EXPLAINING HEALTH INEQUALITIES IN THREE MEGA-URBAN REGIONS IN INDONESIA UNDERGOING RAPID DEMOGRAPHIC CHANGE AND DECENTRALIZATION

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International Union for the Scientific Study of Population (IUSSP)
XXV International Population Conference
Tours, France, 18-23 July, 2005

Abstract

Indonesia's rapidly growing mega-urban regions of Jabotabek (Jakarta Extended Metropolitan Region), Bandung and Surabaya each have a large socially and economically heterogeneous population. As a result, substantial spatial and socio-economic inequalities in child mortality risk exist. A means for policy makers to address these differentials is to increase the utilization of trained birth assistance, especially to the urban poor. Multilevel multinomial logistic regression reveals that use of a skilled birth attendant is highly associated with pre-disposing factors (ie, mother's education) whilst highly skilled assistance is more related to enabling factors (ie, household expenditure quintile and proximity to hospitals). Recent decentralization of government powers, however, has caused numerous challenges to policy makers to ensure more equitable access to health services and reduce inequalities in child mortality risk.

The author wishes to acknowledge the assistance of Wendy Hartanto of Statistics Indonesia in providing data from the Village Potential Survey 2000.

Background

Indonesia's mega-urban regions of Jabotabek, Bandung and Surabaya have each experienced high population growth in recent years[1]. Given their heterogeneous population, it is important for policy makers to identify both spatial and socio-economic inequalities in child mortality risk and seek means through which to reduce them. However efforts to address these inequalities face challenges of governance. The decentralization of many former central government powers to district (*kabupaten*) and municipality (*kotamadya*) governments in 2001 has drastically altered the nature of government administration and created multiple jurisdictions in each mega-urban region[2]. This environment provides a complex and dynamic setting through which to analyse inequalities in child mortality risk.

In Indonesia, as in many other developing countries, rapid urbanization has caused many cities to expand beyond traditional administrative boundaries to become "mega-urban regions" (Dharmapatni and Firman 1995; McGee 1995). The three largest mega-urban regions in Indonesia - Jabotabek, Bandung and Surabaya - are each located on the island of Java. Given some of the problems of the conventional urban-rural classification outlined by Champion and Hugo (2004), application of the zonal classification developed by Mamas et al. (2001) and Jones (2002) can aid in determining spatial differences in demographic behaviour. The categorization of each mega-urban region in to a city core, inner zone and outer zone is shown in Appendix 1[3]. Although some of the outer zone is officially classified as rural, given the proximity to urban areas these areas are perhaps best referred to as peri-urban and therefore worthy of inclusion in an analysis of mega-urban regions. Table 1 shows the population in each zone and table 2 illustrates the spatial pattern of population growth in Jabotabek. Its population has increased from 17.1 million to 21.1 million from 1990 to 2000, due both to in-migration and natural growth, with far more growth in Botabek (the inner and outer zone) than the city core. In Bandung and Surabaya, growth in the city core was similar to the surrounding zones (Jones 2002).

[1] Jabotabek is the Jakarta Extended Metropolitan Region.
[2] Jabotabek has twelve district or municipality governments, Bandung two and Surabaya six.
[3] The core of each mega-urban region refers to the traditional administrative boundaries of the city, ie, DKI Jakarta, and the municipalities of Bandung and Surabaya. The inner and outer zone comprise surrounding municipalities and districts, with the inner zone consisting of highly urbanised settlements and the outer zone comprises both more peri-urban settlements. Each sub-district (*kecamatan*) is classified as inner or outer zone is based on spatial location and/or the proportion of residents living in villages (*kelurahan/desa*) classified as urban. The boundaries of the inner and outer zone differ slightly from Jones (2002). For Jabotabek and Bandung, these boundaries are those of the districts and municipalities however in Surabaya certain sub-districts that were not determined to be part of the mega-urban region were excluded.

Table 1: Population of mega-urban regions of Jabotabek, Bandung and Surabaya by zone, 2000 Indonesian Census

Mega-urban Region	City Core	Inner Zone	Outer Zone	Total Population
Jabotabek	8,347,083	8,198,845	4,643,781	**21,189,709**
Bandung	2,136,260	1,887,085	2,270,998	**6,294,343**
Surabaya	2,599,796	1,855,497	2,656,256	**7,111,549**

Table 2: Population of Jabotabek and percentage of people living in DKI Jakarta, 1990-2000 ('000s), 1990 and 2000 Indonesian Census

Mega-urban Region	1990	2000	Annual growth rate (%)
DKI Jakarta (Core)	8,259	8,347	0.2
Botabek (Inner and outer zone)	8,876	12,843	3.8
Total Jabotabek	17,135	21,190	2.1
% of people in Jabotabek living in DKI Jakarta	48.2	39.4	-

Source: Jones (2002): Table 6
Note: The 2000 Population Census figures differ slightly from Jones (2002). Due to differences in definition of the inner and outer zones from Jones (2002), they are combined.

