To estimate the benefit–cost ratio for investing in the package, we used a published method<sup>33</sup> that is based on the Copenhagen Consensus method.<sup>34</sup> We converted the number of deaths averted in the age groups 0–4 years and 5–69 years to disability-adjusted life years (DALYs). For the age group 0–4 years we used a factor of 97 DALYs per death averted. For the age group 5–69 years, we used 97 DALYs per death averted for the ages 5–49 years and 42 DALYs per death averted for ages 50–69 years. The conversion factors were derived by dividing the total all-cause DALYs by the total number of deaths in each age group in lower-middle income countries from the 2016 WHO global health estimates.<sup>35</sup> We monetized the DALYs conservatively by multiplying by twice the 2016 gross domestic product (GDP) per capita in each country. We obtained GDP per capita from the World Development Indicators.<sup>21</sup> We applied a 3% discount rate to costs and benefits over 15 years.

### **Sensitivity analysis**

To examine the effect of the package on mortality reduction at different levels of delivery efficiency and coverage levels, we conducted sensitivity analyses at 70%, 80%, 90% and 95% efficiency in intervention delivery and at 60%, 70%, 80%, 90% and 100% coverage levels. All analyses were performed in Stata version 15.1 (StataCorp. LCC, College Station, United States of America).

### **Results**

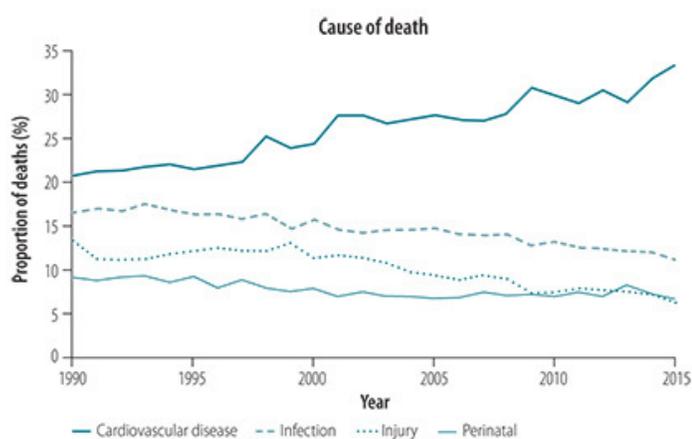
## Demographics in 2030

As urban populations are increasing over the next decades, the population structure will shift towards middle and older ages, with the largest increases in the 30–69-year age group in both countries. The proportion of population aged 30–49 years will increase from 26.7% (12.8 million/48.1 million) in 2011 to 32.0% (26.9 million/84.1 million) in 2030 in urban Bangladesh, and from 28.2% (106.2 million /377.1 million) to 31.6% (193.5 million /611.5 million) in urban India. The proportion of population aged 50–69 years will increase from 10.4% (5.0 million /48.1 million) to 17.2% (14.5 million /84.1 million) in urban Bangladesh, and from 13.1% (49.2 million /377.1 million) to 18.2% (111.4 million /611.5 million) in urban India (available in the data repository).<sup>8</sup> This shift reflects migration patterns, a progress in preventing deaths in infancy and childhood, natural population growth and increased life expectancy due to income growth, education and better health-care services.<sup>4</sup>

## Causes of mortality

In urban India, noncommunicable disease deaths are rising as a proportion of overall mortality, such as cardiovascular disease, respiratory diseases and injuries (Fig. 1 and data repository).<sup>8</sup> However, infectious diseases are still a problem. Urban crowding, lack of clean water and sanitation and mobility contribute to continuing transmission of infectious diseases. For example, India has a high tuberculosis burden, and Mumbai, a megacity of more than 18 million people, is a particular hotspot.<sup>36</sup>

