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CHILD MORTALITY IN INDONESIA'S MEGA-URBAN REGIONS: MEASUREMENT, ANALYSIS OF DIFFERENTIALS, AND POLICY IMPLICATIONS

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Abstract

The mega-urban regions of Jabotabek (the Jakarta Extended Metropolitan Region) Bandung and Surabaya have been widely demonstrated to have some of the lowest child mortality rates (CMR) in Indonesia. However, the wide disparities in socioeconomic characteristics, living conditions and access to health services of the rapidly growing populations of these places leads to the assumption that CMR levels vary drastically as well. This paper, which contains the initial results of a PhD thesis, presents analysis of the spatial distribution of CMR in the sub-districts within Jabotabek, Bandung and Surabaya. The CMR are indirectly estimated by the Brass methods (Trussell equations) using the 2000 Indonesian Population Census, and the important limitations of this methodology and data source are analysed in depth. The results show large differences in CMR within these mega-urban regions, especially between the low CMR of the population living in the urban core and the significantly higher CMR of those living in peri-urban areas. The disparities in CMR closely correspond with differences in socioeconomic characteristics and access to health services of these populations. The paper concludes by examining the policy implications of the disparities in CMR in Jabotabek, Bandung and Surabaya, and analysing how the collection of such child mortality data needs to be improved in Indonesia, especially with the advent of decentralisation.

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Background

Rapid demographic change in Indonesia's mega-urban regions of has resulted in a large and heterogeneous population. A variety of risk factors relating to child mortality are faced by these residents. This paper analyses the measurement and data quality issues related to estimating child mortality rates (CMR) in Indonesia's mega-urban regions. The spatial distribution of CMR within each mega-urban region is presented, with preliminary explanations of differentials provided. These results are then placed in the context of health sector reforms in Indonesia, including rapid decentralisation.

A major global demographic transformation in recent decades has been the rapid urbanisation of developing countries. In 1975, 27 per cent of people in the developing world lived in urban areas, but by 2000 this had risen to 40 per cent and is projected to rise to 56 per cent in 2030 (UN 2004: 162-163). Indonesia has also experienced rapid urbanisation, with the proportion of the population living in urban areas increasing from less than 10 per cent at Independence in 1945 to 40 per cent in 2000 (Hugo 1996). Such rapid population growth has caused the population of many cities to spill over into surrounding areas to become "mega-urban regions" (McGee 1995, Dharmapatni and Firman 1995).

Jabotabek[1] (Jakarta Extended Metropolitan Region), Bandung and Surabaya are the three largest mega-urban regions in Indonesia. Each is located in the country's most populated island of Java. To analyse these mega-urban regions appropriately, especially for planning purposes, the identification of zones has been used to illustrate the diversity of demographic change that is occurring (Mamas et al 2001, Jones 2002). To study child mortality, this paper uses a simplification of the classification of zones used in previous studies. Two zones are identified: the city core, or traditional administrative area of city, and the outer zone, or surrounding areas. The city core in each mega-urban region is the traditional administrative area of the city, ie, DKI Jakarta, *Kotamadya* (municipality) Bandung and *Kotamadya* Surabaya. The outer zone is a combination of regencies and municipalities that surround the city core. In Jakarta it is the area known as Botabek (refer to footnote 1), in Bandung it is *Kabupaten* (regency) Bandung, while in Surabaya, because there is no obvious combination of municipalities and regencies to determine the boundaries of the mega-urban region, a combination of sub-districts (*kecamatan*) that surround the city core are used, with an emphasis on a major growth corridor near the municipality of Mojokerto. Each outer zone consists of villages officially classified as rural[2], however these are located close to urban areas and perhaps best described as peri-urban[3].

[1] The name 'Jabotabek' refers to the area that constitutes the municipality of DKI Jakarta, and the surrounding municipalities and regencies of Bogor, Tangerang, Bekasi and Depok

[2] In Indonesia urban areas are defined according to classification of *kelurahan* or *desa* (villages), which are the lowest levels of administration (directly below sub-districts or *kecamatan*). The classification is determined by demographic, economic and facility characteristics.