The growth of mega-urban regions has drawn attention to potential health-related problems. Despite residents of urban areas conventionally being regarded as having superior health status to rural residents, Brockerhoff and Brennan (1998) have found this advantage to be declining in developing countries, most notably in large cities. The social and economic diversity commonly found in large cities implies inequalities in child mortality risk may occur (Montgomery et al. 2003). However official statistics conventionally do not provide health-related data within urban areas. In urban Indonesia, despite drastic decreases in the under-five mortality rate (U5MR) in recent decades from 84 in the 1991 Indonesia Demographic and Health Survey (IDHS) to 42 in the 2002/03 IDHS (Central Bureau of Statistics et al. 1992, BPS and ORC Macro 2003). Given the strain on infrastructure placed by rapid population growth, together with the effect of the economic crisis of the late 1990s on the urban poor, close analysis of inequalities is especially important in Indonesia's mega-urban regions[4] Large intra-urban health differentials in child mortality risk by socio-economic group exist in Indonesia, Bangladesh, Egypt and Brazil (Caldwell et al. 2001; Gwatkin et al. 2000; Timaeus and Lush 1995). Spatial inequalities are also present, with U5MR in the urban periphery of Sao Paulo, Brazil from 1970-91 being higher than the city core, other urban areas and, in 1980, even rural areas (Sastry 2004). However, the high mortality of the periphery was explained by poorer socio-economic and environmental characteristics, which has also been revealed in analyses these three mega-urban regions from the 2000 Indonesian Census as well

[4] Each figure refers to the ten years prior to the survey.

as in Buenos Aires, Argentina, Mexico City, Mexico and Bangkok, Thailand (Adair 2004, Arrossi 1996, Aguilar 2003, Daniere and Takahashi 1999).

The evidence reviewed suggests that aggregate-level inequalities in child mortality risk, both spatially and by socio-economic status, are likely to be present in the mega-urban regions of Jabotabek, Bandung and Surabaya. However, detailed analysis of differentials in child mortality risk in these mega-urban regions has been lacking. To explain what may be causing these inequalities in child mortality risk, reference can be made to the Mosley-Chen framework, which postulates that various socio-economic variables influence child mortality risk by operating through more proximate determinants (Mosley and Chen 1984). In urban Indonesia the major cause of under-five mortality is neonatal factors, as reflected in the high proportion of early age mortality occurring in the first 28 days[5] (Tim Surkesnas 2002). Therefore, a major proximate determinant of child mortality risk undoubtedly is pregnancy-related personal illness control, or more specifically, antenatal and birth delivery care[6]. The benefits of appropriate care in preventing and treating complications during pregnancy and delivery have been discussed greatly in recent times (Bhutta et al. 2003; Darmstadt et al. 2005). These not only include decreasing the risk of death from neonatal causes but also increasing nutrition of the newborn, which has long-term health benefits. More generally, health service accessibility has been described as a condition for a country to reach low mortality (Caldwell 1986).

The focus of this paper is on the type of birth attendant utilized, which has been demonstrated to largely reflect the providers of antenatal care as well (Bloom et al. 1999). Consistent with other mega-urban regions, the provision of health services in Jabotabek, Bandung and Surabaya is complex with both Western and traditional practitioners, and government and private providers, prominent (Surjadi 1997). For birth assistance, these range from highly skilled providers such as doctors and obstetricians, skilled providers such as nurses and midwives, through to unskilled (ie, traditional birth attendant or TBA, relative/friend, no one, or other)[7]. Highly skilled providers mainly deliver at either government or private hospitals and their greater expertise is reflected by their significantly cost than other providers. Formally trained nurses and midwives normally deliver either at health care facilities or at the

[5] Neonatal factors include pregnancy-related causes such as neonatal tetanus, sepsis, birth asphyxia and complications of prematurity. Other major causes of death are pneumonia and diarrhoea, whilst malnutrition is a major underlying cause (Pelletier 1995).
[6] Unpublished multivariate analysis of the determinants of child mortality risk using the 2002/03 Indonesian DHS found that use of either a skilled antenatal care of birth delivery provider significantly reduced the likelihood of dying ($p<0.05$).
[7] This question was only asked of children currently alive, so would underestimate the use of unskilled providers.

woman's home, in addition to referring more complicated cases to hospitals. The majority work both for government and in private practice. Despite the availability of modern birth assistance, many women still utilize TBAs that primarily deliver home births[8]. In the three mega-urban regions according to the 2001 National Socio-economic Survey (SUSENAS), skilled providers are the most commonly used (59.1%), followed by unskilled (22.9%) and highly skilled (17.9%)[9]. To decrease U5MR further, a substantially higher use of both skilled and highly skilled providers is required. In the lower mortality setting of urban Vietnam, for example, 92.3 per cent of births are attended by a highly skilled provider[10] (Committee for Population, Family and Children and ORC Macro 2003). Both government and private services skilled and highly providers exist, with the private presence increasing over the past fifteen years.

One of the main missions of Indonesia's health policy is the maintenance and enhancement of quality, equitable and affordable health services (Azwar 1999). However there are concerns whether this is being achieved in these mega-urban regions. Some of these involve decentralization of former central government powers which, with the passing of Laws 22/1999 and 25/1999 in the Indonesian Parliament, was aimed at improving the efficiency and responsiveness of public service delivery. Contrary to its intention, there are concerns that health will not be a priority funding area of the local governments and that central government transfers will be inadequate to appropriately subsidize public services, thus exacerbating already low funding of the health sector in Indonesia by regional standards (Suharyo 2003). These worries are reflected by the increase in fees in some government health centres (*puskesmas*) since the decentralization process began (Febriany 2004). Although some decentralization had occurred in the health sector prior to 2001, local governments had been primarily facilitators of central government programmes. Hence, the technical and managerial capacity of these governments, together with the co-ordination of service provision by multiple authorities within each mega-urban region, are potential obstacles to service provision. Another problem is the substantial disparities in service provision in Jabotabek, Bandung and Surabaya, with a far greater number of hospital beds per person in the city core compared to the inner and outer zone (Direktorat Jenderal Peleyanan

[8] An exception to the pattern that birth assistance provider reflects antenatal care provider is for women that utilize an unskilled birth attendant. The majority of these women saw a skilled provider during the antenatal period. However, according to the 2002/02 IDHS a visit to a provider in the first three months of pregnancy, receipt of iron tablets/syrup and receipt of at least one tetanus toxoid injection are significantly lower ($p<0.05$) for women that subsequently see an unskilled birth attendant (BPS and ORC Macro 2003). This indicates the quality of their antenatal care is low.

