

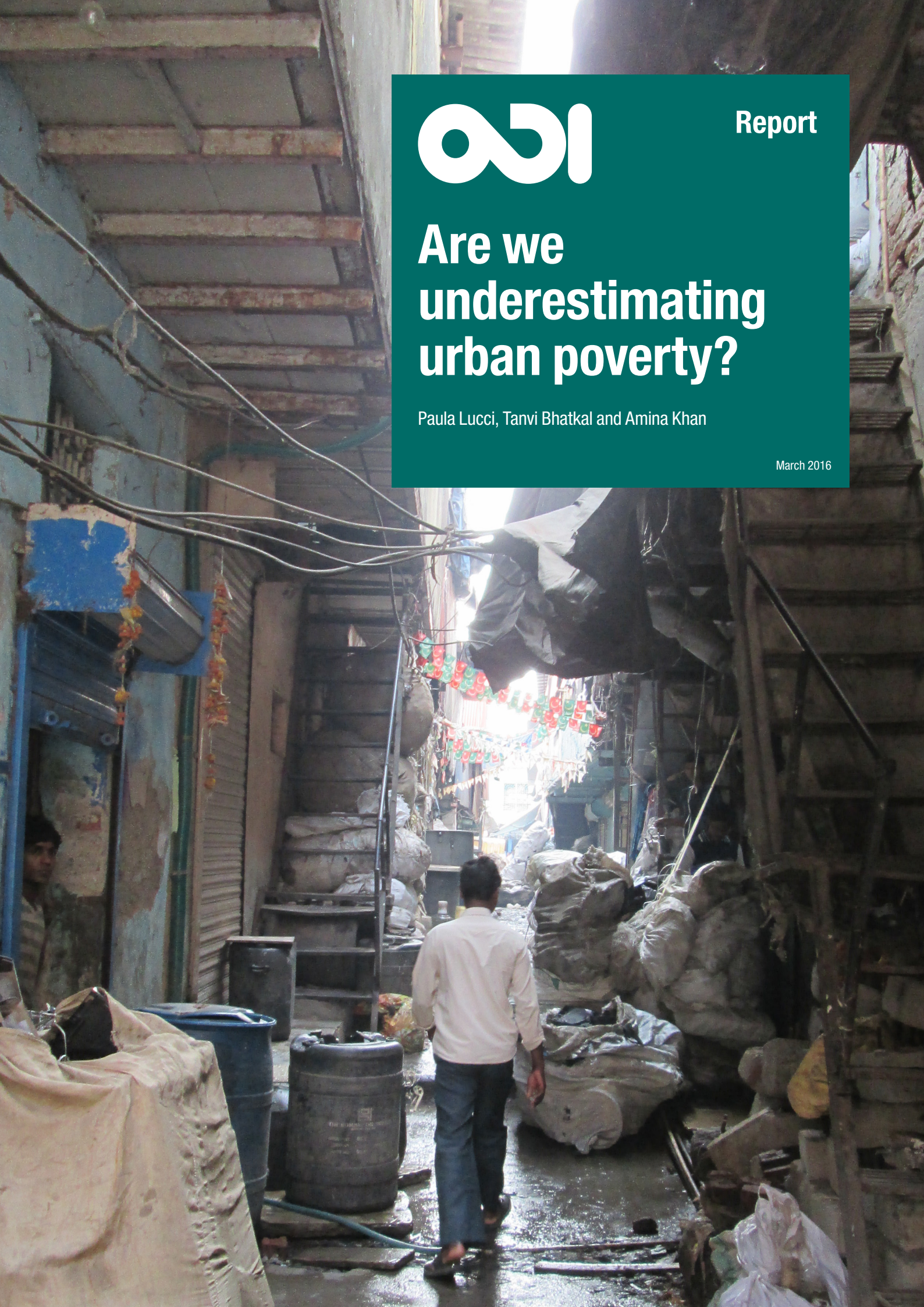


Report

Are we underestimating urban poverty?

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Cover photo: A man walks through Dharavi Slum, Mumbai, India - Chris Shamburg - CC BY NC ND

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Key messages

- Data collection methods and poverty measures have not caught up with the reality of an increasingly urbanised world; as a result, it is likely that urban poverty is underestimated. This has important implications for targeting interventions and allocating resources.
- Definitions matter: our estimates in eight cities in India using UN-Habitat's definition of a slum household rather than that of the national census result in figures for slum dwellers that are two to four times higher.
- Data collected through household surveys or censuses can underrepresent slum dwellers. Estimates of the population of Nairobi's Kibera slum based on independent sources are 18–59% higher than those in Kenya's most recent national census.
- Commonly used indicators can also underestimate urban poverty. A modified version of Oxford Poverty and Human Development Initiative's Multidimensional Poverty Index (MPI) – changing some indicators to better account for deprivation in urban areas – resulted in poverty rates that were over 5 percentage points higher than the original MPI for six out of the eight Indian cities selected in our analysis. In the case of Delhi, this amounts to over 1 million people.
- Improvements in data collection are urgently needed. Only then will governments and others better understand the consequences of urbanisation and tailor policies to improve poor city dwellers' lives.

Acronyms

APHRC	African Population and Health Research Centre	NSO	National Statistics Office
CDR	Call Detail Record	NSSO	National Sample Survey Organisation
CPI	Consumer Price Index	OPHI	Oxford Poverty and Human Development Initiative
CRC	Citizen Report Card	PPP	Purchasing Power Parity
DHS	Demographic and Health Survey	PSU	Primary Sampling Unit
EC	European Commission	SDG	Sustainable Development Goal
GPS	Global Positioning System	SDI	Shack/Slum Dwellers International
HCES	Household Consumption Expenditure Survey	UK	United Kingdom
IAEG	Inter-agency Expert Group	UN	United Nations
IIPS	International Institute for Population Sciences	UN DESA	UN Department of Economic and Social Affairs
IMF	International Monetary Fund	UNDP	UN Development Programme
INE	Instituto Nacional de Estadísticas	UNFPA	UN Population Fund
JMP	Joint Monitoring Programme	UN-Habitat	UN Human Settlements Programme
KNBS	Kenya National Bureau of Statistics	UNICEF	UN Children's Fund
MDG	Millennium Development Goal	UNSD	UN Statistics Division
MHUPA	Ministry of Housing and Urban Poverty Alleviation	US	United States
MICS	Multiple Indicator Cluster Survey	WHO	World Health Organization
MKP	Map Kibera Project		
MPI	Multidimensional Poverty Index		
NCSS	Nairobi Cross-sectional Slums Survey		

1. Introduction

Many argue that urban poverty is underestimated (Mitlin and Satterthwaite, 2013). Poor urban populations, such as those living in informal settlements, are often undercounted and indicators used to measure basic deprivations in urban contexts are not providing policy-makers with the information they need (Lucci and Bhatkal, 2014). In fact, household surveys – the main instruments to collect data on poverty – have not changed much in 30–40 years, when the focus was mostly on rural poverty (Gibson, 2015). It is therefore unsurprising that these tools are in many aspects inadequate to account for living standards in an era of increasing urbanisation.

Despite well-known measurement problems, we do not know enough about their scale. Using examples from the literature and our own analysis of Demographic and Health Survey (DHS) data for eight Indian cities, this paper attempts to illustrate the extent of the bias in urban poverty measurement at different stages of the production of poverty estimates.

While discussions about data may appear very technical, they are in fact inherently political and have important implications for interventions. If current estimates underestimate deprivation in urban contexts, then governments and donors' priorities and resource allocations may be neglecting pockets of deprivation in cities.

With urbanisation currently accelerating in many countries, raising the profile and improving our understanding of deprivation in urban contexts are becoming increasingly urgent. The UN Human Settlements Programme (UN-Habitat) – the only source of internationally comparable data on slum dwellers

– estimates that 881 million people or 30% of developing countries' urban populations live in slums (UN-Habitat, 2014). This could rise to 3 billion or 60% by 2050 (UN DESA, 2013, 2014).

The discussions in this paper are relevant to ongoing international debates about implementing and monitoring the new Sustainable Development Goals (SDGs), particularly Target 11.1 on 'ensuring access for all to adequate, safe and affordable housing and basic services and upgrade slums', now at the heart of Habitat III.¹ Our analysis also speaks to the 'Leaving No One Behind' agenda, which posits that progress on the SDGs should include the hard to reach; this includes marginalised urban communities, such as slum dwellers.

This paper is structured as follows:

- Section 2 discusses how estimates of the number of slum dwellers, arguably a high proportion of the urban poor,² vary according to the definitions used.
- Section 3 sets out some of the problems with the data that are currently collected, particularly undercounting of slum dwellers and the lack of disaggregated data beyond urban averages, hiding pockets of deprivation in cities.
- Sections 4 and 5 discuss how commonly used indicators (monetary poverty and multidimensional poverty, respectively) can also underestimate poverty in urban contexts.
- Section 6 concludes by summarising our findings and providing a set of suggestions on how to improve data collection and indicators going forward.

1 Habitat III refers to a global summit, formally known as the UN Conference on Housing and Sustainable Urban Development, to be held in Quito, Ecuador, on 17–20 October 2016. The UN has called the conference, the third in a series that began in 1976, to 'reinvigorate' the global political commitment to the sustainable development of towns, cities and other human settlements, both rural and urban. The product of that reinvigoration, along with pledges and new obligations, is being referred to as the New Urban Agenda. That agenda will set a new global strategy around urbanisation for the next two decades (Citiscopes, n.d.).

2 We use the terms 'slum' and 'informal settlement' interchangeably. We are aware that not all residents of informal settlements are (income) poor, and this varies by context and conditions of different settlements (Gulyani, Talukdar and Jack, 2010). In a way the number of slum dwellers represents an upper bound of the number of people in urban poverty. At the same time, as implied by most definitions of slums (see Section 1), many of their residents are poor by multidimensional measures of poverty as they do not have adequate access to basic services and housing.

2. Problems related to definitions of ‘slums’

It is hard to discuss urban poverty without focusing on slums, as they are often where most poor people in cities in the developing world live. The term ‘slum’ has been used to cover a range of housing deficiencies and lack of access to basic services, as different organisations – even within a country – often use varying definitions. This variation makes it difficult to measure the number of people living in such areas.

UN-Habitat has developed a definition applicable across countries. A slum household is defined as a set of people living under the same roof in urban areas that lack one or more of the following:

- access to improved water services
- access to improved sanitation services³
- a sufficient living area, with no more than three people sharing a sleeping room⁴
- durable housing of a permanent nature that protects inhabitants against extreme climate conditions and
- secure tenure that prevents forced evictions (this is included in the definition but not in slum measurement as there are insufficient data on it; UN-Habitat, 2004, 2010).

The main advantage of this definition is that it allows for international comparisons, which are of particular interest to donors and multilateral organisations as they look at resource allocation across countries. In fact, this is the definition used to monitor the ‘slum’ target in the Millennium Development Goals (MDG 7, Target 11). While indicators for the SDGs are currently under discussion, a similar definition has been proposed for SDG 11, Target 11.1 (IAEG, 2016). This definition also provides a comprehensive picture of housing and/or basic service deprivations in urban settings, as any household lacking just one of the conditions described above would classify as a slum.

At the same time, this comprehensiveness is not sufficiently nuanced to distinguish different types of housing deprivations. For example, it does not include

density criteria for a settlement, a characteristic commonly associated with informal settlements. This means that, under the UN definition, one household living in a precarious building in the inner city would qualify as a slum household. In other words, UN-Habitat’s definition identifies all households lacking some service or structural attribute, not just slum settlements: it is a very wide definition.

In principle, this limitation could be addressed if this aggregate number of households with all types of housing and deprivations and lack of access to basic services (i.e. the one currently used for the ‘slum’ target) could be broken down by different types of housing deprivations (i.e. slum settlement or inner city tenement). These more nuanced breakdowns could be carried out based on density criteria and type of building structure. Further disaggregation by number of deprivations experienced (i.e. differentiating those with multiple ones from those with just one) would also be helpful in providing a more nuanced picture of the extent of housing and basic service deprivations in urban contexts. In fact, it is common for some of these deficiencies to run together, which can make addressing standalone issues (such as drinking water) somewhat problematic and in some cases even counterproductive.⁵

While the UN-Habitat definition and numbers have been used to monitor global voluntary commitments such as the MDGs and now the SDGs, countries usually deploy their own definitions of slum settlements in their own planning. Take the example of India. In 2001, India conducted for the first time a national slum census. Slums were identified at the neighbourhood rather than at the household level, and were defined as those satisfying any of the following three criteria:

- all specified areas in a town or city notified as ‘slum’ by state or local governments and union territory administration under any Act, including a ‘Slum Act’

3 The UN-Habitat definition of access to improved services follows the World Health Organization (WHO)/UN Children’s Fund (UNICEF) Joint Monitoring Programme (JMP) definitions (these indicators are discussed in more detailed in Section 5; e.g. see Box 4).