Figure 1: City core and outer zone, Jabotabek

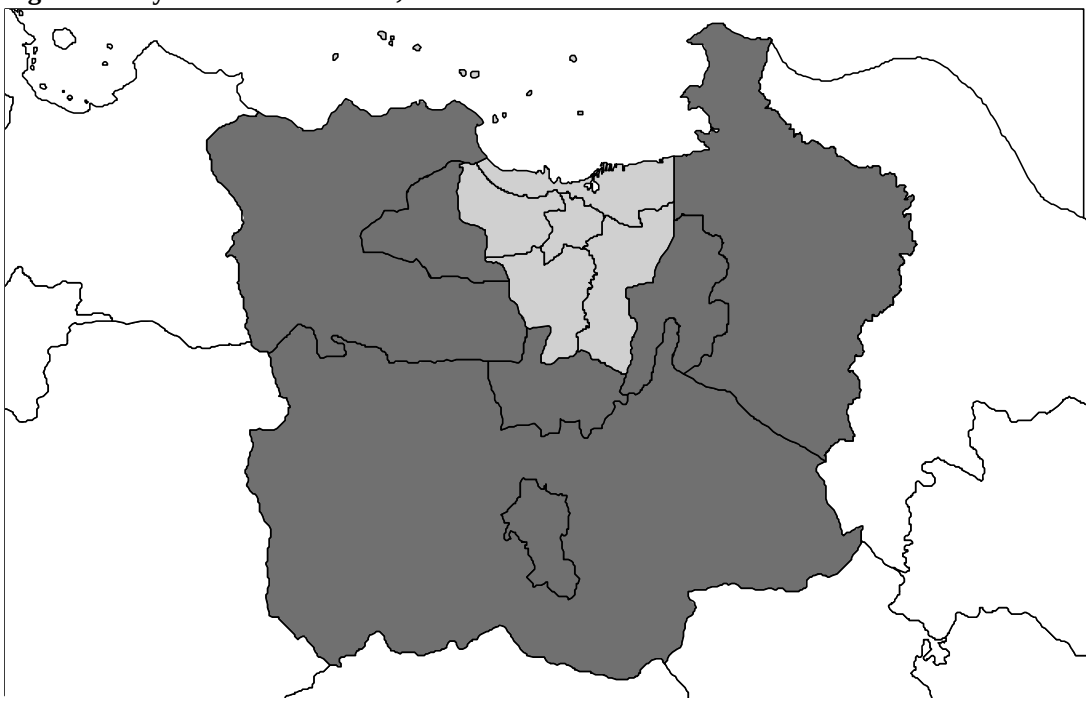


Table 1 shows the total population of each mega-urban region and table 2 shows the population growth of Jabotabek. The total population of Jabotabek exceeds 20 million, while for Bandung and Surabaya is greater than 5 million. Jabotabek's population more than doubled from 1980 to 2000. Both the total population and the population growth of the outer zone is higher than the city core, which indicates the importance analysing these areas. In the city core of DKI Jakarta, the population barely increased from 1990 to 2000.

Table 1: Population of mega-urban regions of Jabotabek, Bandung and Surabaya, 2000

Mega-urban Region	City Core	Outer Zone	Total Population
Jabotabek	8,347,083	12,842,626	**21,189,709**
Bandung	2,136,260	4,158,083	**6,294,343**
Surabaya	2,599,796	4,511,753	**7,111,549**

Source: 2000 Indonesian Census

[3] The use of the urban-rural dichotomy to classify villages does not allow for adequate measurement of peri-urban areas.

Table 2: Population of Jabotabek, 1980-2000 ('000s)

Mega-urban Region	1980	1990	1995	2000	Change 1980-2000 (%)
DKI Jakarta	6,481	8,223	9,113	8,347	28.7
Outer zone	5,411	8,876	11,047	12,842	137.3
Total Jabotabek	11,892	17,098	20,160	21,189	78.2
% of people in Jabotabek living in DKI Jakarta	54.5	48.2	45.2	39.7	-

Sources: Mamas et al (2001), McGee (1995), 2000 Indonesian Census data tapes

The high population growth in the outer zone has occurred as a result of the rapid expansion of the economy under the Suharto regime beginning in the 1960's. Increased levels of investment caused these areas to transform from predominantly agricultural to primarily manufacturing. Migrants from rural areas, especially from other parts of Java, were attracted to settle in these outer zones (Firman 1997). In Jabotabek, out-migration from the city core also occurred, especially among the middle-class because of improved coverage of arterial roads, cheaper land and development of arterial roads (Firman 1997, Hugo 1996). Other out-migrants were former residents of *kampungs* near the centre of the city that were demolished by city planners moved to cheaper land on the periphery of the city (Jellinek 1991). These dynamics have led to the periphery of Jabotabek to become a mixture of housing developments and illegal settlements (Cybriwsky and Ford 2003). Lifetime residents are also a major component of the population of the outer zone, with many retaining rural characteristics. In the city core, many older kampung settlements that formerly were squatter settlements have gained legal status, and subsequently have received improved facilities and services. This evidence suggests that in these mega-urban regions a greater proportion of residents in the outer zone are poorer when compared to the city core. A similar spatial pattern of residents' socio-economic status is found in Buenos Aires, Mexico City and Bangkok, where residents on the city periphery have poorer access to services and a lower standard of living (Arrossi 1996, Aguilar 2003, Daniere and Takahashi 1999).

The increasing proportion of the population living in urban areas has led to interest in the health status of urban populations. Urban areas in developing countries have been widely regarded as having lower infant mortality levels than rural areas and therefore regarded as helping cause early age mortality rates to fall (Stephens 1996). However, urban areas have a heterogeneous population and much literature in the past 20 years has analysed intra-urban mortality differentials. Studies in Bangladesh, Egypt and Brazil have each found poorer households in urban areas and those with worse living conditions have considerably higher levels of child mortality than other households (Caldwell et al 2001, Timaeus and Lush 1995).