[9] These refer to the most qualified birth attendant.

[10] According to the 2002/03 IDHS, U5MR in urban Indonesia was 42 per 1,000 births, compared to 16 in urban Vietnam according to the 2002 Vietnam DHS (BPS and ORC Macro 2003, Committee for Population, Family and Children and ORC Macro 2003).

Medik 2001, Badan Pusat Statistik 2000a). The traditional focus of urban health service provision on expensive curative services, with the development of primary health care services largely occurring in rural areas, also could cause the provision of basic services in these mega-urban regions to be of concern (Streatfield et al. 1991, Caldwell et al. 2001). However the proximity to midwives, as measured provision of private practices, does not exhibit large spatial disparities (Badan Pusat Statistik 2000b).

To distinguish between the different factors that affect birth attendant utilization within the constraints of the Indonesian health system, application of the Andersen Behavioural Model is useful (Andersen and Newman 1973). The model postulates that health service and societal determinants each affect different individual level components. These components are pre-disposing (ie, demographic, social structural and attitudinal-belief characteristics), enabling (ie, the condition allowing a family to satisfy the need to use a health service such as economic resources and service access), and need. Of the enabling factors, proximity of residence to services has been demonstrated as highly associated with birth assistance (Wagstaff 2004). The often urgent need for assistance during labour can lead to utilization patterns to be very homogenous within small areas (Pebley et al. 1996). The unequal distribution of hospitals in these mega-urban regions could lead to very low usage of highly skilled services in some areas. However even living in an area with relatively high concentration of services may not be advantageous to residents if they are unaffordable. The 1997 IDHS indicates that poor people in urban Indonesia have affordability problems, with the use of trained delivery assistance and a doctor varying greatly between wealth quintiles (Gwatkin et al. 2000). Other studies have found low usage of trained providers among the urban poor (Population Reference Bureau 2004, Magadi et al. 2003). In urban sub-Saharan Africa, the non-poor are more likely to have a birth delivery in a facility than the poor, with differences most pronounced Household wealth is particularly vital when an emergency procedure is required, especially for rural-urban migrants that have small social networks in urban areas and therefore difficulties borrowing money (Caldwell et al. 2001).

Although various factors may enable a health service to be utilized, pre-disposing determinants can act as a barrier. Such obstacles include knowledge of available services, traditional health beliefs and a woman's empowerment and confidence to interact with modern health providers (Beegle et al. 2001, Caldwell 1979). These are commonly reflected by the level of the mother's education, which is a strong predictor of use of trained birth assistance and modern health services in general (Wagstaff et al. 2004, Caldwell 1979, Caldwell 1986). Increased maternal age can also reflect knowledge of services, however its effect on use of trained providers has been inconsistent (Thind 2004, Pebley et al. 1996).

Rural-urban migrants particularly may have traditional health beliefs and hence a low likelihood of using a trained provider (Caldwell et al. 2001). Father's education could also reflect such pre-disposing characteristics and has been found to use of skilled care in Indonesia and Guatemala (Thind 2004; Pebley et al. 1996). The effect of community attitudes and variables on an individual's pre-disposition to use a trained provider possible is reflected by community level average years of women's education. This variable has been found to increase the use of a skilled prenatal care provider even after controlling for individual mother's education (Kravdal 2004). Given that more serious cases are often referred to a doctor, although rarely by TBAs, the need component can be assumed to increase the use of highly skilled providers (Alisjahbana et al. 1995). It can be hypothesized that both enabling and pre-disposing factors affect the use of a skilled provider. However enabling factors are important given cost and proximity, rather than social, factors would influence choice of a highly skilled attendant especially when compared with skilled.

The following section explains the data and methodology used to determine the extent of spatial and socio-economic inequalities in under-five mortality rates (U5MR) in the three mega-urban regions and analyse the determinants of birth attendant utilization. These results are then presented, followed by discussion of the findings in the context of the challenges local governments face in reducing these inequalities.

Data and Methodology

To enable local governments to plan for programmes to alleviate U5MR inequalities, accurate data at the small-area level are needed. Due to the lack of an adequate vital registration system in Indonesia, the full-count 2000 Indonesian Population Census is used to estimate U5MR at the sub-district level[11] (Badan Pusat Statistik 2000a). It thus enables more detailed results to be revealed than from sample surveys and overcomes the limitations of many urban health studies that only apply to a specific area of a city. Issues related to data quality, such as the effect of budget cuts, problems of an undercount and measurement of place of residence, have been discussed elsewhere (Hull 2001). However, these are not expected to significantly affect the results obtained.

The Brass method of indirectly estimating mortality, using the Trussell equations, is computed from child survival data using Mortpak v4.0 (Brass and Coale 1968, Trussell 1975,

[11] The average sub-district has a population of 118,074.

United Nations Population Division 2003). U5MR is estimated based on data from women aged 25-29, using West model life tables[12]. Although estimations of U5MR using indirect estimation from the 2002/03 IDHS are positively biased compared to direct estimation, this is not expected to affect the analysis of the differentials.

Data for the multivariate analysis of health service utilization are obtained from the 2001 National Socio-economic Survey (SUSENAS), which is conducted annually (Badan Pusat Statistik 2001). The analysis is restricted to births within the last five years and residents of the districts and municipalities that constitute the three mega-urban regions. The dependent variable is the most qualified birth attendant of the first and last person to attend the birth, categorized as highly skilled, skilled and unskilled, consistent with the description above. Of the enabling factors, household per capita expenditure quintiles (excluding health-related expenditure) and household tenure measure economic status. The provision of hospitals is measured at the district level, based on the number of children aged under five years per hospital bed from administrative data compiled by the Ministry of Health. Private midwife's practice data, measured at the sub-district level, is calculated as the number of children aged under five years per practice from the 2000 Village Potential Survey (*Survei Potensi Desa*) (Badan Pusat Statistik 2000b)[13,14]. The pre-disposing variables are maternal age at birth, mother's and father's education (each measured by highest completed level of education), and sub-district level woman's education[15]. Although each sub-district has a large population, a degree of homogeneity of choice can be expected given the likely spatial variation in U5MR. Some variables that would be expected to be determinants of health service utilization are not measured in the SUSENAS, including religion, ethnicity, and migrant status. No variables are available to measure the need component.