Fig. 1. Distribution of leading causes of mortality in urban India, 1990–2015



## The intervention package

### Cost

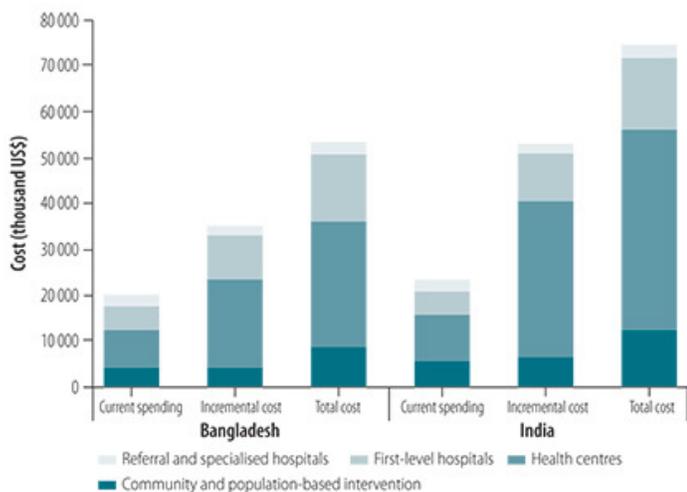
Table 1 shows the current annual spending on health services for the urban population in Bangladesh and India, and the incremental and the total annual cost if interventions in the package were implemented. At 80% coverage, the suggested package would cost US\$ 75.1 per urban inhabitant in Bangladesh and US\$ 105.0 in India by 2030. To achieve this coverage, the Bangladeshi government would need to increase their health spending by US\$ 49.3 per urban inhabitant, while the Indian government would need to increase this sum by US\$ 74.6 per urban inhabitant. To cover 80% of urban populations in 2030, both Bangladesh and India would need to spend about an additional 2.0% of the 2016 GDPs. This spending is an addition to the current spending of about 1.0% of the 2016 GDP.

**Table 1. Estimated cost of an urban package of essential health services for a city with a population of one million, Bangladesh and India**

html, 8kb

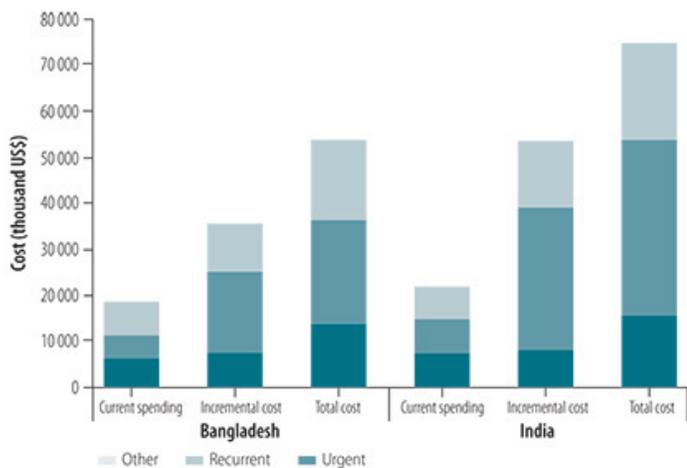
The total incremental cost would be US\$ 35.2 million in Bangladesh and US\$ 53.3 million in India (Table 1). In both countries, most of the incremental cost would be invested in health centres, followed by first-level hospitals and community- and population-based interventions. Investment in referral and specialised hospitals accounts for only 5.3% (US\$ 1.9 million) of the total incremental cost in Bangladesh and 3.8% (US\$ 2.0 million) in India (Fig. 2). Examining the distribution of package costs by type of provision showed that in both countries, more than half of the incremental cost, 50.9% (US\$ 17.9 million) in Bangladesh and 58.6% (US\$ 31.2 million) in India, would be invested in management of chronic conditions to reduce risk of further events. Routine interventions would account for 28.2% (9.9 million) of incremental costs in Bangladesh and 26.5% (14.1 million) in India. Urgent conditions account for the remaining incremental costs (Fig. 3).

**Fig. 2. Projected cost for an urban package of essential health services in a city with a population of one million, by type of platform of intervention delivery, Bangladesh and India, 2030**



US\$: United States dollars

**Fig. 3. Projected cost of an urban package of essential health services, in a city with a population of one million, by type of intervention, Bangladesh and India, 2030**



Note: Recurrent provision includes interventions for chronic conditions. Other type of provision is interventions that are neither urgent nor recurrent, but nonetheless

are important, such as childhood immunizations and provision of iron and folic acid supplementation for pregnant women.

### Mortality reduction

If the countries' governments would implement the recommended package, we estimate that per million population, the number of premature deaths in the year 2030 would decrease from 3362 to 2335 in Bangladesh and from 3913 to 3085 in India. These averted deaths would constitute 30.5% and 21.2% of the baseline deaths in Bangladesh and India, respectively. The package would contribute to achieving the 40x30 reduction target by averting 76.3% (1027/1345 per million population) of premature deaths set by the target in Bangladesh. In India, this percentage would be 52.9% (828/1565 per million population). Furthermore, both countries would make progress towards the 40x30 target for under-five mortality by averting 168 deaths in Bangladesh and 163 deaths in India per million urban population, resulting in 58.2% of deaths set by the 40x30 reduction target to be averted (Table 2). Progress towards the 40x30 target for noncommunicable diseases would be much higher in Bangladesh (90.9%; 586/645) than in India (64.5%; 504/782).