The CMR in DKI Jakarta (the city core of Jabotabek) has fallen sharply since 1980, as shown in table 3. This fall has mirrored the decline in child mortality rates throughout all of Indonesia. However, just examining this decline fails to recognise any variations within the entire mega-urban region.

Table 3: Child Mortality Rate in DKI Jakarta, 1980-2002/2003

Source	Reference Date	CMR
1980 Census	1976	119
1991 IDHS	1981-91	60
1997 IDHS	1987-97	42
2000 Census	1996	26
2002/2003 IDHS	1993-2002	41 (95% CI: 28-54)

Source: BPS 1983, Indonesian Census 2000 data tapes, Susenas 2002 data tapes, CBS, NFPCB, MOH and MI 1995, CBS, NFPCB, MOH and MI 1992, BPS and ORC Macro 2003

Risk Factors of Child Mortality

In each of these mega-urban regions residents face a number of risk factors of child mortality. The provision of infrastructure and services under the strain of rapid population growth is a cause of problems relating to the living environment of the residents, especially water supply, waste collection and sanitation. Piped water quality is poor, due to siltation of reservoirs caused by rapid development near on the high lands between Jabotabek and Bandung (Dharmapatni and Firman 1995, Jones 1993). Groundwater is also often unusable because of overuse and penetration of supply by seawater (Dharmapatni and Firman 1995, Nur et al 2001). Lack of adequate waste collection systems are a problem, while in Surabaya blockage of drainage canals in low-lying areas causes flooding (Nur et al 2001, Dick 2002).

The links between poor water quality and sanitation and child health have been demonstrated in numerous studies. Streatfield at el (1990) found that environmental conditions in North Jakarta are conducive to high levels of transmission of respiratory, diarrhoeal and parasitic diseases among children. Lenz et al's (1988) study of eleven *kampung* regions in Jakarta concluded that environmental variables, especially source of drinking water, have an impact on becoming ill with malaria or diarrhoea. Albalak et al (2003) analysed the blood lead levels of children in Jakarta and found a higher risk for using piped water. Each of these health problems are major causes of death of children.

The large discrepancies in socio-economic status within these mega-urban regions will affect the relative risk of child mortality within the population. Gwatkin et al (2000) have showed that according to the 1997 Demographic and Health Survey, infant mortality rates in urban areas of Indonesia is

substantially lower for richer wealth quintiles. The richest wealth quintile has an infant mortality rate about three times higher than that of the 2nd poorest quintile.

Wide access in a population to effective health services can reduce the risk of child mortality (Caldwell 1986). Frankenberg and Thomas (2001), using the longitudinal Indonesia Family Life Survey, illustrated how the addition of a village midwife in a community increases birth weight, which can decrease the risk of child mortality. Frankenberg (1995) also found that the addition of a maternity clinic to a village in Indonesia decreases the risk of infant mortality by almost 15 per cent. Streatfield et al (1990) demonstrated that, regardless of the severity of the illness, self-treatment for a few days quite often occurred, which may have a negative impact on the chances of cure. Use of a trained birth attendant, a key factor in reducing early age mortality according to Caldwell (1986), are used almost twice as much by the richest wealth quintile in urban areas of Indonesia compared within with the poorest quintile (Gwatkin et al 2002). In Indonesia's mega-urban regions health services follow a mixed-provider model, with both private and government services operating widely. Private services have been shown to be perceived to be of higher quality than public services and are also more expensive, indicating that accessibility may be a problem (Surjadi 1997).

This evidence illustrates that the population in these mega-urban regions face various risks of child mortality. This suggests that there is significant variation in child mortality risk in Jabotabek, Bandung and Surabaya. It can also be hypothesised that higher CMR exist in the outer zone of these mega-urban regions because of the evidence suggesting that socio-economic status is lower in these areas compared to the city core.

Data and Measurement Issues

For the evaluation and planning of services in relation to child mortality, accurate data are required. This is especially the case since the introduction of decentralisation in January, 2001. Political, administrative and fiscal responsibilities were transferred from the central government to over 400 district governments in many sectors of government, including health. The size of Indonesia and its previous rule by an authoritarian government for many decades meant the handover of these powers was extensive.

Because of the devolution of responsibilities, the demand for accurate child mortality at the small area level has increased since 2001. District governments require these data to be aware of differentials in CMR amongst their citizens, especially between different sub-districts and villages, to assist in the development of health programs within their constituency. These data can also be of use to the central government for comparative purposes between districts, especially the Ministry of Health. These

issues are especially important in mega-urban regions, where the density of population means that a number of district governments operate within a relatively small area.