Given the hierarchical nature of the data, where community-level factors are observed to influence the choice of birth attendant, the multivariate analysis needs to account for potential unobserved characteristics at the sub-district level. A two-level multilevel multinomial

[12] Separate analysis has found the 25-29 age group and West model life table are appropriate to use in these mega-urban regions.
[13] Given private midwife's practices are generally provided after-hours by midwives that work in government facilities, they can be assumed to reflect the presence of midwives in each community.
[14] In urban Indonesia, according to the IDHS 2002/03, 81.0% of births delivered by a highly skilled attendants occur in a hospital (government or private), and 41.7% of births attended by skilled personnel are delivered in a private midwife's practice (the most common for skilled personnel, followed by respondent's home) (BPS and ORC Macro 2003). Hospital data are computed for all hospitals (both government and private), excluding mental hospitals. The facility data are matched to the SUSENAS based on location code.
[15] Measured by the proportion of women aged 15-49 that have completed junior high school. In the SUSENAS, the average number of women aged 15-49 per sub-district is 81.

regression model with random effects at both the individual and sub-district level is appropriate in this instance.

The multilevel multinomial regression model with random effects is specified:

$$\log\left(\frac{\pi_{ij}^{(s)}}{\pi_{ij}^{(t)}}\right) = \beta_0^{(s)} + \beta_1^{(s)} x_{ij} + u_j^{(s)} \qquad (1)$$

where *i* signifies the individual level, *j* signifies the sub-district level, π is the probability of choosing a category, *t* is the number of categories (and, in this instance, the reference category), *s* is either of the two other categories, $\beta_0^{(s)}$ is the constant, $\beta_1^{(s)}$ is the vector of explanatory variables, and $u_j^{(s)}$ is the district-level random effect, which is contrast-specific (Rasbash, Steele and Browne 2003). The model is undertaken using the GLLAMM program in Stata 9.0, using 4 quadrature points (Rabe-Hesketh et al. 2004: StataCorp 2005).

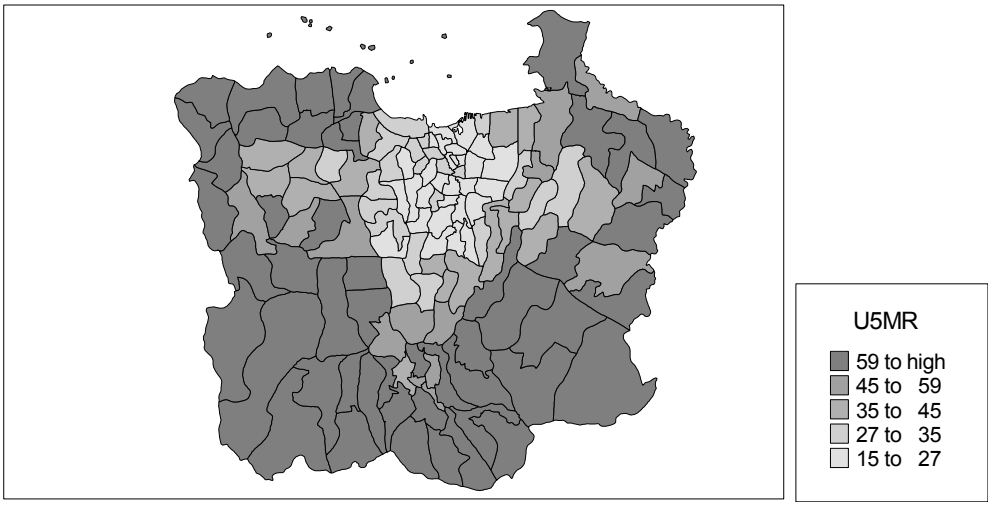
A test of the assumption of the Independence of Irrelevant Alternatives (IIA) is undertaken using the Small-Hsiao test on a single-level multinomial logistic model with the same variables. This revealed the hypothesis that the odds are independent of other alternatives is not rejected. Furthermore, the provision of hospital and private midwife's practices may be affected by unobserved factors that are related to health service utilization, thus causing bias in the model (Frankenberg 1995). An instrumented probit model is used to test this potential source of endogeneity, with three separate models run for each combination of the categories of type of birth assistance (Newey 1987). The two health facility variables are each used as the instrumented variables, with the presence of a private toilet in the house used as the instrument not in the regression. The health facility variables were not found to be endogenous.

Results

Figure 2 shows substantial spatial differences in U5MR exist in Jabotabek and Bandung. A clear spatial pattern is present, with U5MR increasing by distance from the city core. In Jabotabek the U5MR in many sub-districts in the outer zone exceeds the figure for rural Indonesia in the 2002/03 IDHS of 65, whilst in parts of the city core is less than 20 (BPS and ORC Macro 2003). In Bandung, low levels of U5MR in the city core are also present, however in the outer zone the levels of U5MR are not as high as in Jabotabek. In Surabaya, a less obvious spatial pattern exists, with U5MR more evenly spread.