[Table 2. Estimated deaths averted by an urban package of essential health services in a city with a population of one million in Bangladesh or India, 2030](#)  
html, 7kb

### Benefit–cost ratio

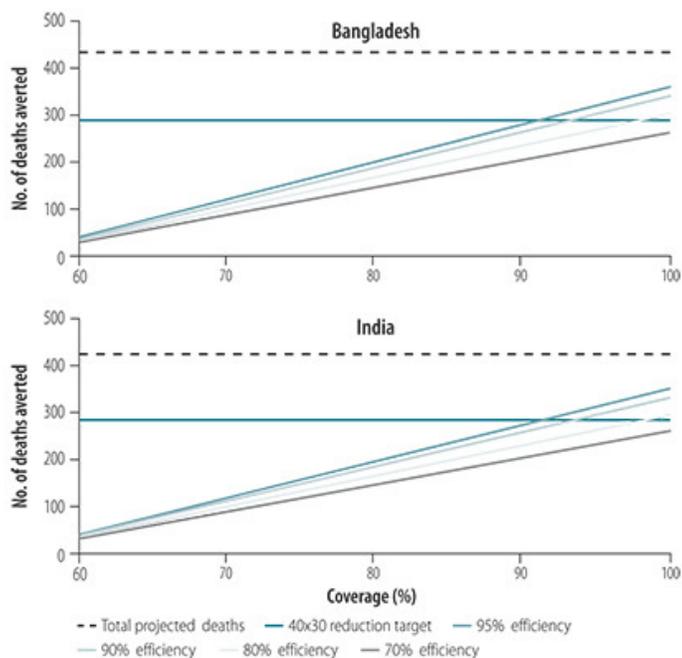
We estimated that in Bangladesh, the benefits of investing in the package would yield US\$ 1.2 of benefits to each dollar spent; in India, the benefit would be US\$ 1.8 (Table 3).

[Table 3. Benefit-cost-ratio for an urban package of essential health services in a city with a population of one million in Bangladesh or India, 2016](#)  
html, 3kb

### Sensitivity analysis

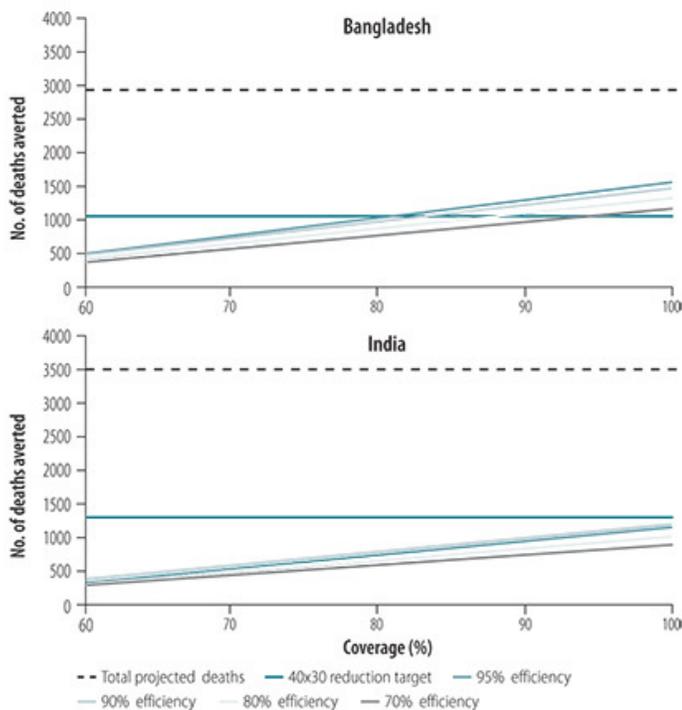
In Fig. 4 and Fig. 5, we have plotted varying intervention delivery efficiencies and coverage levels to demonstrate whether they would achieve the 40x30 reduction target for a city of one million population. Both countries could only achieve the 40x30 target for under-five mortality with at least 90% coverage and at least 90% efficiency in intervention delivery. In the 5–69-year age group, we found that in Bangladesh, the 40x30 reduction target could be achieved if the package was implemented with at least 90% efficiency and at least 85% coverage, or at least 80% efficiency and at least 90% coverage. In India, while substantial progress could be made, the 40x30 target could not be achieved even at the highest coverage and efficiency levels tested.

**Fig. 4. Sensitivity analysis of reduction in under-five mortality for an urban package of health interventions, Bangladesh and India**



Notes: The estimations are based on cities of one million population. The 40x30 reduction target aims for a 40% reduction in deaths among people younger than 70 years; a two-third reduction in child and maternal mortality and mortality due to human immunodeficiency virus infection, tuberculosis and malaria; and one-third reduction in premature deaths from other communicable diseases, injuries and noncommunicable diseases.<sup>32</sup>

**Fig. 5. Sensitivity analysis of reduction in mortality among individuals 5–69 years for an urban package of health interventions, Bangladesh and India**