Ideally, an accurate vital registration system will be able to provide mortality information. However, significant obstacles prevent such a system being fully developed in Indonesia. Firstly, there is a multiplicity of reporting from the government health centres (*puskesmas*), village administrators and the burial office (Rao 2004). Many forms are needed to be completed by government health centres, which often overlap, and there are also uncertainties in regards to the responsibilities of reporting. This has led to the possibility that there is under-reporting (Rao 2004). Private health services need to be more involved in the reporting of mortality, as they are a significant part of the Indonesian health system.

To fill the gap left by vital registration data being incomplete, CMR need to be estimated from other sources. For the purposes of this study, CMR are estimated for sub-districts from the 2000 Indonesian Population Census conducted by *Badan Pusat Statistik* (Statistics Indonesia). The main advantage of using the Census is that it provides full-count data from which rates can be extracted at the sub-district level. This is very important in the context of the data requirements of the newly decentralised government. However, concerns regarding the quality of the Census data have been raised by Hull (2001), which are outlined as follows. These relate firstly to the possibility of an undercount of the population, including those that were away at work from their place of residence during enumeration. The homeless, beggars and ships' crews, which totalled 430,692, were counted separately but with no information demographic about them recorded. Fears of some of these groups about arrest meant that many avoided enumerators. Budget cuts were also a problem, as the pay of interviewers was disrupted and many failed to complete their duties. The measurement of place of residence was also an issue, as a combination of de jure and de facto enumeration was used, with interviewers often used the "official" residence according to the Family Card or Population Card. Each of these issues must be kept in mind when interpreting child mortality data, especially at the small-area level.

The only mortality data provided by the Census are the number of children ever born and children still living, so CMR need to be indirectly estimated. These methods were first developed by Brass (1968). For the purposes of this study, the Trussell equations of the Brass methods, using West model life tables and the software package Mortpak v4.0 are utilised (Trussell 1975, United Nations Population Division 2003). For each age group of women, the proportion of children ever born that have died (D(i)), is converted to a CMR (q(x)), using a multiplier (k(i)) (United Nations 1983: 73). The estimation equation is set out as follows:

$$q(x) = k(i)\, D(i)$$

This relationship between D(i) and q(x) is primarily determined by the age pattern of fertility because it determines the distribution of the length of exposure to the risk of dying of the children of a group of women (United Nations 1983: 73).

The Brass methods are very useful for countries like Indonesia with limited data on mortality. However, these methods do not account for conditions of declining fertility and mortality, which exist in Indonesia's mega-urban regions. A further issue is that the Census asks women to retrospectively answer questions about their birth history, which raises the issue of accuracy of reporting. Due to this issue, when interpreting indirectly estimated CMR it must be noted that they estimate to the number of years before the Census that mortality rates refer (United Nations 1983: 78). The choice of age group of women to use in estimating child mortality is women aged 25 to 29 years because age-specific fertility rates are at their highest and therefore most representative of the whole population (Badan Pusat Statistik and ORC Macro 2003). The average population of the sub-districts in the study area is over 100,000, a more than adequate size with which to use the indirect methods.

Health facility data are used to help explain child mortality differentials. These are extracted from the Village Potential Survey of 2000 conducted by Statistics Indonesia, which surveyed each village in Indonesia about various community-level characteristics.