4 In this analysis, following from WHO accepted standards, babies under 12 months are not counted, and any child between the ages of one and 10 years is counted as half a person.

5 Another criticism of the UN-Habitat definition relates to the specific water and sanitation indicators used; we discuss this in more detail in Section 5. One other criticism of the slum definition used for the MDG target (and now for the SDGs) is that it overlaps with the water and sanitation targets (Gilbert, 2014).

- all areas recognised as ‘slum’ by state or local government and union territory administration that may have been formally notified as ‘slum’ under any Act or
- a compact area with a population of at least 300 people or around 60–70 households of poorly built and congested tenements in an unhygienic environment, usually without adequate infrastructure and proper sanitary and drinking water facilities⁶

The first two criteria are based on administrative designations and require official recognition of neighbourhoods as slums by local or state governments. However, these definitions are inherently arbitrary, as state and local governments have different criteria as to what they consider a slum (MHUPA, 2010, cited in Patel et al., 2014). Further, including slums on official lists has resource implications as municipal authorities are meant to provide notified and recognised slums with basic services (IIPS and Macro International, 2007).

The third criterion identifies areas as slum settlements based on measureable attributes, using similar conditions to the UN-Habitat definition. These slums are often inhabited by temporary or new migrants, and generally have poorer access to basic facilities as authorities have no obligations on provision (IIPS and Macro International, 2007). However, the definition does not specify how the attributes considered are defined (e.g. what constitutes an ‘unhygienic environment’) (Risbud, 2010, cited in Patel et al., 2014).

While the neighbourhood approach – that is, recognising an area as a slum if it has a minimum of 60–70 households or 300 people within an enumeration area – has some limitations, it identifies more clearly what is commonly referred to as a slum settlement. One criticism of this definition refers to the threshold used: the criterion of a minimum of 60–70 households clustered together fails to recognise smaller slum settlements, which may be more recently formed and house particularly disadvantaged households (Patel et al., 2014). In fact, this is one of the reasons why this criterion was amended to 20 households following recommendations by the Pronab Sen Committee (2010).⁷

Another criticism of this approach is that it ignores differentiation in housing deprivation within a neighbourhood, which could be significant (Figure 1, for Indian cities). As a result, better-off households would be classified as a slum if the majority of their neighbours had inadequate infrastructure (Patel et al., 2014). To

some extent, this is an inevitable consequence of a neighbourhood-based approach, but there could be ways around it. For example, the extent of deprivations each household in the slum settlement experience should be accessible if detailed data are available (e.g. the Indian DHS identifies which households were classified as part of a slum settlement and at the same time provides details on access to services for each household, meaning the specific number of households within a slum settlement experiencing deficiencies could be identified).

While discussions about definitions can be very detailed and technical, the way a slum is defined can have a huge impact on estimates of the number of slum dwellers. Figure 1 provides a good example. It presents slum estimates for eight Indian cities for which the DHS (2005–2006) had large sample sizes to provide representative data at the city level using the UN-Habitat and the national census definitions. In half the cities considered – Delhi, Indore, Hyderabad and Chennai – the proportion of households estimated to be living in slums using UN-Habitat’s definition⁸ is two to four times higher than that measured using the definition from the national census.

Further, the DHS (2005–2006) collected data on tenure security for two cities (which, as mentioned above, is included in UN-Habitat’s conceptual definition but not in measurement owing to lack of data). When this is considered, the share of slum households increases even further – to 66% in Kolkata and 83% in Mumbai – suggesting there are some cases where tenure insecurity does not overlap with the other slum deprivations.

There are a number of possible explanations for the large size of the difference between the two estimates. One is the fact that the census definition includes a settlement density criterion, whereas UN-Habitat does not. This means that, whereas the UN-Habitat definition would include households in deprived smaller neighbourhoods (i.e. fewer than 60 households), the census definition would not. That said, as mentioned above, the census definition could misclassify better-off households as slums (which the UN-Habitat definition would not do), making it difficult to assess where the bias lies. Further, the way adequate sanitation is defined is likely to vary between the two sources, with UN-Habitat having a more ambitious definition – one that considers shared sanitation facilities a slum deprivation.⁹ Finally, as the census definition is

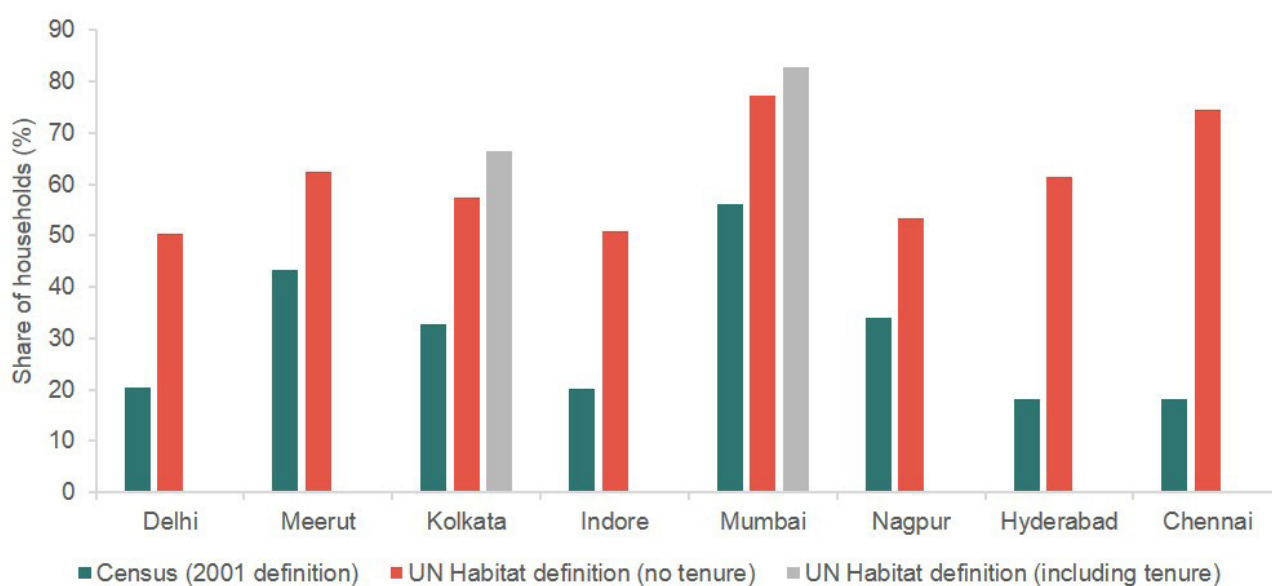
6 This definition was amended following on from the Pronab Sen Committee (2010) to reduce the density requirements to at least 20 households, making it less restrictive. This is the definition used by the National Sample Survey Organisation (NSSO) in household surveys; however, the 2011 national census used the 2001 definition.

7 See footnote 6. It is also worth pointing out that, given the particular vulnerabilities these smaller, recently formed, settlements may face, it might be useful to consider them a separate category (i.e. differentiating settlements by their size and years of formation).

8 The DHS data identified those households in the survey sample that were designated as slums as per the 2001 census. We compare these to those recognised as slum households using the UN-Habitat definition based on available data on housing conditions and access to basic services.

9 While details of how the census defines adequate sanitation facilities precisely are unavailable, the definition is likely to include some shared facilities as adequate sanitation, as these are fairly common in Indian cities, sometimes even in neighbourhoods that are not considered deprived.

Figure 1: Share of households classified as 'slum' in Indian cities, by definition, 2005–2006



Source: Authors' calculation based on IIPS and Macro International (2007).

more subjective and requires recognition from government, official lists could be undercounting slums (Agarwal, 2011).

3. Problems with the underlying data

This section discusses problems with the underlying data collected to produce estimates on slum dweller numbers. It highlights how undercounting can happen for practical and political reasons, and, more fundamentally, because of unrepresentative sampling frames. It also illustrates the scale of undercounting using Kenya's Kibera slum population estimates as an example. Finally, it discusses how the lack of granular data on slums and reliance on urban averages conceals intra- and inter-city disparities.

3.1 Undercounting

Household surveys provide the data used to estimate income and multidimensional poverty in urban areas, including the number of slum dwellers (census data are also often used for the latter). These are the main data tools to produce the numbers at both international (e.g. UN-Habitat slum estimates, see Box 1 for details on how these are produced) and national levels. Yet these sources can undercount marginalised urban populations such as those living in informal settlements.¹⁰

Populations missing for practical and political reasons

There are practical reasons why household surveys may underestimate populations in slum areas. Certain areas may be missed or not thoroughly covered by surveyors because they appear hostile and unsafe, are hard-to-reach or living conditions are appalling – for example places where water is dirty, defecation is out in the open, sewers are uncovered or have reached capacity and sanitation and hygiene are low.

There are also political reasons, as there can be incentives to keep these populations invisible, particularly when the land is occupied illegally. In many cases, governments may not wish to draw attention to complex disputes over land ownership, particularly in areas where speculation over the value of land can give rise to evictions or resettlement without due compensation.

However, it is fair to say that the picture is more nuanced and in some instances governments could have the exact opposite motivation. For instance, if they are seeking

slum dwellers' political support, there may be incentives to make them visible and address their needs. Further, if local governments have to appeal to higher levels of governments for the resources they need and resource allocation is linked to the number of slum dwellers being reported, then there could be incentives to overcount.

Slum dwellers too may have competing motivations. They may insist on being counted so they can then exert pressure on governments to respond to their needs, as demonstrated by the many enumerations carried out by slum federations. Alternatively, in some cases, some groups may wish to be left unreported in that they may prefer to hide their existence for fear of reprisal for being on land that is 'illegally occupied' or for setting up illegally the infrastructure for electricity, water and sewerage, and other services in their neighbourhoods.

Populations missing because of unrepresentative sampling frames

Surveys' sampling frames are based on census data, and therefore will replicate any biases in them (Carr-Hill, 2013; Lucci and Bhatkal, 2014). Even though censuses are meant to enumerate the entire population of a country (by design), they too can leave out certain populations for the same practical and political reasons described above in the case of household surveys (Carr-Hill, 2013).

More fundamentally, census data are collected only every 10 years; this means that, in places where urbanisation is taking place at a rapid pace and the population of informal settlements is changing, census data can very quickly become out of date. For example, a World Bank poverty assessment conducted for Cambodia in 2006 voiced concerns that informal settlements had grown since the sampling frame was constructed in 1999 and therefore the poverty figures might understate their scale (World Bank Cambodia, 2006 in Mitlin and Satterthwaite, 2013). This problem can be more acute in some countries, particularly conflict-ridden ones, where censuses have not been carried out for over 10 years. For instance, the last Population and Housing Census in Pakistan was conducted in 1998; one is scheduled for this year, after a gap of

¹⁰ The homeless, those living in their workplace and mobile groups like migrants (who can also live in informal settlements) are also groups often missed from the data. Further, there are also questions about the extent that tenants in informal settlements are included in the data (Mitlin and Satterthwaite, 2013). As stated in the introduction, in this paper we focus on informal settlements.

Box 1: The sources and methodology underpinning UN-Habitat slum numbers

As mentioned in Section 2, UN-Habitat defines slum households as a group of individuals living under the same roof that lack one or more of the following: access to improved water, access to improved sanitation, sufficient living area, durability of housing and security of tenure (not included in measurement owing to lack of data; UNSD, 2016).

The data on the first four indicators come from many sources (DHS, Multiple Indicator Cluster Surveys (MICS), national household-level surveys or censuses). All these sources suffer from the limitations described throughout this section.

UN-Habitat usually takes a series of data points from these sources (provided they are deemed ‘good quality’) to develop a predictive model for estimating slum population sizes and shares for any specific country for subsequent years (UNSD, 2016; correspondence with UN-Habitat staff, 2016). For instance, the UN-Habitat ‘modelled’ estimates for India for 2014 are based on the last and latest available census data; for Kenya they are based on the latest Kenyan DHS and MICS data; and for Bangladesh they are based on the most recent DHS data.