Notes: The estimations are based on cities of one million population. The 40x30 reduction target aims for a 40% reduction in deaths among people younger than 70 years; a two-third reduction in child and maternal mortality and mortality due to human immunodeficiency virus infection, tuberculosis and malaria; and one-third reduction in premature deaths from other communicable diseases, injuries and noncommunicable diseases.<sup>32</sup>

**Discussion**

We estimated that investing in a hypothetical package of 208 cost-effective health interventions that addresses the health-care needs of the growing urban population in Bangladesh and India is beneficial. For example, noncommunicable disease burden can be controlled with treatments that are low cost and feasible to deliver in primary care and hospital facilities, coupled with public health measures to reduce the impact of major risk factors, such as smoking and obesity. However, access to many of the most cost-effective health system interventions is currently limited, especially among the poorest population groups. Expanding universal coverage of essential health interventions for adults could have a similar levelling effect as seen for improving child health with free or inexpensive vaccines and primary care.

In the last decades, the advance towards universal health coverage (UHC) and the recognition that a healthy population is cost beneficial with substantial welfare gains<sup>33, 34</sup> make a compelling case for public investment in urban health. In India, public expenditure on health was just over 1.0% of GDP in 2015<sup>37</sup> and in Bangladesh, this percentage was 0.8% in 2014.<sup>38</sup> In both countries, out-of-pocket spending on health accounted for more than two-thirds of the total health expenditure.<sup>38</sup> Increasing public spending on health could reduce out-of-pocket payments, as shown in other countries,<sup>39</sup> while improving the quality of services.<sup>4</sup> Increased public health expenditure advances UHC and avoids the impoverishment that often results from out-of-pocket expenditures.<sup>7</sup>

We estimated that to cover all million-plus cities in Bangladesh and India by 2030, governments must increase their current health spending about threefold. While this increase is large, this level of health spending is consistent with WHO recommendations,<sup>40</sup> India's Choosing Health Report<sup>4</sup> and the National Commissions for Macroeconomics and Health in both countries.<sup>41, 42</sup> Expecting that the governments of Bangladesh or India can immediately increase their expenditures to the suggested levels would be unrealistic, but they can plan for a decade-long scale-up of health spending and deploy new tactics to increase revenue to finance health-care. For example, they could require mandatory contributions from people with high income through taxation, and/or compulsory earmarked contributions for health insurance.<sup>43</sup> Innovative financing schemes, such as issuing diaspora bonds to expatriates and imposing taxes on foreign exchange transactions, could be adopted.<sup>44</sup> For instance, in 2017, an average daily turnover of foreign exchange amounted to US\$ 58.0 billion in India;<sup>45</sup> a transaction levy of 0.005% on every working day would yield about US\$ 630.0 million a year. Taxes on tobacco and other harmful substances and reduced government subsidies on fossil fuels have also been recommended as strategies to increase revenue available for the health sector. Although tobacco taxes would not themselves provide enough to cover the financial needs of UHC,<sup>46</sup> they could make significant contributions.<sup>47</sup>

Given the enormous gains in health and welfare from healthy populations in cities, countries could also responsibly take low-interest loans from the international market, with federal guarantees for on-lending or for grants to cities. Borrowing from development partners, such as the Asian Development Bank and the World Bank is also attractive, given the large returns produced by investments in population health. Novel mechanisms to enable cities to borrow or spend with federal financing and support could also be developed. For example, in addition to providing loan financing, the Asian Development Bank provides technical assistance and advisory services to enhance and accelerate operationalization of the government's investment on health policies, programmes or projects. This investment will be returned by improved

economic growth, and by lifting many out of poverty and maintaining the vibrancy and enhancement of many of the world's largest cities.

Our study has several limitations stemming mainly from the limited reliable data available for many of the inputs. Data on intervention costs in low- and middle-income countries are particularly sparse. We believe the *Disease control priorities* cost information is the best currently available data, but many of the costs are based on very few studies and in some cases, based on similar interventions because no reliable cost studies were found. Improved studies of local intervention costs in multiple sites are needed to improve estimates,<sup>48</sup> including the benefits that may come with economies of scale in urban areas.<sup>49</sup> Data on current coverage levels for several interventions are lacking. In our study, we used global estimates for lower-middle income countries for coverage and populations in need of mental health interventions and rehabilitation services from *Disease control priorities* because country-specific data are missing for both countries. Reliable mortality data for Bangladesh are also missing.

Better population health is a profitable investment, resulting in increased productivity and economic stability.<sup>50</sup> Expanding health expenditure increases productivity and years lived with good health, and the health sector is a source of employment at every level, raising the national GDP.<sup>34</sup> Sufficient funds for expansion of coverage of health interventions may not be immediately available, but future economic growth, driven by cities, is justifying that Bangladesh and India should expand investments in urban health.

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#### Competing interests:

None declared.

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