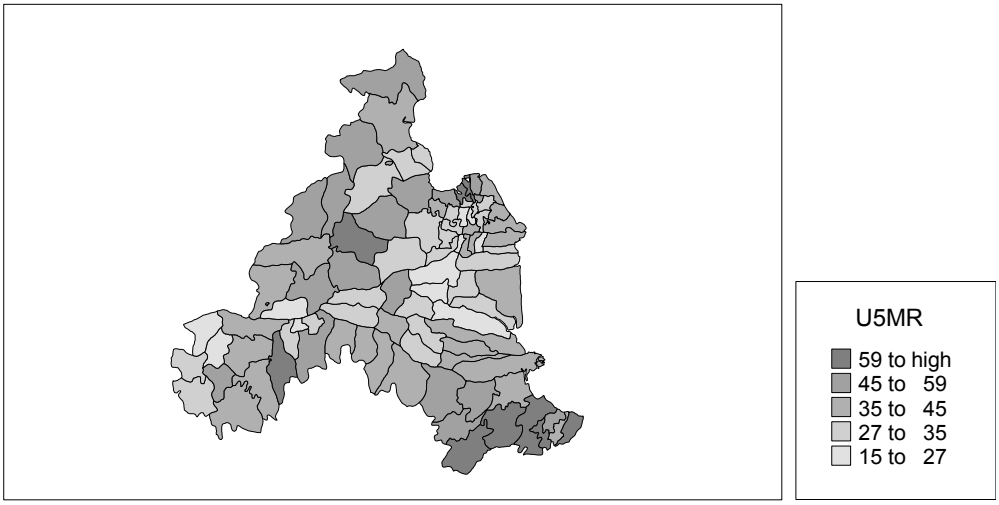
Figure 2: Under-five mortality rate (per 1,000 births) in mega-urban regions by sub-district, 2000 Indonesian Census (continued over page)

Jabotabek



Bandung

Surabaya



Note: The reference dates range from May 1996 to May 1997.

Clearer results can be obtained by measuring U5MR for the zones in each mega-urban region, as shown in table 3. In Jabotabek, the U5MR in the outer zone is a very high 87, more than triple that of the city core and again above the figure for rural Indonesia. For the inner zone the figure is just under double. In Bandung, the U5MR in the city core and inner zone are almost identical to Jabotabek, however in the outer zone it is much lower. In Surabaya, where spatial differences are less apparent, the inner zone has a lower U5MR than the city core.

Table 3: Under-five mortality rate (Brass methods, Trussell equations, women aged 25-29) in mega-urban regions by zone, 2000 Indonesian Census (per 1,000 births)

Mega-urban Region	Zone		
	City Core	Inner Zone	Outer Zone
Jabotabek	26	46	87
Bandung	26	43	54
Surabaya	37	33	49

Note: The reference dates range from May 1996 to May 1997.

Much of these differences can be explained by socio-economic factors. Table 4 shows that inequalities in U5MR by mother's education are also substantial, with a disadvantage for lower educated women[16]. For women with no completed level of education, the U5MR is over 75 in each mega-urban region. However, maternal education does not fully explain the spatial differences. Figure 3 shows the U5MR in each mega-urban region standardized by listing the figure for each level of mother's education. It is always higher in the outer zone compared to the city core and inner zone and in almost all cases is higher in the inner zone compared to city core. For women with no completed level of education that live in the outer zone of Jabotabek the high U5MR is over 120 and in the inner zone 90. For women that have completed at least senior high school and live in the city core of either Jabotabek or Bandung the U5MR is less than 20, which is substantially lower than women of the same education in the outer zone. Furthermore, for women in the city core of Jabotabek with no completed level of education the U5MR is approximately the same as a woman in the outer zone of Jabotabek who has completed junior high school. This evidence suggests that spatial differences in child mortality risk cannot be explained solely by mother's education.

Spatial differences also exist in the type of birth attendant utilized, as shown in table 5. In each mega-urban region, the city core has a higher level of highly skilled provider usage and a lower level of unskilled usage compared to the inner and outer zones. This corresponds closely with differences in U5MR. The Jabotabek and Surabaya city cores have the highest usage of highly skilled providers but both are well under one half of all births. The Bandung

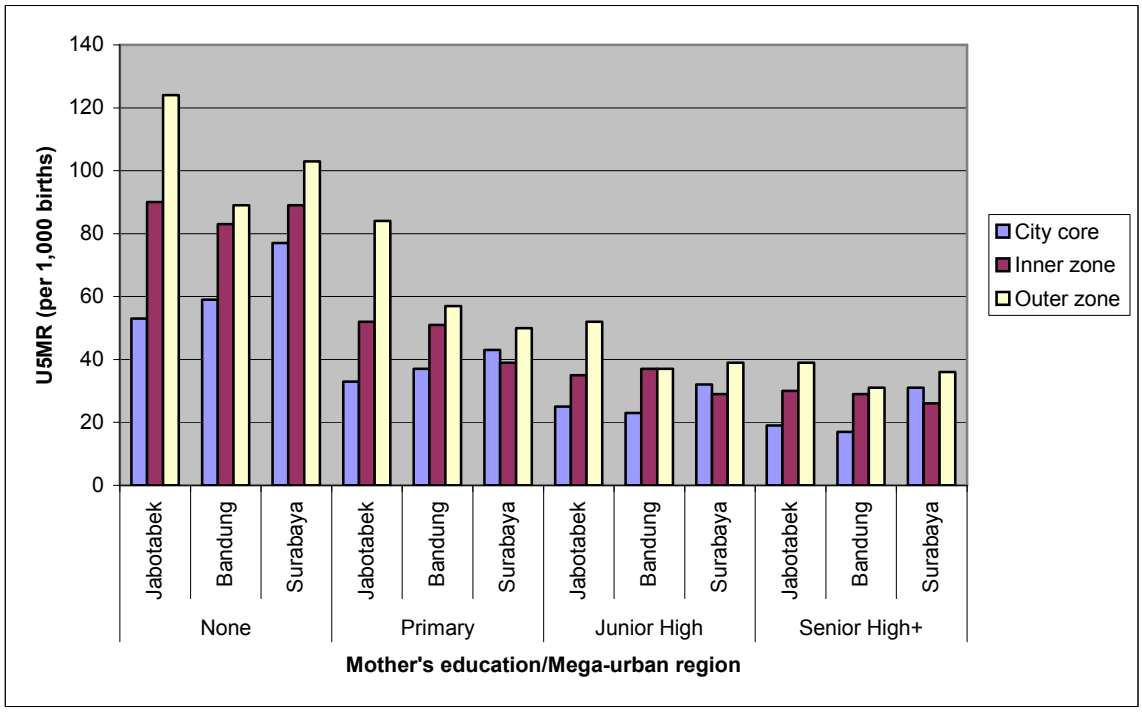
[16] No measure of household wealth is available in the 2000 Indonesian Census.