Sources: UNSD (2016) and correspondence with UN-Habitat staff (2016).

18 years.¹¹ Some countries make more efforts to update census listings than others, for example by using aerial photography to do so.

The scale of undercounting: some examples

By definition, it is difficult to say what the scale of undercounting may be, and most sources and estimates produced at international and national levels are likely to face this limitation to some extent. Using arbitrary but conservative estimates, Carr-Hill (2013) suggests that, if one in every 10 slum dwellers or one in every five slum dwellers is uncouned in global slum population figures, the number of slum dwellers being left out of censuses and out of sampling frames of household surveys ranges from 88 to 176 million people.¹² This is a sizeable range of people being uncouned, and underscores the point about how large the problem of undercounting is globally.

At a more micro level, controversies over the recent official and unofficial numbers of people who live in Kibera in Kenya can also help illustrate the scale of undercounting. Kibera consists of 13 villages; it is nearly 5 km southwest of the centre of Nairobi and is about 2.5 km², or roughly 75% of the area of Manhattan’s Central Park. By some population estimates, it is ‘the largest slum in Africa’; by some other estimates it is the second largest (after Soweto in South Africa) (Marras, n.d.). Yet some of the available data are quite unreliable and highly contested. We simply do not know what its ‘true’ population size is or has been historically, or how it is growing.

Recent estimates of its population range from about 170,070 (figure from the 2009 Kenya Population and Housing Census (KNBS, 2009) to 270,000 (MKP, 2008). ‘It’s a different number today than yesterday. The definition of “living” in Kibera varies, it’s quite a transient place’ (Maron, 2010).

In 2008, the Map Kibera Project (MKP) team conducted a door-to-door census of the population in Kianda (one of the 13 villages in Kibera) alongside a mapping of the physical features of the settlement. On the basis of Kianda’s population (15,219),¹³ the MKP estimated Kibera’s total population to be between 235,000 and 270,000 (Marras, n.d.; MKP, n.d.). In 2009, the KEYOBS RESPOND project¹⁴ used satellite images of built structures in Kibera to estimate population per structure and reported that the number ranged between 199,959 and 205,108 (Maron, 2010).

Both the MKP and the KEYOBS RESPOND project have published their methodology, and their estimates are perceived as credible (Maron, 2010; Robbins, 2012). Contrasting census numbers with those from these two sources suggests the 2009 census (170,070) undercounted the population of Kibera by 30,000–100,000 – that is, by 18–59% (see Table 2; for more details on data resources available online for Kenya’s slums settlements, see Annex 2).¹⁵

The controversies over the population numbers in Kibera show how we lack some very basic information. What evidence is there to determine the success or failure of a policy or programme if we do not know how many people these intend to benefit in the first place? Box 2 provides some examples of how to address the issue of undercounting.

11 See World Bank (2015a) for a list of over 15 countries with outdated census data (i.e. more than 10 years since last census).

12 Updated using latest UN-Habitat figures (2014).

13 Given that the type, dimension and distribution of the buildings observed in Kianda are typical of all of Kibera, the MKP team estimated the population of the entire slum by multiplying the population density found in Kianda (95,120 people per km²) by the area of Kibera (2.3–2.5 km²), while factoring in an estimated error of 7% (Marras, n.d.; MKP, n.d.).

14 The RESPOND Humanitarian Global Mapping Services Project was part of the Copernicus programme of the European Commission (EC). It aimed to use geographic information to improve the work of the European and international humanitarian community. KEYOBS, a Belgian enterprise, was one of the project’s partners. <http://www.copernicus.eu/projects/respond>

15 Note that we have also released a separate Excel table listing some examples of useful resources on slum data for different countries.

Table 1: Controversies over Kibera's recent population numbers

Type of instrument to collect data	Type of source	Year	Slum population estimates	Differences between official and independent sources in absolute terms	Differences between official and independent sources in percentage terms
Kenya Population and Housing Census by KNBS	Government	2009	170,070		
Satellite imagery of built structures in Kibera by KEYOBS RESPOND Project	Independent	2009	199,959–205, 108	30,000–35,000	18–21%
Door-to-door census and mapping of physical features of Kianda village by MKP	Independent	2008	235,000–270,000	65,000–100,000	38–59%

Sources: Maron (2010), Marras (n.d.), Marx et al. (2013), MKP (n.d.), Robbins (2012).

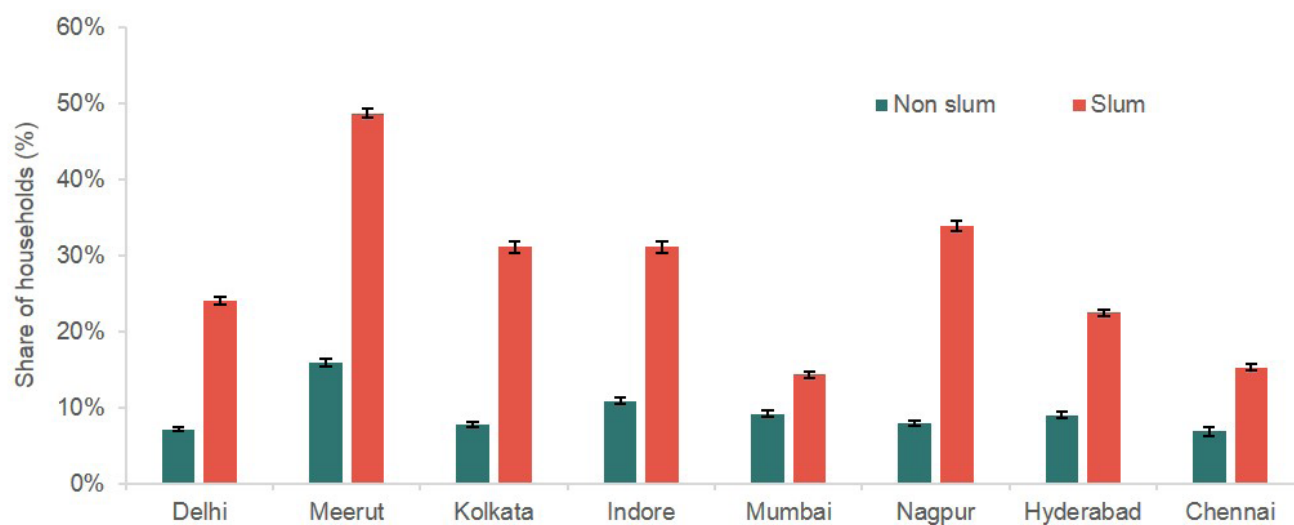
3.2 Lack of granularity: How urban averages hide intra- and inter-city disparities

Another problem that applies to household surveys is that sample sizes are often too small to represent adequately subnational areas. This means breakdowns are available only for broad geographical areas, such as rural/urban areas or regions (Lucci and Bhatkal, 2014), and not for cities, let alone slum areas. This means there is no information about the poor development outcomes and low levels of access to services among marginalised groups within cities or about differences between cities.

To illustrate this point we calculated the Multidimensional Poverty Index (MPI)¹⁶ for eight Indian cities where we have data to calculate the index for slums. As we can see from Figure 2, the share of households considered poor (as measured by the MPI), ranges from between double to nearly four times the share among non-slum households, illustrating how city averages conceal differences within cities. Further, a comparison with the more commonly reported urban average shows that in some cities slum areas have a higher share of MPI poor than the average, whereas in others the opposite trend is observed. This shows that the urban average also hides differences between cities.

¹⁶ This analysis draws on city-level data for eight Indian cities collected by the National Family Health Survey – that is, the Indian DHS (2005–2006). The MPI considers outcomes on three dimensions: health, education and living standards. A household is considered poor if it is deprived in one third or more of the weighted indicators considered (details on indicators in Table A1 in Annex 1). Note that these shares are likely to be underestimates as some of the indicators included in the MPI (e.g. on housing) may not always be appropriate for urban areas (this is discussed in Section 5).

Figure 2: MPI headcount ratio in Indian cities by type of residence, 2005–2006



Note: More details included in Table A3 in Annex 1. UN-Habitat's definition is used to identify slums. Note that all the issues discussed in this paper (undercounting, including an outdated census sampling frame and appropriateness of indicators – including those within the living standards dimension of the MPI, which we discuss in more detail in Section 5, Box 5) also apply to these numbers.

Source: IIPS and Macro International (2007).

Box 2: How can the problem of undercounting be mitigated

Enumerations by slum dwellers

Many slum dwellers (organised as federations) have recently carried out enumerations that can complement and verify the data collected through conventional methods in addition to filling data gaps. Community-generated data have been gathered in places like Kisumu in Kenya (Karanja, 2010) and Cuttack in India (Livengood and Kunte, 2012), among others. In some instances, it has also been possible to compare community-generated data across countries and to collect such data using Global Positioning System (GPS) technology (Beukes, 2014). GPS-based data have location and time components, so clearly identifiable points with precise GPS coordinates allow slum dwellers to be 'proactive in defining their own spaces and in putting themselves on the maps' (ibid: 2), especially when governments' city maps fail to register their neighbourhoods' (ibid.).

It is also worth highlighting the Know Your City initiative. This is a global campaign that collects and consolidates the data generated by slum federations that are part of the Shack/Slum Dwellers International (SDI) network through enumerations, settlement profiles and maps. It includes an interactive online data tool to make these community-generated data easily accessible. Federations use this rich information to negotiate with local government, influence resource flows and development priorities and make poor communities vocal and visible (Know Your City, 2016a).

Slum-specific surveys

Slum-specific surveys can include the use of standardised surveys like the DHS or MICS, but sampling frames are designed especially for slums. For instance, the African Population and Health Research Centre (APHRC) designed a survey for Nairobi's slums in 2000, the results of which could be compared with Kenya's 1998 DHS (APHRC, 2012). The Kenyan National Bureau of Statistics (KNBS) conducted a MICS exclusively for Mombasa's slums in 2009. Such surveys are exceptions, however, not the rule (Carr-Hill, 2013).

The use of satellite imagery

Some national statistics offices (NSOs) use satellite imagery to update census enumerations of households prior to undertaking a household survey (to address the issue of outdated sampling frames). This has been the case in some Latin American countries, like Chile (INE, 2009).

Others have used satellite imagery more specifically to identify slums. For instance, the Center for Urban Studies' 2005 Census and Mapping of Slums survey used high-resolution satellite images of the six city corporations of Bangladesh where most slums of the country are concentrated. These images provided rich visual detail and helped produce a series of relatively accurate and detailed ward and sub-ward (mohalla) maps of slum settlements in the six city corporations and a database describing the exact location of the settlements visited by field teams, as well as their general characteristics (Angeles et al., 2009). It helped 'construct a sample frame for slum primary sampling units (PSUs) based on geographically coherent neighbourhoods' for an urban health survey in 2006. In theory, this census could have also informed any study 'treating slum and non-slum areas of the six city corporations as statistical domains' (ibid.).

But even this approach has limitations, as it did not capture nearly 30% of slums. Slums in places with steep gradients or heavy tree cover were often missed. Moreover, the density and roofing materials found in some slums were also common to some markets, meat processing plants and light industrial facilities, which were then counted as slums (Angeles et al., 2009). Notwithstanding these difficulties, and highlighting the need to 'ground-truth' estimates with good quality informants, including satellite imagery to gather data on slums (ibid.; Carr-Hill, 2013) can be considered good practice in developing countries.

The use of 'big data'

Big data, in particular mobile phone call detail records (CDRs), can also be used to capture high-frequency data on poor mobile populations that move in and out of slums. CDRs have been used to analyse mobility and migration patterns, and to predict levels of poverty.

In Rwanda, for example, Blumenstock (2012) estimated internal migration patterns using a dataset containing mobile phone CDRs for 1.5 million people between 2005 and 2009 and from calling about 900 subscribers to collect anonymised demographic data. Similarly, Wesolowski and Eagle (2009) used mobile phone CDRs for 6 million mobile phone subscribers in Nairobi, Kenya, between June 2008 and 2009 to examine the dynamics of the Kibera slum – how long people stay there, migration from the slum and where people move to, as well as where they work.

These approaches have certain limitations, though. Not all mobile populations (including women) have access to or own cell phones (Lucci and Bhatkal, 2014), so CDRs will reflect the mobility and migration patterns of cell phone users and owners only, and of males more so than of females.