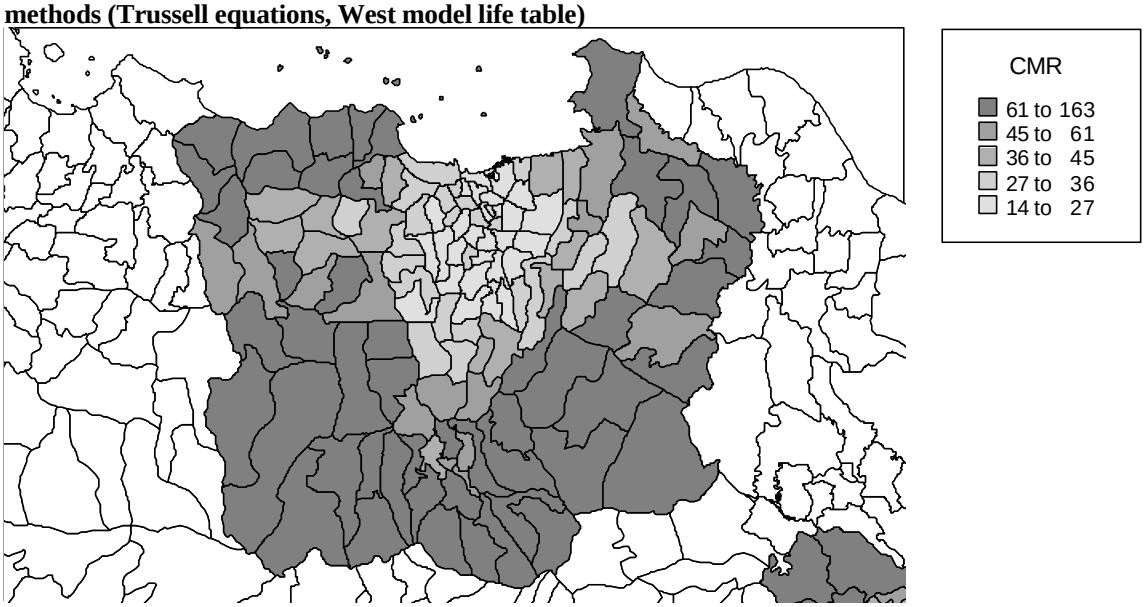
Results

The spatial distribution of CMR[4] for women aged 25-29 for sub-districts of each mega-urban region is shown in figures 2, 3 and 4. The spatial pattern of child mortality in both Jabotabek and Bandung shows large differences in child mortality. In these mega-urban regions, child mortality levels are highest in the sub-districts located furthest away from the city centre. In Jabotabek, some of these sub-districts have CMR levels that exceed 100 deaths per 1,000 births. In the city core the CMR reaches below 20 in a number of sub-districts, with the highest sub-district having 36. In Surabaya, however, the spatial pattern of CMR is more even, with pockets of both very high and very low rates found in both the city core and outer zone.

Close examination of the higher CMR in the outer zone in Jabotabek (figure 2) reveals that in the municipalities of Bekasi, Tangerang and Bogor the CMR is significantly higher than in the city core (in one sub-district in Bogor the CMR is 73). This illustrates that the higher risk of child mortality residents in the outer zone face, even if they live in what can be defined as small cities.

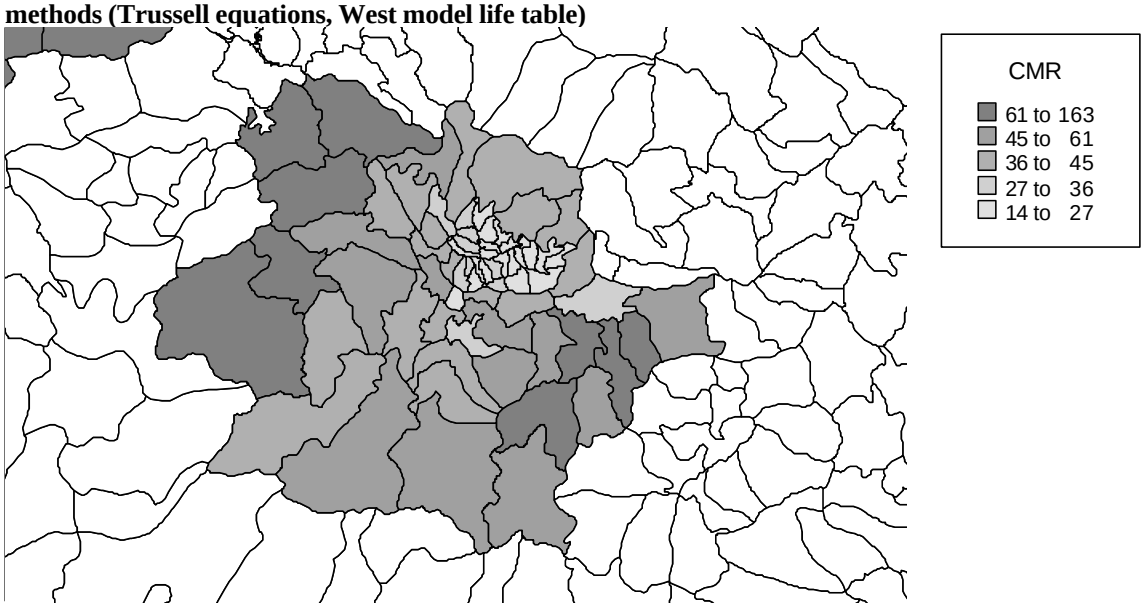
[4] The reference date of the CMR in each sub-district is between late 1995 to early 1997.

Figure 2: Child mortality rates by sub-district (*kecamatan*), Jabotabek, 2000, women aged 25-29, Brass methods (Trussell equations, West model life table)