Table 4: Under-five mortality rate (Brass methods, Trussell equations, women aged 25-29) in mega-urban regions by mother's highest completed level of education, 2000 Indonesian Census (per 1,000 births)

Mega-urban Region	Mother's highest completed level of education			
	None	Primary	Junior High	Senior High+
Jabotabek	80	49	34	27
Bandung	76	48	32	25
Surabaya	88	44	33	31

Note: The reference dates range from September 1996 to February 1997.

Figure 3: Under-five mortality rate (Brass methods, Trussell equations, women aged 25-29) in mega-urban regions by zone and mother's highest completed level of education, 2000 Indonesian Census (per 1,000 births)



city core, however, has a lower use of highly skilled providers and higher use of unskilled providers, which is somewhat surprising given the low U5MR there. Of the inner and outer zones, Surabaya has the lowest level of unskilled usage as consistent with its lower U5MR compared with Jabotabek and Bandung, where unskilled usage is substantially higher. Almost half of all births in Bandung are not attended by a trained provider. The use of skilled providers does not vary greatly spatially, except where there is a high level of unskilled usage.

Table 6 shows that use of a skilled compared to an unskilled birth attendant are affected greatly by pre-disposing factors. Most notably, mother's education is strongly associated with the type of birth attendant utilized. Women that have completed at least senior high school are substantially more likely than a woman with no completed education to use a skilled than an

Table 5: Mega-urban region zone by most qualified birth attendant, 2001 SUSENAS

Mega-urban Region	Zone	Most qualified birth attendant provider				
		Unskilled	Skilled	Highly skilled	Total	N
Jabotabek	City core	3.4	68.0	28.6	100.0	1,796
	Inner/outer zone	31.1	53.9	15.0	100.0	2,085
Bandung	City core	17.3	65.7	17.0	100.0	347
	Inner/outer zone	47.1	46.8	6.1	100.0	428
Surabaya	City core	5.1	61.6	33.3	100.0	297
	Inner/outer zone	16.9	67.6	15.5	100.0	1,546

Note: Weighted cases. No missing cases. Only surviving children. Due to sample design, calculations can only be aggregated to the district/municipality level. Hence, the inner and outer zone are combined.

unskilled birth attendant, controlling for all other factors. Father's education and maternal age at birth also significantly predict utilization of skilled assistance. Sub-district level women's education is significantly associated with skilled usage, even after controlling for individual mother's education. A 10 per cent increase in the proportion of women having completed junior high school increasing the likelihood of a child using a skilled provider by 40 per cent. Of the enabling factors, household expenditure is significant, but not as strong as mother's education. As expected, living in an area with higher provision of private midwife's practices is a predictor of skilled usage whilst hospital provision is understandably insignificant. If the mother and father of the child live with their parents, the use of a skilled attendant is increased compared with not owning the home.

For use of highly skilled providers, enabling factors are especially prominent. Households in higher expenditure quintiles are more likely to have a delivery attended by a highly skilled provider. The importance of household expenditure in predicting use of highly skilled above skilled assistance is worth placing particular focus on. A child in a household in the highest consumption quintile is substantially more likely to use a highly skilled attendant than if in the lowest quintile. The importance of wealth is demonstrated by the increased probability of a birth being attended by a highly skilled provider if the household owns the residence. Higher hospital provision also increases the chance of using a highly skilled provider, after controlling for all other factors. The pre-disposing factors significantly affect use of highly skilled compared to unskilled providers, however when contrast is made with skilled assistance only the highest category of mother's education is significant. The presence of variance at the sub-district level indicates there are unobserved factors at the community level influencing the type of birth attendant utilized. The high correlation of random effects between the skilled and highly skilled categories illustrates how these unobserved characteristics affect both these types of providers similarly. Understandably, minimal correlation of random effects between highly skilled and unskilled providers is present.

Table 6: Multilevel multinomial logistic regression analysis of the determinants of type of birth attendant, coefficients and standard errors, 2001 SUSENAS