Sources: Angeles et al. (2009), Blumenstock (2012), Carr-Hill (2013), Karanja (2010), Livengood and Kunte (2012), Lucci and Bhatkal (2014) and Wesolowski and Eagle (2009).

4. Problems with monetary poverty measures in urban contexts

As explained in the section above, the limitations underlying household and census data will of course have an impact on estimates of urban poverty, both income-based and multidimensional ones. But in addition to household and census data collection problems, the specific information, assumptions and methods used to calculate poverty will also have an impact on the estimates produced. In this section, we focus on some of the problems related to calculating income/expenditure-based poverty, typically used to set a poverty line, in urban contexts.

Poverty lines are one of the most common measures countries use to estimate the number of poor people (see Box 3 for a summary of the methodology). They are used to monitor poverty trends, target resources where poverty is highest and evaluate the impacts of interventions or of external shocks. If assumptions are made that are more attuned to rural contexts, then the estimates produced for urban areas could be misleading.

To compute a poverty line it is first necessary to identify a minimum basket of goods and services that separates the poor from the non-poor and then price that basket. Here, we focus our analysis on how the methods used to estimate income poverty may misrepresent urban poverty in each of these stages. First, we discuss the way food and non-food allowances are accounted for and whether this is representative of consumption patterns of the urban poor. Second, we consider how prices for a minimum consumption basket are derived and the extent to which this takes into consideration differences in cost of living between urban and rural areas and cities of different sizes.

4.1 The composition of food and non-food allowances in the poverty line

Outdated questionnaires do not reflect current food consumption habits

Urbanisation can lead to a change in diets and eating habits, and this may not be properly captured by questionnaires gathering the information on food expenditure needed to estimate poverty. As Gibson (2015) points out, many Household Consumption Expenditure Surveys (HCES) record food consumption by providing long lists of ingredients such as rice, wheat and flour and asking how many units are consumed and how much money is spent at the household level, assuming households eat from a common pot. While this made sense in the early 1990s when most of the poor were still rural and more likely to eat meals together, it seems less appropriate for the urban poor, who may eat independently of other members of the households, either buying street food or purchasing meals to heat and eat at home.

In other words, there are two related problems: one is that surveys do not include the same level of detailed information for food ingredients as for meals out.¹⁷ Information on quantities is often missing, which makes it impossible to translate this information to calories consumed (Gibson, 2015). The other problem is that this information is often recorded at the household level rather than by each adult. The latter would be more appropriate for urban contexts with different household members eating outside the house.

Reinforcing this point, Beegle et al. (2012) report on a survey experiment in Tanzania that shows that urban households report 29% lower consumption, if surveyed with a household-level diary rather than a personal one (there was no difference for rural areas). The headcount poverty ratio was over 10 percentage points lower if a

¹⁷ In fact, Dupriez et al. (2014) analyse HCES for 100 low- and middle-income countries and find that questions on food eaten out of the house have less detail. Among the interview surveys, the average number of groups in the food list is 110 but an average of just three of these are for meals and other forms of food eaten away from home. In contrast, ingredient categories like cereals or vegetables each have an average of 14 groups.

Box 3: A brief overview of the methodology used to set poverty lines

Drawing on household surveys, governments set a minimum level of welfare based on income or expenditure, below which individuals (adjusted for household size) are classified as poor. It is widely known that income is more difficult to measure accurately as it is more volatile than consumption (Chandy, 2013).

The most commonly used method to set a level of minimum welfare or poverty line is to calculate the cost of a 'minimum food basket' needed to achieve a minimum calorific intake (typically around 2,100 calories; variations across ages, gender and types of activities are taken into account, although not as much as they probably should be). Of course, different food bundles can be used to meet this amount of calories. Typically, the food basket is constructed based on the consumption of a reference group of low-income households (e.g. the lowest quintile or those households between the 21st and 40th percentiles).

In addition, in most cases some allowances are made for expenditure on non-food items. Often, two poverty lines (a lower one and an upper one) are calculated. The lower one focuses on non-food spending of those households whose total spending equals the food poverty line. This is a very conservative allowance for non-food spending, as it is based on households that are displacing food consumption to pay for some basic non-food needs. The upper poverty line uses a higher non-food allowance that is calculated from the food budget share of those households whose food spending (rather than total spending, as in the lower poverty line) exactly meets the food poverty line (Gibson, n.d.).

Then price information is needed to calculate the costs of the minimum consumption basket identified and to set the poverty line/s. Price data are gathered through either the same survey or the Consumer Price Index (CPI) (price survey).

In addition, the World Bank sets an international poverty line based on the national poverty lines of 15 of the poorest countries. This was updated in October 2015 to \$1.90 in 2011 Purchasing Power Parity (PPP) terms – to make comparisons across countries. These are used to monitor trends for international commitments such as the MDG target to reduce extreme poverty by half and new commitments in the SDGs to eradicate it. Donors and international organisations use these poverty lines to monitor progress across countries and identify areas of highest need.

Sources: Chandy (2013), Gibson (n.d.) and World Bank (2015b).

personal diary rather than a household one (with frequent visits) was used.

The general implication is that levels of consumption in urban contexts are likely to be higher than currently reported, as meals out are poorly recorded. This suggests the way we currently account for food allowances may overestimate urban poverty.¹⁸

Non-food allowances, central to urban poverty, are inadequately covered

Another area where income poverty measures may misrepresent urban poverty is in their treatment of non-food allowances. While the monitoring of food purchases is a core part of all surveys, questionnaires vary in their inclusion of other important consumption items, such as housing, health, education, energy and water (Chandy, 2013). Evidence suggests many such items are likely to be more important to urban dwellers and thus excluding them undercounts urban poverty.

In urban contexts, meeting non-food needs, such as housing (either rented or self-built) and other basic services (e.g. paying for safe water and toilets) can be very costly. Housing in particular can represent a high share

of the urban poor's budgets but it is difficult to measure, particularly for owner occupiers (e.g. the information needed to measure it is often missing). In fact, in some cases, because surveys do such a poor job of accounting for consumption of housing services, it is dropped from analyses (Gibson, 2015). It is more straightforward to account for the costs facing tenants, which are of course much higher in urban areas, particularly large cities.

Similarly, poor households often pay higher rates to purchase water from informal providers. For instance, according to Citizen Report Card (CRC) research in Kenya, urban households that obtain their water from a kiosk paid between two to five times more per unit of water than those that received water through the network (CRC, 2007, cited in Twaweza, 2010). Sometimes the situation is even worse, for instance in Nairobi's Kibera slum, where households paid up to 30 times more per unit compared with what middle- and higher-income residents paid (ibid.).

Transport can also represent a substantial share of the urban poor's budgets. In Karachi, interviews with 108 transport users among slum dwellers suggested that half were spending 10% or more of their income on transport (Mitlin and Satterthwaite, 2013, based on Urban Resource

¹⁸ There is a further argument to support this point. In urban areas, because there is greater access to a variety of food, food baskets can be changed to minimise expenditure without compromising calorific intake. Thus, the seasonal factors inherent in rural food consumption may be much weaker in urban areas. However, since all poverty estimates use fixed food baskets, this factor is ignored. Urban poverty would perhaps be lower if this was taken into account.

Centre, 2001). In Harare, the urban poor spend more than a quarter of their disposable income on transport; in Kampala, they spend almost half (World Bank and IMF, 2013). Other costs, such as paying for health care and medicines, school fees and schools materials and fuel, can also be high in some contexts. Of course, rural households face many of these costs, but because of the concentration of people and high demand in cities, particularly large ones, these tend to be higher in urban areas.

Given that poverty lines do not account properly for non-food costs, Mitlin and Satterthwaite (2013) argue that the allowances made for non-food items are simply too small, meaning the poverty line is set too low. As mentioned in Box 3, a common way of calculating the cost of non-food items is estimating how much those on/or close to the poverty lines spend on these items. However, there are questions as to whether taking the poor as the reference group for non-food spending is appropriate, as they are probably not going to have enough resources to afford essential non-food items.

Sabry (2009) considers what the non-food allowance estimated by the World Bank would buy in Egypt and finds that this in many cases would not be enough to cover just the costs of very inadequate housing, education and transport. In the case of India, Chandrasekhar and Montgomery (2010) calculated the costs of adequate housing and concluded that the urban poverty line required significant upward adjustment to account for this.

4.2. Accounting for price differentials

Another area where urban poverty may be misrepresented is through the methods used to account for differences in the cost of living. Prices are needed to place a monetary value on the food basket and for non-food needs where allowances for the latter are made.¹⁹ In addition, some sort of price index is needed to calculate the change over time in the cost of reaching a poverty line (Gibson, n.d.).

There are, of course, variations in costs and prices for different locations, and therefore spatial price deflators are needed. As information on the composition of a minimum consumption basket is based on a reference group of low-income households, if differences in costs of living between areas are ignored then households from areas where prices are high, typically larger cities, are less likely to be included in the reference group (Gibson, n.d.).

Yet poverty lines are not always adjusted to reflect these differences in prices. From an analysis of poverty lines in 53 countries, Mitlin and Satterthwaite (2013) found that 12 countries did not make any differentiation. In seven it was not feasible to ascertain the approach taken to deal with price differentials; nine differentiated between urban

and rural only; and about half of them (25) followed a more complex differentiation of prices (e.g. between urban centres of different sizes).

Another problem may be that the differences between prices are based on differentials in food prices, when spatial differences for non-food prices may be higher (Hentschel and Lanjouw, 1996). There is also a question about the availability of data for different items – for example most of the data on non-food items focus on goods and services found in shops or markets, with little information on transport, health care, water bills, housing and schooling expenditure, which are all likely to be higher in urban areas, particularly in larger cities.²⁰

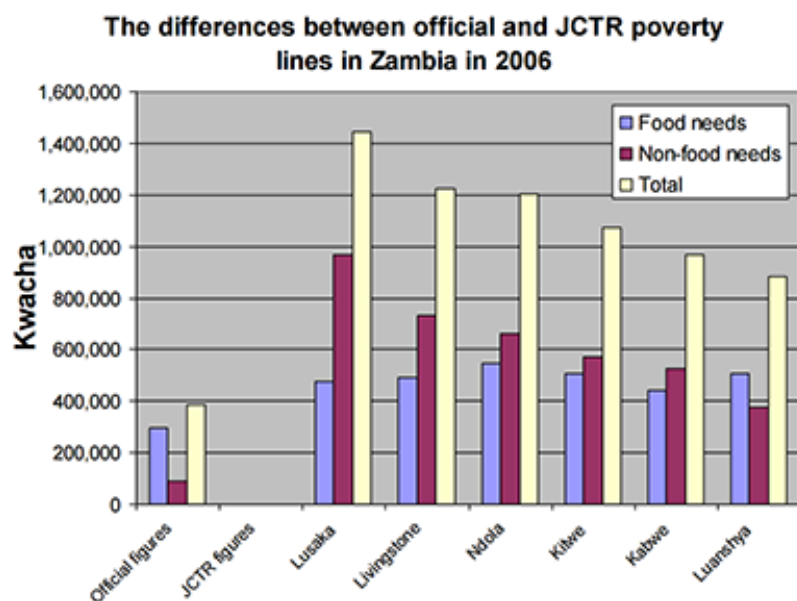
The price information can be sourced from expenditure surveys themselves when these include information on quantities in addition to total expenditure, but most commonly a price index like the CPI is used. It is rare for the CPI to detail geographical differences, even in developed countries like the UK or New Zealand, let alone in developing countries, where price information is more incomplete (Gibson, n.d.). In fact, Jolliffe (2006) shows how adjusting poverty measures in the US to account for cost-of-living differences between metro and non-metro areas reverses the common finding that poverty is higher in non-metro areas (the assumption that costs of living are the same in all areas underestimates poverty in areas where prices are high and overestimates it in areas where those prices are low). After adjusting for cost-of-living differences, Jolliffe finds that metro poverty is greater than non-metro poverty in terms of prevalence, depth and severity over the entire period under study (1991–2002). The author argues that this has implications for the allocation of social assistance funds, which have tended to focus on non-metro areas.