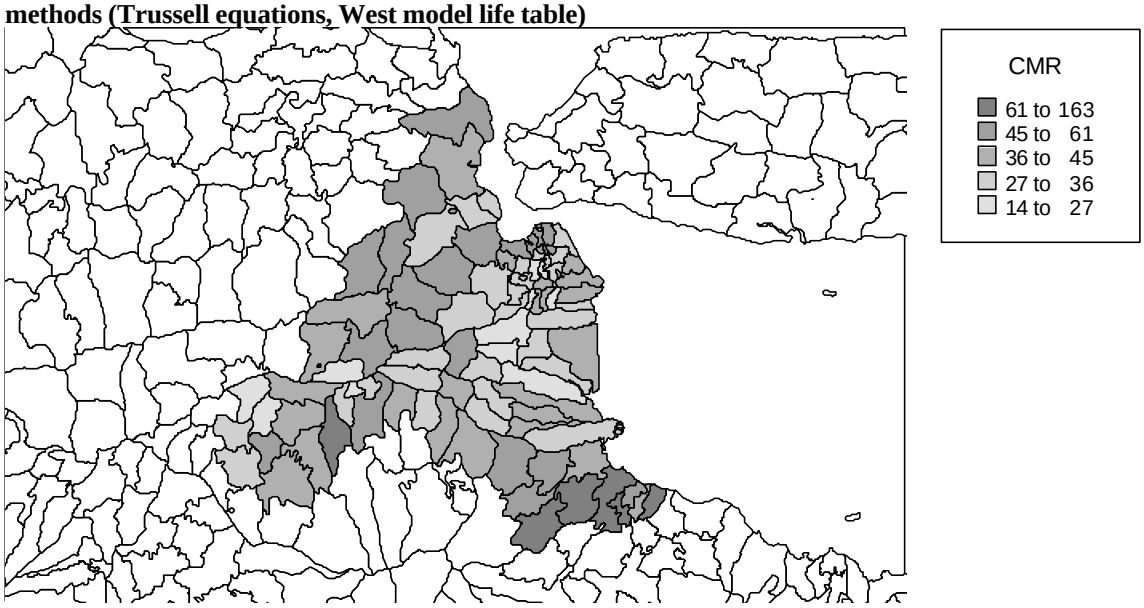
Source: 2000 Indonesian Census data tapes
Note: The reference date of CMR in each sub-district is between late 1995 and early 1997.

Figure 3: Child mortality rates by sub-district (*kecamatan*), Bandung, 2000, women aged 25-29, Brass methods (Trussell equations, West model life table)



Source: 2000 Indonesian Census data tapes
Note: The reference date of CMR in each sub-district is between late 1995 and early 1997.

Figure 4: Child mortality rates by sub-district (*kecamatan*), Surabaya, 2000, women aged 25-29, Brass methods (Trussell equations, West model life table)

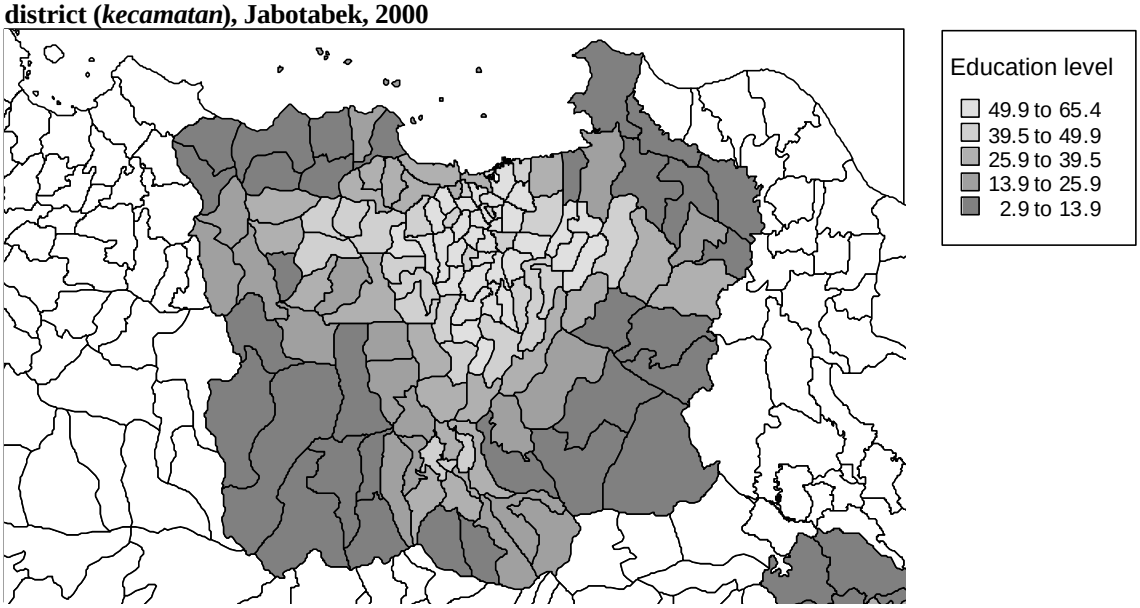


Source: 2000 Indonesian Census data tapes
Note: The reference date of CMR in each sub-district is between late 1995 and early 1997.

One potential explanation for this variation in child mortality risk is differences in socio-economic status, especially education of the mother and father. Figures 5 and 6 show the proportion of the population aged 15 years and over that have completed senior high school in Jabotabek and Bandung. There is a similar spatial pattern of education of the population to child mortality risk, with lower levels of education found in the outer zone where higher levels of child mortality exist. Figure 7 shows that in Surabaya, however, the spatial distribution of education level does not correspond to CMR.