Variable	β (S.E.)		
	Skilled v Unskilled	**Highly skilled v Unskilled**	**Highly Skilled v Skilled**
Enabling			
Household expenditure			
0: Lowest quintile	Ref	Ref	Ref
1: Second lowest quintile	0.250* (0.121)	0.542** (0.183)	0.292 (0.150)
2: Middle quintile	0.370** (0.142)	0.985** (0.195)	0.615** (0.148)
3: Second highest quintile	0.760** (0.199)	1.686** (0.239)	0.926** (0.152)
4: Highest quintile	1.065* (0.413)	3.054** (0.434)	1.989** (0.167)
Household tenure			
0: Don't own	Ref	Ref	Ref
1: Live in parents' house	0.429* (0.177)	0.456* (0.207)	0.027 (0.121)
2: Own	0.247 (0.145)	0.543** (0.167)	0.296** (0.094)
Private midwife's practice provision			
0: Low provision	Ref	Ref	Ref
1: High provision	0.404* (0.206)	0.273 (0.250)	-0.131 (0.143)
Hospital provision			
0: Low provision	Ref	Ref	Ref
1: High provision	0.497 (0.285)	0.872** (0.330)	0.375* (0.166)
Pre-disposing			
Mother's education (highest completed)			
0: None	Ref	Ref	Ref
1: Primary	0.562** (0.135)	0.492* (0.232)	-0.070 (0.210)
2: Junior High	1.438** (0.181)	1.403** (0.268)	-0.035 (0.222)
3: Senior High +	2.347** (0.230)	3.110** (0.300)	0.763** (0.219)
Father's education (highest completed)			
0: None			
1: Primary	0.271 (0.145)	0.347 (0.265)	0.076 (0.244)
2: Junior High	0.738** (0.175)	0.698* (0.289)	-0.040 (0.254)
3: Senior High +	1.153** (0.191)	1.514** (0.293)	0.361 (0.248)
Maternal age at birth			
0: 15-19 years			
1: 20-39 years	0.562** (0.161)	0.806** (0.261)	0.244 (0.225)
2: 40-49 years	0.997** (0.294)	1.526** (0.411)	0.529 (0.320)
Sub-district level women's education	0.036** (0.005)	0.043** (0.007)	0.007 (0.004)
Constant	-2.841** (0.347)	-6.428** (0.506)	-3.587** (0.393)
$Var(u_j^{(s)})$	1.878** (0.287)	2.665** (0.425)	0.627** (0.117)
$Cor(u_j^{(unskilled)}, u_j^{(skilled)})$	0.547		
$Cor(u_j^{(unskilled)}, u_j^{(h.skilled)})$	-0.073		
$Cor(u_j^{(skilled)}, u_j^{(h.skilled)})$	0.875		
Total cases	6,108		
Missing	391		
Log likelihood	-4049.283		

* p<0.05 ** p<0.01

Discussion and Conclusion

Large inequalities in child mortality risk, both spatially and socio-economic status, exist in the mega-urban regions of Jabotabek, Bandung and Surabaya. These are so stark that in parts of the urban periphery and the lowest socio-economic groups the level of early age mortality is well above that of rural Indonesia. Although the indirect estimates tend to over-estimate U5MR, the high levels of child mortality risk present are quite alarming. Lower socio-economic status, measured by maternal education, in the outer urban areas does not explain all of the spatial differences. This indicates that some community characteristics have some influence on child mortality risk. These results illustrate the challenge for the governance of these mega-urban regions, where decentralization of former central government functions has resulted in increased powers to numerous district-level governments. To help reduce the inequalities, increased utilization of skilled and highly skilled birth attendants is one effective approach the government can take given the epidemiological profile present and the persistent high usage of unskilled providers by sections of the population.

The multivariate analysis presented demonstrates how the type of birth attendant utilized is related to a combination of factors. It is associated with enabling factors such as household consumption and proximity of private midwife's practices. However the relationship with pre-disposing factors such as mother's education, sub-district level woman's education and maternal age demonstrate the importance of attitudinal and behavioural characteristics both at the household and community level. This indicates that traditional attitudes to health care use, especially in the periphery, still exist in the mega-urban regions. Improving primary health care through increasing midwife numbers, especially in high mortality areas, could be expected to have some effect on both the accessibility for the poor and perhaps lead to a change in attitudes to modern services. The rapid shift from use of unskilled to skilled providers in rural areas following the beginning of the village midwife programme provides evidence that such policies can be effective[17].

The use of highly skilled providers, however, is primarily associated with enabling factors. Household consumption is the strongest explanatory variable, indicating that affordability acts as a major barrier. The impact of wealth, especially given the often urgent need for highly skilled assistance and the lower social support networks than exist in rural areas, is sown by the significance of household ownership. Given the relative weakness of the pre-disposing factors, government policy to increase usage of highly skilled providers needs to be aimed

[17] In needs to be borne in mind that some villages in the outer zone of the mega-urban regions are classified rural, and would have been included as part of the Village Midwife program.

primarily at increasing affordability for the urban poor. Additionally, improved provision of highly skilled providers primarily in the inner and outer zone would also be beneficial, perhaps in government clinics. The increased presence of private hospitals in the health sector in recent years that may choose to set up in wealthier areas in the city core emphasizes the importance of provision of highly skilled practitioners on the urban fringe.

Meeting the central government's stated aim of increasing affordability and equitability of health services is a significant policy challenge, compounded by the persistent willingness of many sections of the population to use traditional health service providers, rapid population growth and the increased powers the multiple local governments in each mega-urban region have gained since decentralization. Co-ordination of government provision of services is difficult in the new jurisdictional environment and especially problematic in the early years of the new governmental structure. Services to the urban poor, particularly primary health care, need to be accessible. The problems in obtaining timely and accurate data at the small-area level, both health and demographic, concerns over the capacity of local government officials to implement health programmes and sufficiently fund services make this task more difficult. Furthermore, the increased provision of health services by private providers means more health services are beyond direct government control. Ensuring more equitable access to trained birth assistance is not the only means to reducing inequalities in child mortality risk - improvements to child nutrition, provision of clean water, and household health-related behaviour could also be effective.

The results discussed can only be identified by focusing on these mega-urban regions as important areas of demographic change. Large spatial and socio-economic inequalities in child mortality risk and health service utilization may otherwise be ignored if intra-urban heterogeneity not analysed and conventional urban-rural distinctions are made. Additionally, the significance of community as well as household level variables and the presence of unobserved characteristics at the sub-district level as determinants of birth attendant utilization emphasize that spatial differences in child mortality risk are not solely due to household level socio-economic differences. Further analysis of inequalities in urban population health status will be facilitated by improvements in the availability of accurate small area level data.