It is important to highlight that in some cases the CPI draws more heavily on information in urban areas or big cities in different regions, therefore in those instances there could be an urban bias in the prices used (Chandy 2013). In those cases where poverty lines are constructed using prices that have an urban bias, then the price information used is less likely to underestimate costs in urban areas (and to overstate them in rural ones). Further, depending on the extent the price information draws on bigger and smaller urban areas, there could be implications for poverty number in larger and smaller cities. Ultimately, to make more conclusive points about the impacts of the price information used on urban poverty measurement, further work would be needed that looks in more detail at the information used in price surveys in different countries and the extent it is representative of outlets in different areas.²¹ But the main point remains: how urban (including

19 Even alternative methods to calculate a poverty line that require less information, such as the Food Energy Intake method, depend on price information to adjust for differences in nominal expenditures between different areas (see Gibson, n.d. for more details).

20 The CPI is based on average consumption, so there is also an issue around whether it is representative of a typical poor person's expenditure.

Figure 3: Official estimates of food and non-food costs in the poverty lines versus alternative ones for different cities in Zambia



Source: This figure has been taken from Chibuye (2011).

differences between large and smaller cities) and rural prices are treated and whether or not they are adjusted can make a big difference to the resulting estimates.

A World Bank assessment for Ethiopia (2005, cited in Mitlin and Satterthwaite, 2013) provides examples of how poverty estimates can vary if locally specific lines are used. While the government estimated urban poverty at 33% in 1995 and 37% in 1999, the use of specific poverty lines allowing households to substitute their food consumption bundles in response to price changes and accounting for price differentials in different locations puts these numbers at 32% and 46%. The use of an upper urban poverty line puts these figures at 47% and 70%. In this case, more detailed assessments of food and non-food costs of living in different areas resulted in an increase in the numbers of urban residents estimated as having consumption below the poverty line.

Further, a study by Chibuye (2011) calculated the costs of food and non-food needs in a series of cities in Zambia and compared it with the expenditure used in the official

figures, all for 2006. Her calculations for a poverty line vary from the official figures in that she includes housing and more generous allowances for fuel, soap, electricity and water. Her results showed non-food needs in Lusaka that were 10 times higher (K996,100 for a household of six, so approximately \$1.50 a day) than those in the official figures (K88,709, approximately \$0.13 per day). According to Chibuye, much of this increase owed to housing needs. Her estimates also show the differences in expenditures between larger and smaller cities.

In short, in this section we have shown that monetary poverty measures can misrepresent urban poverty, but it is less clear what the direction of the bias is. While the way food allowances are accounted for may overstate urban poverty, the lack of consideration of non-food allowances is likely to underestimate it. Further, more granular price information would be needed to account for costs of living in different areas, particularly between larger and smaller cities.

We now turn to discuss the challenges relating to broader measures of well-being and deprivation.

21 It is also worth pointing out that calculations for the World Bank's international poverty line also often use the CPI at national level to adjust changing prices over time to a specific base year. These adjustments use urban and rural relative prices only in the case of large countries like China and India; for the others national-level CPIs are used (World Bank, 2015b). Further, the price information used for conversions of poverty lines into a PPP US dollar, the International Comparison Program data, is also likely to have an urban bias for some big countries like China (Ravallion, 2014). In fact, for the 2005 round of PPPs, Chen and Ravallion (2008) used adjustments to address urban bias. This adjustment reduced poverty in China by nearly half in 2005, from 26.4% to 15.6%. Adjustments are also common for other countries, for instance Latin American ones, where urban bias is also likely. The Socio-Economic Database for Latin America and the Caribbean (SEDLAC) database scales up all rural values by 15% to account for urban-rural price differences (SEDLAC, n.d.). Views on the extent of urban bias in the more recent 2011 round differ, with some (World Bank, 2015b) suggesting it was much better at capturing rural prices than the 2005 round, particularly with respect to China, India and Indonesia (Jolliffe and Beer Prydz, 2015). There are also other countries that have adjustments for urban bias built in.

5. Problems with indicators in multidimensional measures

In principle, multidimensional measures of poverty (e.g. access to basic services) ought to address some of the shortcomings of monetary poverty indicators in urban contexts, particularly their limitations in dealing with non-food needs. Yet some of the indicators used in common multidimensional measures such as the Joint Monitoring Programme (JMP) definition of access to improved water and sanitation, the Oxford Poverty and Human Development Initiative's (OPHI's) MPI or even UN-Habitat's slum numbers may not be the most appropriate for dense urban contexts. Lack of sufficient data across a number of countries is likely to be the reason behind the choice of these indicators.

In this section, we focus our analysis on indicators of access to basic services (mainly water and sanitation) and decent housing, which are salient deprivations in urban contexts²² and constitute UN-Habitat's definition of a 'slum'.²³

5.1 Access to basic services

Access to safe drinking water and adequate sanitation is often measured as the proportion of people that have access to 'improved' facilities as defined by the WHO/UNICEF Joint Monitoring Programme (JMP) (see Box 4).

In the case of access to water, a wide definition of 'improved access' has generally been used to track global progress on access to drinking water. This is also one of the indicators used for the slum target (see Box 1, Section 2).

This means shared sources – such as a public tap – count as an improved source, which neglects the prevalence of higher demand and overcrowding in urban areas, particularly in dense settlements, where a public tap may

be shared with hundreds (Tacoli et al., 2015). This means household members may have to queue to access drinking water, spending considerable periods of time waiting for and carrying water, resulting in unsatisfactory access and inadequate supply of water.

For instance, a survey of slums in Mumbai found that, while only 4.5% of households needed to travel or wait 30 minutes or more to get water from a standpipe, an additional 17% could access the standpipes for less than two hours a day (Bag et al., 2016).

Similarly, a CRC exercise in Kenya in 2007 found that more than a third (36%) of poor households relied on water kiosks for their water (CRC, 2007, cited in Twaweza, 2010). These households typically make four to six trips a day to fetch water; even when a water kiosk is nearby this consumes a considerable amount of time. For instance, in Nairobi, households spend on average 54 minutes going to the kiosk in normal times, and more than twice that (126 minutes) in times of water scarcity. In Kisumu the situation is worse: households relying on water kiosks spend almost two hours (112 minutes) collecting water every day, and more than three hours (200 minutes) in times of scarcity (ibid.).

Further, the indicator does not consider frequency of the service, quality of the water and its affordability. The access to water component of other multidimensional measures, like OPHI's MPI suffer from the same weakness (the MPI adds a distance component, but this does not consider waiting times, which may be more relevant to urban slum settlements).

All the countries in Figure 4 are considered to have met the MDG target on drinking water.²⁴ Yet the majority of urban households that access improved facilities have

22 For instance, in a study of Nairobi's slums (Gulyani, 2006), respondents identified access to basic infrastructure, such as toilets and water supply, among others, as their priority. Similarly, a survey in urban-poor communities in Bangkok (National Statistical Office, Thailand, 2006) recorded housing and environmental conditions among the chief concerns of respondents, along with financial concerns and crime.

23 Of course, many other dimensions of poverty (e.g. lack of access to good education, health, decent work) are also relevant but the indicators for these are less controversial in terms of capturing urban-specific deprivations, but rather some of the problems with estimates produced at urban level are more related to the data problems discussed in Section 2 (i.e. missing populations and lack of detailed geographical data beyond urban level).

24 Countries within 1 percentage point of the target are considered to have met the target (WHO and UNICEF, 2015), which sought to halve the proportion of people without sustainable access to safe drinkable water.

Box 4: JMP definition of ‘improved’ water and sanitation access

The World Health Organization (WHO)/UN Children’s Fund (UNICEF) JMP includes a standard set of categories that are considered as ‘improved’ for monitoring purposes, which are used in measuring progress on access to basic services as well as in UN-Habitat’s definition of ‘slum’ households.

The JMP defines an improved drinking water source as one that ‘by the nature of its construction and when properly used, adequately protects the source from outside contamination, particularly faecal matter’. The following sources of drinking water are considered improved:

- piped water into dwelling, or yard/plot
- public tap or standpipe
- tubewell or borehole
- protected dug well
- protected spring
- rainwater and
- bottled water (if water for cooking and personal hygiene is from an improved source)

In the case of sanitation, the JMP identifies as improved facilities those that hygienically separate human excreta from human contact. Improved sanitation includes:

- flush toilet to piped sewer system, septic tank or pit latrine
- ventilated improved pit latrine
- pit latrine with slab and
- composting toilet

Sanitation facilities (even improved) shared by two or more households and all public facilities are considered unimproved.

In 2008, the JMP introduced a four-rung ladder to track progress on these indicators in a more refined manner. In the case of water, the JMP identified ‘piped water on premises’ and ‘other improved drinking water sources’ as two categories of improved water sources and added two categories of unimproved services (unimproved drinking water sources and surface drinking water). In the case of sanitation, there is one category for improved sanitation and there are three categories for unimproved services (shared, unimproved and open defecation).

Source: UNICEF and WHO (2015).

shared access. Only three out of eight countries have a higher percentage of households with piped water on premises. In Nigeria, only 3% of the urban population has water connections on premises, although 81% is considered to have access to improved water (WHO and UNICEF, 2015).

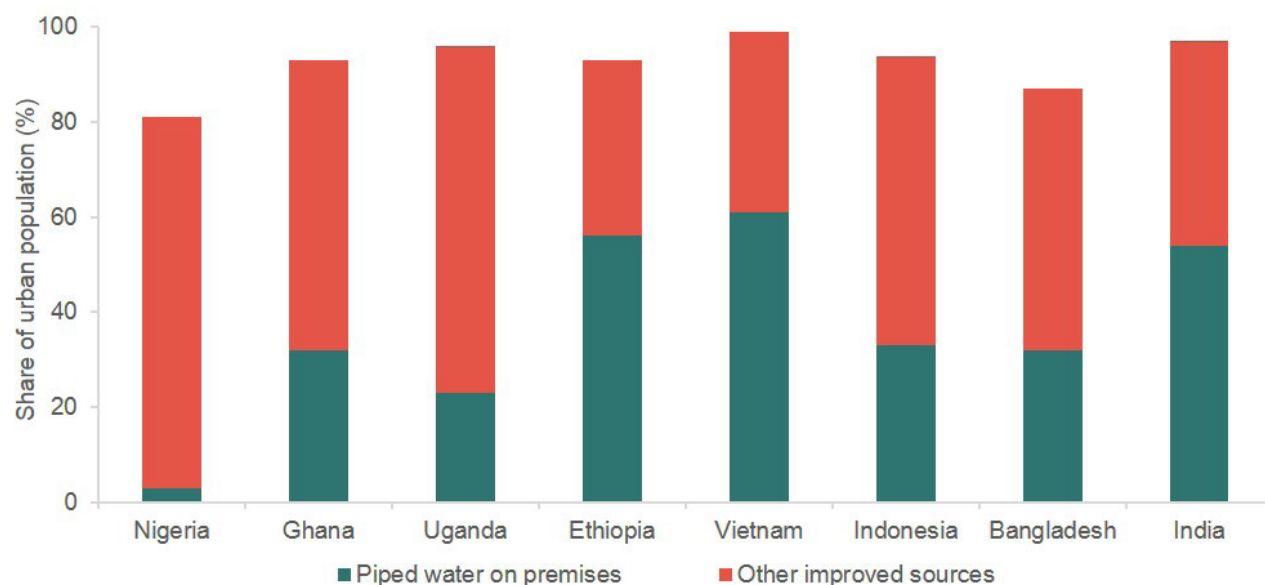
Analysis for our selected eight Indian cities shows similar results. While over 90% of all selected cities’ populations have access to improved water sources, we can reduce this share by half when a more restrictive definition is considered (i.e. connections to premises).

For the SDGs, although the final indicators are yet to be confirmed, the target to achieve ‘universal and equitable access to safe and affordable drinking water for all’ aims to record the share of population using a basic or improved water source ‘available on premises and available when needed and free of faecal (and priority chemical) contamination’ (IAEG, 2016). This suggests countries may be encouraged to collect information and

report on frequency of service and quality of the sources as well. While water contamination mainly occurs at a system level and not a household level, contamination can be reintroduced through neighbourhood pipes of groundwater contamination in the case of wells in low-income settlements even if water is treated. This will require strengthening data collection efforts, as data on these aspects are often more sparse.