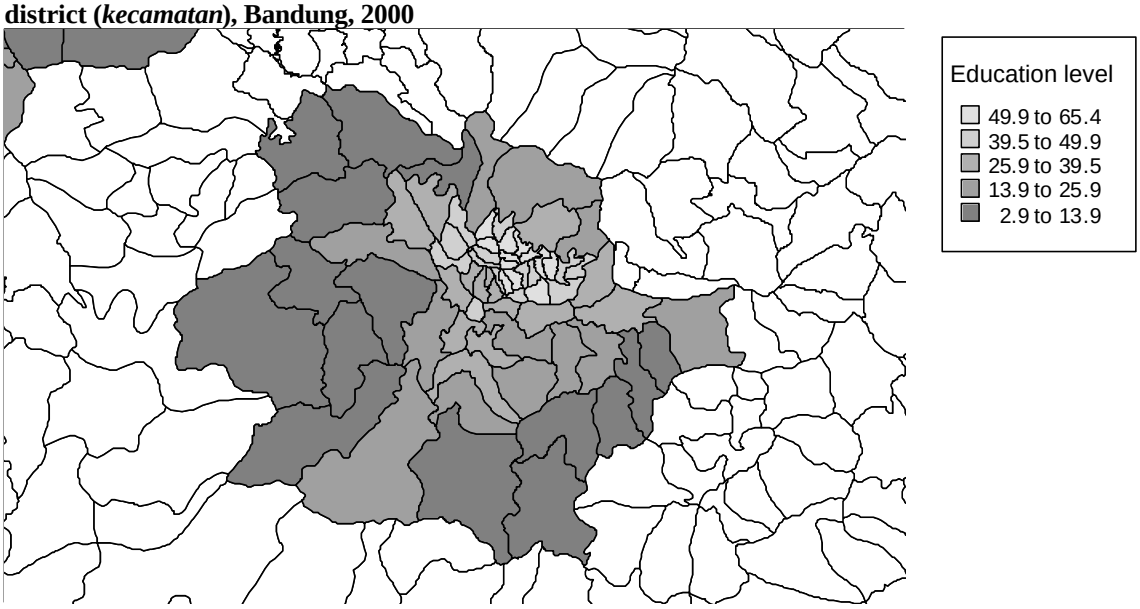
Substantially lower levels of education are found in the outer zone compared to the city core despite the risk of child mortality being quite even throughout the entire mega-urban region. This result indicates that in Surabaya at least, other factors are affecting risk of child mortality in addition to education of parents.

Figure 5: Proportion of population aged 15 years and over that have completed senior high school by sub-district (*kecamatan*), Jabotabek, 2000



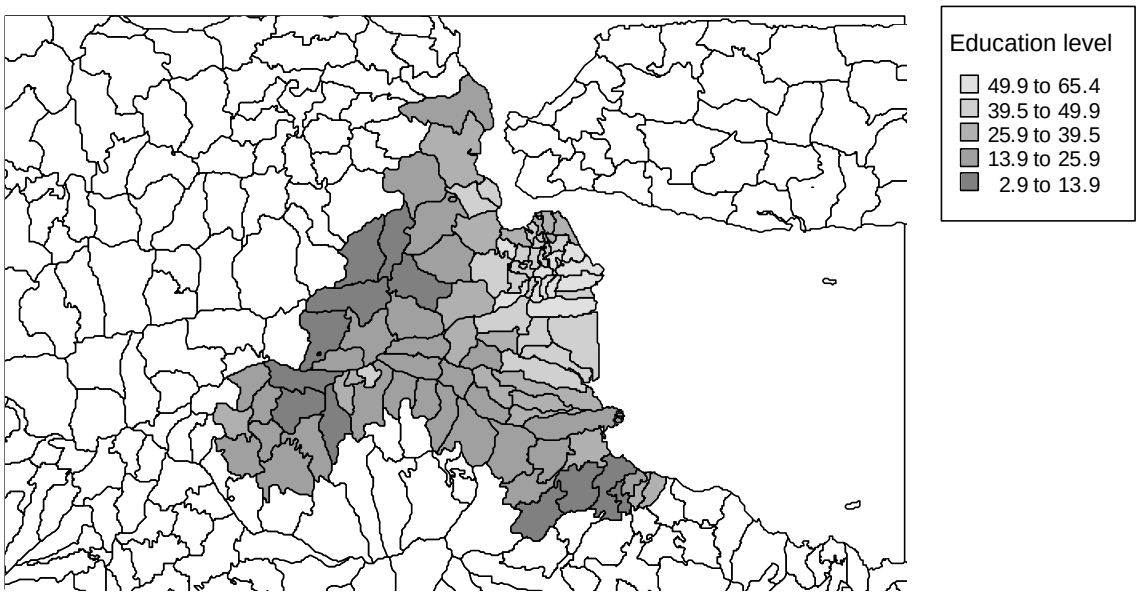
Source: 2000 Indonesian Census data tapes