In the case of sanitation, unlike with drinking water, the JMP definition of ‘improved’ access excludes facilities shared by two or more households. The indicator used by OPHI’s MPI follows a similar criterion. While in principle private facilities should be the standard to aspire to, some experts argue that in the short term it is unrealistic to achieve, and there are good examples of hygienic shared toilets (Mitlin, 2015). Currently, these facilities are classified as ‘unimproved’ as they are shared, suggesting these definitions need to be revisited (ibid.; WHO and UNICEF, 2015). Ideally, we would have data and criteria

Figure 4: Share of urban population by drinking water source in selected countries, 2015



Source: Authors' elaboration based on WHO and UNICEF (2015).

that would allow us to distinguish between shared facilities that are hygienic and adequate and those that are not, but the criteria currently used are not nuanced enough to allow for this type of distinction.

Other facilities considered 'improved' may not necessarily be adequate for good health in dense urban settlements. For example, toilets that connect to a septic tank or pit latrines may work well in many rural contexts or low-density urban areas where they can be emptied regularly and safely or there is space to build additional pits. However, they may be poor alternatives in dense urban contexts (Graham and Polizzotto, 2013; Satterthwaite, 2014). For instance, pit latrines in urban areas fill up quickly, and maintenance can be difficult (Sutcliffe and Bannister, 2014). In many slum settlements, when they are not regularly re-sludged this creates problems when storage fills up so they can no longer be used and has negative health implications. The most effective system for collecting and disposing wastes in high-density urban contexts is a sewer system, with treatment of wastewater (Satterthwaite, 2014).²⁵

Figure 5 illustrates the difference that varying the sanitation indicators can make to the level of access to sanitation in urban areas. We consider four different categories, which in descending order of ambition include flush latrines to piped sewer systems (unshared); the current JMP definition; flush latrines to piped sewer

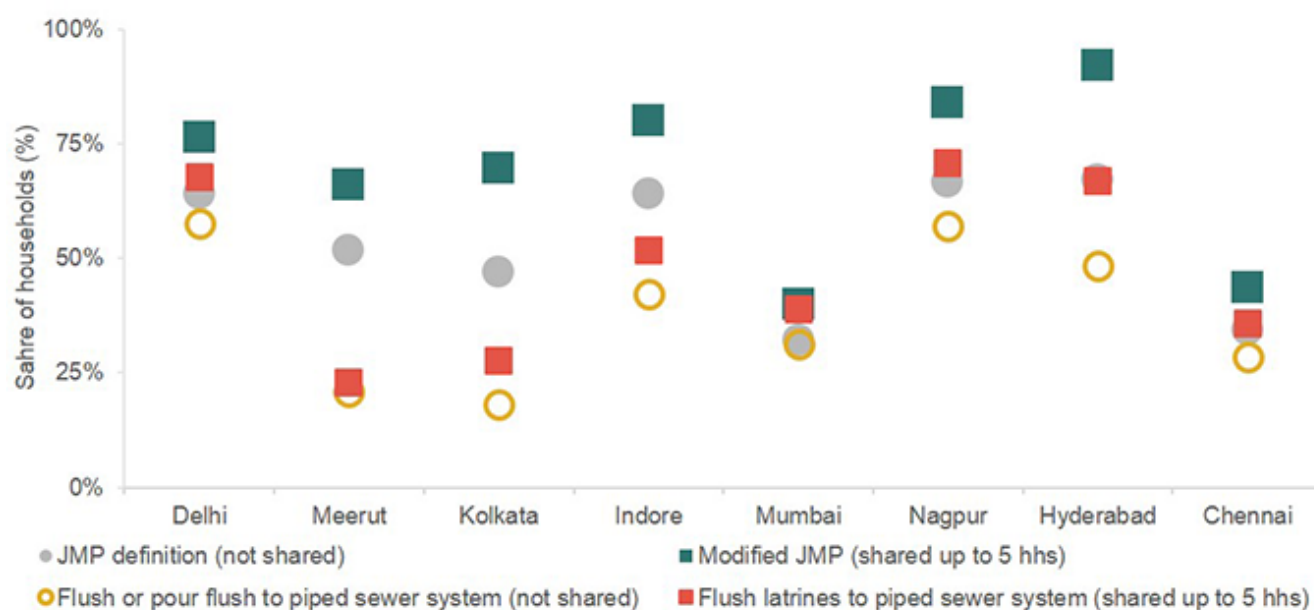
systems allowing for shared facilities; and modified JMP (same as JMP but allowing shared facilities with up to five households). As Figure 5 shows, differences in access can be sizeable depending on the criteria used.²⁶ For instance, in Kolkata in India 47% of households were identified as having improved sanitation facilities as per the JMP, but only 18% had individual flush latrines to a piped sewer system in 2005–2006.

Compared with the current JMP definition, if we consider 'limited sharing' as improved, a significantly higher proportion of households would be counted as using adequate sanitation facilities, with the difference ranging from 7.6% of households in Mumbai to 24.9% in Hyderabad. However, as discussed, pit latrines and septic tanks are often inappropriate for urban settings. When excluding these from the measure of 'improved' sanitation, the proportion of household with improved facilities is lower in half the cities (Meerut, Kolkata, Indore and Hyderabad). Therefore, in some regards, the JMP definition seems too narrow for the urban context (i.e. by not allowing any sharing of facilities); on the other hand, in some respects it is too wide (i.e. by including pit latrines as improved). While the net effect would vary based on local circumstances, indicators must be more nuanced since these differences would have varied policy implications.

²⁵ Local, decentralised sanitation solutions have worked well in some circumstances in terms of addressing challenges relating to environmental health conditions. However, these have largely been small in scale and require further research in terms of measurement and classification as 'improved' sources.

²⁶ It is worth mentioning that, in the case of sanitation, particularly in India, there is a distinction between access and use, with the latter influenced by behavioural and attitudinal barriers. However, the DHS asks households what type of toilet facility household members usually use, rather than whether they have a toilet.

Figure 5: Share of households with improved sanitation in selected Indian cities, 2005–2006



Note: *Modified JMP includes improved facilities shared by up to five households as 'improved'.

Source: IIPS and Macro International (2007).

5.2 Access to decent housing

Housing indicators used to assess well-being do not always consider the range of deprivations city dwellers experience. For instance, the MPI takes into account only the quality of floors and considers a family deprived in housing if they have dirt, sand or dung floors (the restrictive choice of indicators owes to data availability in constructing a cross-national measure).

However, this may underestimate poverty by failing to consider precarious multi-storey dwellings, common in slum settlements (Satterthwaite, 2014). There may be concerns regarding the quality of the walls and roofs, which may not protect people from adverse environmental conditions.

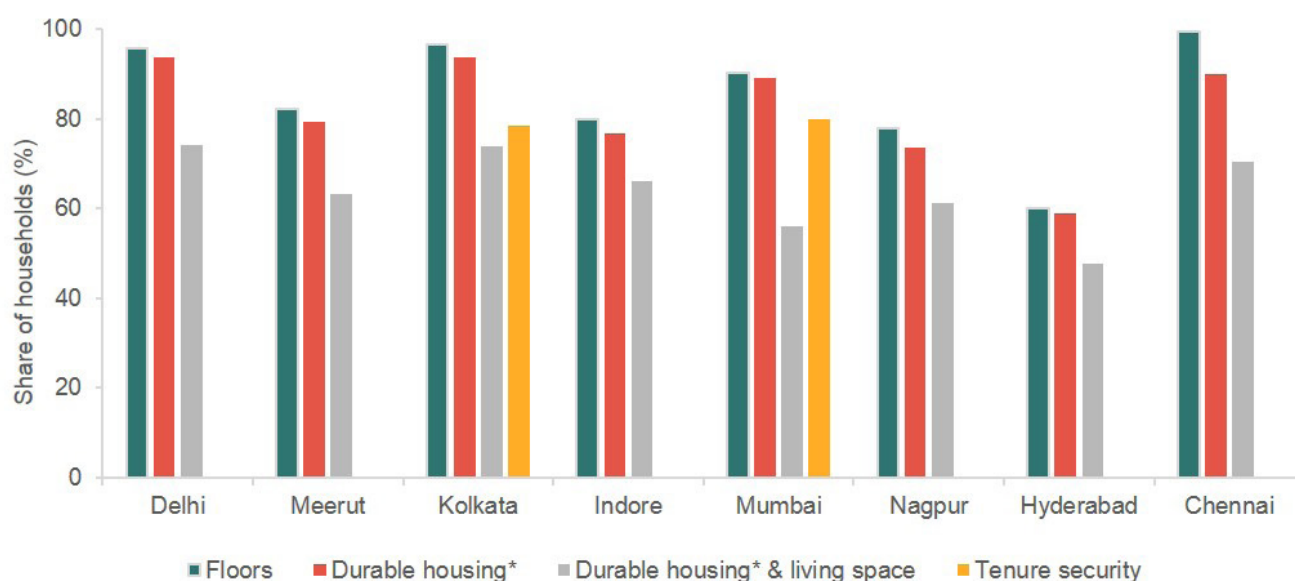
In addition, dwellings may not have sufficient living space for all members. Apart from overcrowding, insufficient space sometimes limits households' options for basic services and housing improvements. For instance, Bag et al. (2016) find that small plot sizes of 25 square yards or less in 'relocated colonies' in Delhi mean households with poor provision of sewerage systems are unable to construct

their own sanitation facilities, which forces them to use paid public toilets.

UN-Habitat's slum data do take into account all these different aspects of housing deprivations. Overcrowding is often significant in urban (as opposed to rural) areas; ignoring it in measurement of housing indicators may mean understating urban deprivation. This is, of course, often context-specific. Overcrowding may be more prevalent in larger cities with greater pressure on land.

For instance, in the case of the Indian cities considered in our analysis, the majority of households have improved floors – over 90% in the megacities of Delhi, Kolkata and Mumbai along with Chennai – and even when incorporating durability of walls and roofs this share is largely unchanged in most cities (Figure 6). However, when considering overcrowding, this share drops significantly in all the cities. The difference ranges from 11 percentage points in Indore and Hyderabad to up to 33 percentage points in Mumbai.

Figure 6: Durable housing and overcrowding in Indian cities



Source: IIPS and Macro International (2007)

Box 5: How would changing some the indicators currently used in the MPI affect results? An illustrative example

So far, we have shown that some parameters of the multidimensional indicators used to measure access to basic services and housing do not adequately consider pertinent concerns in urban areas. Improved water facilities include shared facilities (in informal settlements it could be shared by hundreds); improved sanitation can include types of facilities that are inadequate for good health in urban areas (e.g. facilities connected to a septic tank or pit latrines); and housing indicators based on flooring materials can underestimate overcrowding, among other housing deprivations.

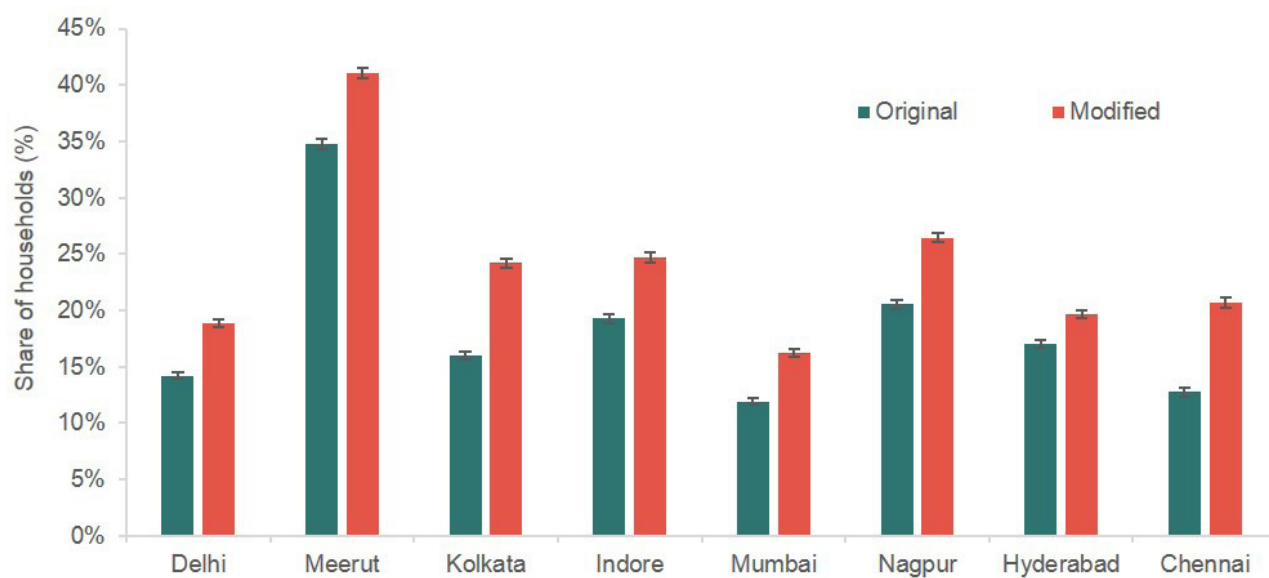
As an illustrative example, we wanted to assess the extent to which making changes to the indicators on water, sanitation and housing under the living standards component of the MPI would change the extent of multidimensional poverty. We considered a household deprived if:

- The household does not have access to water piped drinking water on premises.
- The household does not have flush or flush pour latrine to piped sewer system.
- The household does not have a ‘finished’ roof, walls or floors or it has four or more people sharing a sleeping room (see Annex 1 for more details on the MPI and its methodology, and how the modifications made compare with the MPI indicators).

Even amending only selected indicators from the ‘living standards’ dimension in urban areas, considerable changes in the MPI emerge (Figure 7). The difference in the poverty headcount ratio (the share of people identified as poor) between the global MPI and the modified MPI is 5 percentage points or more in six out of eight cities. As an example, in Delhi this would amount to over a million people.

There are also differences in the average intensity of poverty among the poor, or the share of weighted indicators in which the poor are deprived, of up to 3 percentage points (in Meerut) (see Table A2 in Annex 1 for further results). This is interesting as it seems to suggest the headcount changed considerably more than the depth of poverty in these particular cities.

Figure 7: Headcount ratio for multidimensional poverty in Indian cities, 2005–2006



Note: This uses the latest population figures, assuming the same distribution holds today (as our estimation is based on 2005–2006 data).

Source: IIPS and Macro International (2007). More details on the methodology are included in Annex 1.

6. Conclusion

As the pace of urbanisation accelerates, it is increasingly important that the way we monitor poverty trends is suitable for urban contexts. Some aspects of our data collection and poverty measures were devised at a time when poverty was mostly rural. These require adjustments in an era of urban transition.

In this paper, we have looked at different ways in which current measures may underestimate poverty in urban areas. We have considered problems with varying definitions of slums and issues related to the data (e.g. undercounting of slum populations and lack of detailed geographical disaggregation beyond urban averages). We have also discussed how particular assumptions and indicators used in monetary and multidimensional measures of poverty may be inappropriate for urban contexts, and proposed some indicators that might be more suitable.

We conclude by providing a series of suggestions for improvements with regard to each of the problems identified throughout the paper.

6.1 Addressing problems with slum definitions

Definitions matter: our report demonstrates how national and global level estimates on the size and proportion of slum dwellers can vary significantly with the definitions used.

While finding global standards and definitions of slums applicable to all countries can prove difficult, these can help raise the profile of urban poverty among donors and multilateral banks

That said, it is worth considering whether it is still appropriate to club together one or a few slums households or larger squatter settlements that meet certain deprivation criteria within the same definition, as the UN-Habitat definition does. Adding more nuanced breakdowns that would differentiate between types of housing deprivations (e.g. squatter settlement versus inner city precarious building) could be a way of addressing this issue (this would require agreement on settlement density/housing structure criteria). There is also scope to improve the transparency of definitions and specific thresholds used for different criteria. At present, it is often difficult to find this information by reading metadata published online by data producers.

6.2 Addressing problems with data

Undercounting in data collection

Data collected through household surveys or censuses can underrepresent/undercount slum dwellers. This occurs because census and household surveys do not thoroughly include slum settlements, owing to practical (e.g. difficulties of identifying and interviewing slum dwellers) or political reasons or because surveys are based on outdated sampling frames.

Many of the biases inherent in undercounting slum populations can be corrected by improving data collection processes. NSOs and international organisations (e.g. those coordinating MICS, DHS, etc.) all have a role to play in this regard.

As in the case of definitions, it would be useful to increase transparency over the methods used to construct sampling frames. Metadata could state clearly the extent to which methods used could undercount certain populations, such as slum dwellers. This way, independent sources can verify and replicate these estimates on their own. Cross-checking and using different sources of data produced by different actors (e.g. global numbers, national number, enumerations by civil society) could also help highlight issues relating to missing slum populations.

In addition, more countries, particularly those where urbanisation is taking place at a fast pace, could consider conducting slum-specific censuses. For example, in Bangladesh, slum-specific censuses are being carried out in between two Population and Housing Census rounds. If one slum-specific census is carried out at the mid-point between two Population and Housing Census rounds, the data are likely to better reflect conditions in slums, and to provide consistent time series data to compare changes over time. The UN Population Fund (UNFPA), which is coordinating the 2020 round of the Population and Housing Census, is ideally placed to spearhead this exercise and to mobilise countries in doing so. Finally, it would also help if Population and Housing Census data generally included slum settlements as another geographic unit, making these estimates easily available with every round (e.g. through NSO portals).

Lack of granularity

The lack of granularity of survey data means we have information only for urban averages, and do not know about the extent of intra- and inter-city disparities. Household surveys often have small sample sizes that do not allow for disaggregation of data beyond urban averages.

Conducting slum-specific censuses (and/or ensuring household and population include slum settlements as a geographical unit) can also help deal with lack of granularity, as censuses can provide detailed information at slum settlement level. Further, these can provide more up-to-date sampling frames to conduct slum-specific surveys. Trying and testing new methods and new technologies to capture slum data more easily and frequently (in between periods where survey data are unavailable) could also be useful (see Box 3 for further details).

6.3 Addressing problems with monetary poverty measures

Commonly used indicators like the income poverty headcount ratio can also underestimate urban poverty. In particular, the fact that non-food spending and relative costs of living, which are much higher in larger urban centres, are not properly accounted for can result in setting urban poverty lines too low.

Outdated questionnaires do not reflect current food consumption habits

One of the problems with monetary measures is that questionnaires do not reflect changing habits (e.g. an increasing tendency for household members to eat separately and out of the house). Household consumption and expenditure surveys should include questions for meals out and make sure these include quantities consumed to calculate caloric intake. Ideally, food expenditure should be recorded by each adult rather than by a household head, and using diaries as this method is perceived to be more accurate. Of course, this is less feasible in countries with high rates of illiteracy, and accuracy has been shown to diminish over time as respondents develop fatigue (Beegle et al., 2012).

Non-food allowances, central to urban poverty, are inadequately covered

Another central problem of monetary measures is that the data needed to account for non-food allowances, key elements of low-income households' budgets in urban areas, are often not consistently collected. Expenditure surveys should include comprehensive questions on non-food needs, including housing, transport, water, access to toilets, schooling and health care, among others. It is also worth considering a review of most common methods to account for non-food allowance in urban contexts, as the most popular ones are likely to set the urban poverty line too low.

Differences in costs of living are insufficiently accounted for

Finally, as the importance of comparing poverty incidence and standards of living across areas and provinces is likely to increase in the near future, further differentiation of the cost of living between different areas (large cities versus smaller ones) will be also be needed. There is also

scope here to consider whether new technologies can help produce more frequent and granular data on prices in different areas.

6.4 Addressing problems with multidimensional measures

Access to basic services: Accounting for dense urban contexts with high demand

Sources that are adequate in rural settings may not be appropriate in urban areas. In this context, for instance, only having data on distance from or time taken to walk to a drinking water source is not enough; we need information on how many people share a source (and/or waiting times) in order to account for overcrowding in dense slum settlements.

There is also scope to be more nuanced about the definition of access to improved water, building on the 'ladder' approach set out by the UNICEF/WHO JMP. For instance, in addition to a share/unshared dichotomy, there could be another category of data readily available for limited sharing (i.e. by 'up to five households'). This is in line with what is currently proposed by the slums targets in the SDGs (UNSD, 2016). Although the number of surveys including a question on sharing services has increased over the years, data on the extent of sharing are rare – only 85 out of over 400 surveys in 2015 lent themselves to distinguishing the number of households sharing facilities (UNICEF and WHO, 2015). Therefore, this level of detail would require additional data collection efforts.

In the case of access to sanitation facilities, there is scope to revisit the categories used and what constitutes 'improved' access. Although the JMP classifies all shared facilities as unimproved, shared sanitation is on the first step of the sanitation ladder and as such should be reported individually (UNICEF and WHO, 2015). Some have suggested that a threshold of five or more households, as in the case of water facilities, known as 'limited sharing', should be included in the 'improved' category for sanitation (ibid.). Others argue that even limited sharing has negative impacts on health and should not be considered 'improved'. Note that limited sharing would still consider community toilet blocks – which, for instance, work well in Mumbai's dense slums settlements as a short-term solution – as unimproved facilities (Mitlin, 2015).

In addition to issues of overcrowding, indicators used must pay attention to the implications of the quality of the service. As argued in Section 5, a pit latrine or septic tank may be sufficient in rural areas but this is not the case in densely populated urban settlements where they may fill up soon and communities may find it difficult to get these emptied or to build new pits. In fact, the absence of a piped sewerage network in urban areas raises concerns about the adequacy of sanitation services given adverse health risks caused by poor faecal waste management (Mitlin, 2015).

This and ongoing discussions on shared facilities and how to classify hygienic toilet blocks shared with more than five households warrant further discussions about the JMP criteria of improved sanitation. Other aspects, such as the quality of the service (e.g. the quality of the water, the hygienic condition of toilets or whether access is frequently available), its affordability and the number of hours households receive water, or indeed sanitation, are important.

Access to housing: Collecting information beyond the quality of the flooring

In the case of housing too, there is a need for more consistent data collection on quality – beyond the

material of the flooring of households (e.g. on materials of roofs and walls, overcrowding and tenure, which fewer household surveys collect). Again, this will require strengthening data collection efforts in these areas.

Improvements in data collection are urgently needed. Only then will governments and campaigners better understand the consequences of urbanisation and push for policies that can improve poor city dwellers' lives. Of course, data alone will not be enough to achieve these changes, but they will be a step in the right direction.

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Annex 1: Indicators and weights used in calculating the Multidimensional Poverty Index

It is widely acknowledged that poverty is not about just income or consumption but is rather a much wider concept. People experience deprivations in many different ways, and ending income poverty may not necessarily end the many overlapping deprivations facing poor people (Alkire and Sumner, 2013). In this regard, recent efforts have attempted to better measure deprivation that accounts for broader aspects of well-being.

The MPI²⁷ mentioned is one such an initiative. It is a headline index and includes deprivations in three dimensions (Table A1).

- health – measured through child mortality and nutrition
- education – measured by years of schooling and enrolment
- living standards – using water, sanitation, electricity, cooking fuel, floor, assets

The three dimensions are equally weighted, and all indicators within a dimension have an equal weight. The methodology used identifies households deprived in each of these indicators, and then classifies households as poor if they suffer deprivations across a third or more of the weighted indicators. The MPI is then the product of the proportion of population that is poor (H or headcount ratio) and the average share of weighted indicators that poor people are deprived on (A or intensity of poverty).

Table A1 shows the different weights and indicators used in the MPI. Box 5 in Section 5 discusses how the estimated poverty rate as measured by the MPI would vary if the indicators used to assess deprivation included urban-specific areas of concern. In particular, modifications were introduced in the living standards component. The weights and original measure follow from the methodology used to calculate the global MPI as discussed in Alkire and Robles (2015). In order to remain comparable instead of adding new indicators, we have modified only existing measures. In addition, owing to unavailability of data on quality and cost on the indicators, these factors have not been accounted for and therefore this remains an underestimate.

27 The MPI was introduced by OPHI and UNDP, and is published annually by the Human Development Report Office.

Table A1: Weights and indicators used in original and modified version (for illustrative purposes)

Dimension	Weight	A household is considered deprived if... Original indicator	Modification
Health	1/6	Nutrition:* Any adult or child for whom there is nutritional information is malnourished	-
	1/6	Child mortality:** Any child has died in the household within the past five years	-
Education	1/6	Years of schooling: No member older than 10 years has completed 5 years of schooling	-
	1/6	School attendance: Any school-age child is not attending school up to the age they would complete Class 8	-
Living standards	1/18	Cooking fuel: The household cooks with dung, wood or charcoal	-
	1/18	Sanitation: The household's sanitation facility is not improved, or it is improved but shared with other households	The household does not have flush or flush pour latrine to piped sewer system, or it shares this with other households
	1/18	Water:**** The household does not have access to an improved drinking water source or it is a 30-minute walk or more from home, round trip	The household does not have piped drinking water to premises or plot/yard
	1/18	Electricity: The household has no electricity	-
	1/18	Housing: The household has a dirt, sand or dung floor	The household does not have a 'finished' roof, walls or floors, or it has 4 or more people per sleeping room
	1/18	Assets: The household does not own more than one radio, TV, telephone, bike, motorbike or refrigerator and does not own a car or truck	-

Note: While we have amended access indicators such that they consider urban-specific deprivations, data are unavailable on some indicators (e.g. number of hours of water access).