Figure 6: Proportion of population aged 15 years and over that have completed senior high school by sub-district (*kecamatan*), Bandung, 2000



Source: 2000 Indonesian Census data tapes

Figure 7: Proportion of population aged 15 years and over that have completed senior high school by sub-district (*kecamatan*), Surabaya, 2000



Source: 2000 Indonesian Census data tapes

Access to maternal and child health services that can reduce the risk of child mortality can also explain this variation. Surjadi (2002) found that the proximity of residents to health facilities influences their usage of them. In Indonesia, because more expensive private facilities are perceived to be of higher quality than public services they can therefore be assumed to be better at reducing child mortality risk. Table 4 shows the number of private doctor's practices per 100,000 people in each mega-urban region. The provision of private doctor's practices in each mega-urban region is far greater in the city core than outer zone. This difference is most pronounced in Bandung, where residents in the outer zone have an alarmingly low number of these services available close to them. Surabaya has the smallest difference in private doctor's practice provision, perhaps providing some explanation for its more even distribution of child mortality risk. Although access to private services is determined by factors other than geographic proximity, the residents in the outer zone find it very difficult to easily utilise these services. One explanation for this distribution is that many doctors also work in hospitals that are also more concentrated in the city core. Therefore, they reside and have their practice close to the hospital they work in.

Table 4: Number of facilities per 100,000 population, 2000

	Private doctor's practice	
Mega-urban region	**City core**	**Outer zone**
Jabotabek	32	12
Bandung	40	3
Surabaya	24	16

Source: BPS; 2000 Village Potential Survey, Source: 2000 Indonesian Census data tapes

Discussion

The large inequalities in the risk of child mortality are a major challenge facing the governments of these mega-urban regions. To reduce these inequalities, accessibility to health services needs to be improved to poorer members of the population. The decentralisation of many former central government responsibilities provides an opportunity to make such improvements.

Decentralisation has the potential to improve the efficiency and suitability of government services for the local population. However, there are concerns about whether the rapid decentralisation that is presently occurring will enable this potential to be reached. Concerns relate to the technical capacity of the local governments to properly plan and manage health services because many have recruited non-administrative technical staff (Febriany 2004). Their employees, who are used to working under a highly centralised system of government, have to adjust to working under decentralisation and may lack skills and experience to work under the new system. They also will have to learn how to manage larger budgets. The district health offices will also need to be able to interpret data correctly. The combination of these factors means that proper planning and management of health programs that meets the needs of the communities they govern may not be occurring and the scarce resources available in the health sector may not be used effectively.

With local governments having new powers over their health budgets, concerns have been raised that the district governments will not allocate sufficient resources to the health sector, instead preferring to develop physical infrastructure in other areas. Local governments have expressed concerns that increasing expenditure may not be matched by increased transfers from the central government, impacting poorer districts (Suharyo 2003). As a result, financing for the government health sector has seen funding for some government clinics fall since decentralisation began (Suharyo 2003). For the poorer members of the population, this has caused a worrying trend of fees at some government health centres being increased (Febriany 2003). Previously, about 80 per cent of funds government health centres received from the central government were in the form of a block grant that enabled them to allocate the money as they wished (Febriany 2004). However, under decentralisation they are required

to submit budget plans to the district government for approval and then only receive funds for programs as determined by the office (Febriany 2004). The Ministry of Health's role has also changed substantially because of decentralisation, with it now playing more of a supervisory role. There is a problem of ambivalence and uncertainty regarding the relevant roles of MOH and the local governments, which may affect service delivery (The World Bank 2003).

The increasing role of the private health sector in the past fifteen years is another factor to take into account when considering reducing inequalities in the risk of child mortality. Due to low government funding these reforms were implemented to promote private sector involvement. This has resulted in a significant increase in the number of private hospitals in Indonesia, especially in urban areas (Marzolf 2002). Other services, such as private doctor's midwife's practices also are playing a more substantial role. The importance of these services to the health system is not fully recognised by the Ministry of Health, especially in regard to regulation and monitoring (Surjadi 2002). As mentioned earlier, private health services are regarded as being of a higher quality than public services (Surjadi 1997). However, these services are more expensive than government subsidised services, leading to fears about the access of poorer members of the population to them.

As the private sector continues to expand in Indonesia, the financing of health expenditure in the future is a matter of much debate. Presently 72 per cent of total health expenditure is out-of-pocket (Marzolf 2002). This is explained by the lack of health insurance infrastructure in Indonesia. Only 14 per cent of the population are covered by any form of health insurance (Thabrany 2000). Therefore, many poorer people are at risk of not being able to access health services should private health services expand further.

Conclusion

This paper demonstrates the large differentials in the risk of child mortality faced by residents of Jabotabek, Bandung and Surabaya. In the context of the rapid demographic change and decentralisation that is occurring in these mega-urban regions, ensuring these inequalities are reduced is a major challenge facing policy makers.

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