** Adults are considered malnourished if their Body Mass Index is below 18.5 m/kg². Children are considered malnourished if their z-score of weight-for-age is below -2 SD from the median of the reference population*

*** The DHS does not collect data on if a child has died in the past five years; instead, it asks women if they have a son or daughter who has died without stipulating a time period.*

**** A household is considered to have access to improved sanitation if it has some type of flush toilet or latrine, or ventilated improved pit or composting toilet, provided they are not shared.*

***** A household has access to clean drinking water if the water source is any of the following types: piped water, public tap, borehole or pump, protected well, protected spring or rainwater, and is within 30 minutes' walk (round trip).*

Table A2: MPI results for Indian cities, 2005–2006

City	Original						Modified					
	H	H (SE)	A	A (SE)	M0	M0 (SE)	H	H (SE)	A	A (SE)	M0	M0 (SE)
Delhi	14%	0.29%	43%	0.22%	0.061	0.001	19%	0.33%	44%	0.21%	0.083	0.002
Meerut	35%	0.45%	47%	0.21%	0.164	0.002	41%	0.46%	50%	0.21%	0.206	0.002
Kolkata	16%	0.37%	46%	0.29%	0.073	0.002	24%	0.43%	46%	0.26%	0.111	0.002
Indore	19%	0.42%	44%	0.29%	0.085	0.002	25%	0.46%	45%	0.26%	0.111	0.002
Mumbai	12%	0.33%	40%	0.20%	0.048	0.001	16%	0.37%	42%	0.22%	0.068	0.002
Nagpur	21%	0.40%	42%	0.23%	0.087	0.002	26%	0.44%	43%	0.21%	0.115	0.002
Hyderabad	17%	0.33%	42%	0.23%	0.071	0.001	20%	0.35%	44%	0.23%	0.087	0.002
Chennai	13%	0.38%	41%	0.20%	0.052	0.002	21%	0.46%	42%	0.20%	0.086	0.002

Note: H refers to the headcount ratio; A is the intensity of poverty among the poor or average the share of weighted indicators in which the poor are deprived; and M0 is the modified headcount ratio or MPI, calculated as the product of H and A. Standard errors of the estimates are included as above.

Table A3: MPI results for Indian cities by type of residence, 2005–2006

City	Non-slum			Slum			Diff in H (% pts)	Diff in A (% pts)
	H*	A*	M0*	H*	A*	M0*		
Delhi	7%	37%	0.026	24%	46%	0.110	17%	9%
Meerut	16%	40%	0.064	49%	49%	0.239	33%	9%
Kolkata	8%	40%	0.031	31%	48%	0.150	23%	8%
Indore	11%	39%	0.043	31%	46%	0.144	20%	7%
Mumbai	9%	39%	0.036	14%	41%	0.059	5%	2%
Nagpur	8%	37%	0.030	34%	43%	0.147	26%	6%
Hyderabad	9%	40%	0.036	22%	42%	0.095	13%	2%
Chennai	7%	37%	0.025	15%	42%	0.064	8%	4%

Note: H refers to the headcount ratio; A is the intensity of poverty among the poor or average the share of weighted indicators in which the poor are deprived; and M0 is the modified headcount ratio or MPI calculated as the product of H and A.

Annex 2: List of available slum-specific data – An example from Kenya

Country	Locations	Source	Year	No. of households surveyed	Income/ consumption variables included	Details on income/ consumption variables	Non-income/ non-consumption variables included	Details on non-income/ non-consumption variables	Use	Data available online	URL
Kenya	Nairobi slums	APHRC, NCSS	2000; 2012	4,564 households in 2000, 5,490 in 2012	Yes	Employment and source of earning	Yes	Characteristics of households and respondents including age-sex composition; household amenities and durable goods; duration of stay in slum households; respondents' important needs; general needs/ concerns of slum residents; major health needs and problems		Yes	http://aphrc.org/wp-content/uploads/2014/08/NCSS2-FINAL-Report.pdf For 2000 survey see http://www.popline.org/node/189234
Kenya	Nairobi slums: Kawangware, Korogocho, Njiru and Viwandani	Health and Livelihood Needs of Residents of Informal Settlements in Nairobi	2002	Closest variable: map of all health, livelihood and other community facilities, interviewing officials of these facilities, and conducting FGDs and in-depth interviews with residents of the four study areas	Yes	Income generation	Yes	Health awareness and treatment-seeking behaviours; major public health concerns (water supply, human waste, garbage disposal, HIV/AIDS, nutrition); modern health facilities; traditional health care delivery; livelihood and other community resources; community institutions; financial services; access to essential services	The overall goal of the Needs Assessment Study was to inform Nairobi Urban Health and Poverty Project partners on the most critical health and livelihood issues facing Nairobi slum residents, and thus help identify key interventions necessary for these areas	Yes	http://www.chs.ubc.ca/archives/files/Health%20and%20Livelihood%20Needs%20of%20Residents%20of%20Informal%20Settlements%20in%20Nairobi%20City.pdf

Annex 2: List of available slum-specific data – An example from Kenya (continued)

Country	Locations	Source	Year	No. of households surveyed	Income/ consumption variables included	Details on income/ consumption variables	Non-income/ non-consumption variables included	Details on non-income/ non-consumption variables	Use	Data available online	URL
Kenya	Nairobi slums: Korogocho and Viwandani	APHRC	2003 -2005	Closest variable: population under surveillance: 75,000	No	N/A	Yes	Mortality burden	Can compare the health outcomes of these slum populations with those of rural dwellers who are often the focus of most interventions	Yes	http://www.pophealthmetrics.com/content/6/1/1 http://aphrc.org/hello-world/
Kenya	Nairobi	Gulyani	2006	1,755 households surveyed, FGDs in 10 sites, some household interviews	Yes	Nairobi poverty incidence: % of people below urban poverty line, per capita income, rent for housing	Yes	Education, unemployment, household enterprises, quality of life, access to infrastructure	Can determine the population of slum dwellers, how poor, ill-housed and/or underserved they are, what aspects should be improved first and what are slum-dwellers' own development priorities	Yes	http://siteresources.worldbank.org/INTKENYA/Resources/Inside_Informality.pdf
Kenya	Nairobi slums: Korogocho and Viwandani	UPHD (APHRC) Detailed Household Income and Expenditure Survey 2007 (APHRC)	2007–2010	900 households (450 in each slum)	Yes	Household income and expenditure	Yes	Households' and respondents' background characteristics, linkages with community of origin, inventory of durable goods, subjective poverty and food security, economic activities, employment	Can investigate the links between migration, poverty and health among people living in Nairobi's slums	Yes	http://aphrc.org/catalog/microdata/index.php/catalog/50/data_dictionary
Kenya	Kianda	MKP	2008	Door-to-door census: 15,219 people	No	N/A	Yes	Topography, demographics, tribes, structures, economy, infrastructure	Can estimate Kibera's population size on the basis of Kianda's population density per km ² and compare this with official census figures	Yes	http://mapkiberaproject.yolasite.com/maps-and-statistics.php

Annex 2: List of available slum-specific data – An example from Kenya (continued)

Country	Locations	Source	Year	No. of households surveyed	Income/ consumption variables included	Details on income/ consumption variables	Non-income/ non-consumption variables included	Details on non-income/ non-consumption variables	Use	Data available online	URL
Kenya	Kibera	Map Kibera Trust	2009	N/A	No	N/A	Yes	Security: police, dangerous location, street light, gender-based violence support, bar, informal settlement; water and sanitation: bathroom, water point, public trash, informal settlement; health: pharmacy, hospital, informal settlement, education: school, informal settlement	Kibera was not visible on any publicly available map and had little reputable local news and information. The Map Kibera members continue to build collaborative digital maps using OpenStreetMap, use SMS and Ushahidi to report news on the Voice of Kibera website, and shoot and edit video news clips to post on Youtube as Kibera News Network. Map Kibera continues to grow to other areas, like Mathare and Mukuru slums in Nairobi, and to provide critical news and data for development and democracy in the community	Yes (in the form of maps)	Security: http://www.mapkibera.org/theme/security/ Water and sanitation: http://www.mapkibera.org/theme/watsan/ Health: http://www.mapkibera.org/theme/health/ Education: http://www.mapkibera.org/theme/education/

Annex 2: List of available slum-specific data – An example from Kenya (continued)

Country	Locations	Source	Year	No. of households surveyed	Income/ consumption variables included	Details on income/ consumption variables	Non-income/ non-consumption variables included	Details on non-income/ non-consumption variables	Use	Data available online	URL
Kenya	Kibera	Marx, Stoker and Suri	2013	Conducted one census of 31,765 households, and one survey of 1,093 households in Kibera	Yes	Consumption - rent paid by households (including area rented per capita; rent per capita; rent per square metre across consumption quintiles in Kibera); monthly consumption per capita in US \$; and living standards and duration of residency in slums of Kenya	Yes	No private latrine; inferior latrine type; no private water source; no garbage collection; ownership type of main dwelling (own, rent, occupy, other arrangements); experience being evicted; deaths		Yes	http://www.mit.edu/~tavnnet/Marx_Stoker_Suri.pdf
								As cited in the publication, see also: Syagga, Paul, Winnie Mitullah, and Sarah Karirah-Gitau (2002). "Nairobi Situation Analysis Supplementary Study: A Rapid Economic Appraisal of Rents in Slums and Informal Settlements" (draft). Contribution to the Preparatory Phase (January–November 2002) of the Government of Kenya & UN-HABITAT Collaborative Nairobi Slum Upgrading Initiative.			

Annex 2: List of available slum-specific data – An example from Kenya (continued)

Country	Locations	Source	Year	No. of households surveyed	Income/consumption variables included	Details on income/consumption variables	Non-income/non-consumption variables included	Details on non-income/non-consumption variables	Use	Data available online	URL
Kenya	Kisumu, Nairobi, Nakuru, Machakos, Makeuni	Know your city (data accessed from site: December 2015)	N/A	No. of informal settlements profiled: Kisumu 1; Nairobi 41; Nakuru 20; Machakos 5; Makeuni 2; estimated informal settlement population: Kisumu 220,956; Nairobi 706,063; Nakuru 131,940; Machakos 75,552; Makeuni N/A; % of city population living in informal settlements: Kisumu 54%; Nairobi 21%; Nakuru 43%; Machakos and Makeuni N/A	No	N/A	Yes	Estimated informal settlement population (but not available for Makeuni); estimated number of structures; % of city population living in informal settlements (but not available for Machakos or Makeuni); what % of population live on what % of land (not available for Makeuni); settlements under threat of eviction, and other variables such as: Infrastructure - % of settlements with road access, % of settlements with electricity, main means of transportation; organisation capacity - saving groups; health service access - average walking time to nearest health service (hospitals, AIDS clinic, health clinic); commercial establishments	This is community collected and owned settlement level data. Communities who collect and share data on this platform do so in order to start a dialogue and partner with their city governments and other development partners around slum upgrading based on their own identified and prioritised needs in their settlements	Yes	Kisumu: http://knowyourcity.info/map.php#/app/ui/city/kisumu-kenya#app Nairobi: http://knowyourcity.info/map.php#/app/ui/city/nairobi-kenya#app Nakuru: http://knowyourcity.info/map.php#/app/ui/city/nakuru-kenya#app Machakos: http://knowyourcity.info/map.php#/app/ui/city/machakos-kenya#app Makeuni: http://knowyourcity.info/map.php#/app/ui/city/makeuni-kenya#app

Sources: APHRC (2002a, 2002b, 2013, 2014a, 2014b); Gulyani (2006); Know Your City (2016b); Map Kibera Trust (2009); Marx, Stoker and Suri, T (2013); MKP (n.d.).



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