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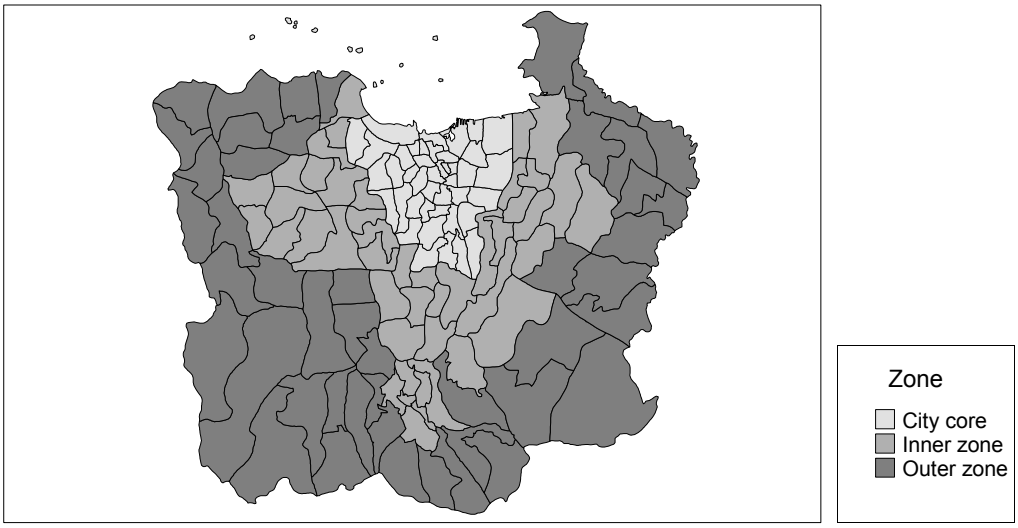
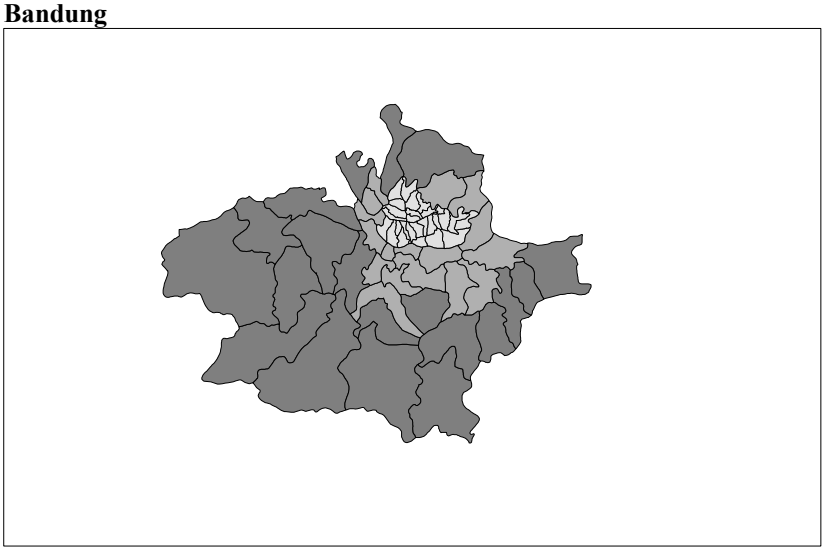
Appendix 1: City, core inner zone and outer zone of mega-urban regions

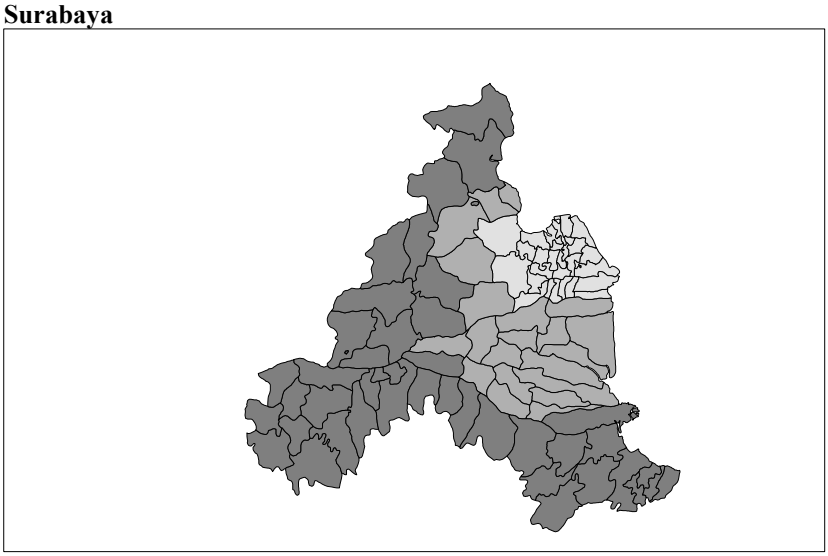
Jabotabek



Bandung



Surabaya



Appendix 2: Univariate statistics of dependent and explanatory variables in multivariate analysis, 2001 SUSENAS

Variable	%	Variable	%
Dependent		***Explanatory - Pre-disposing***	
Most qualified birth attendant		*Mother's education (highest completed)*	
0: Unskilled	20.6	0: None	11.9
1: Skilled	60.2	1: Primary	31.1
2: Highly skilled	19.3	2: Junior High	18.7
Total	100.0	3: Senior High +	34.9
		Missing	3.4
Explanatory - Enabling		Total	100.0
Household expenditure			
0: Lowest quintile	26.7	*Father's education (highest completed)*	
1: Second lowest quintile	23.2	0: None	10.1
2: Middle quintile	21.9	1: Primary	25.3
3: Second highest quintile	18.4	2: Junior High	16.4
4: Highest quintile	9.8	3: Senior High +	44.5
Total	100.0	Missing	3.6
		Total	100.0
Household tenure			
0: Don't own	26.4	*Maternal age at birth*	
1: Live in parents' house	15.6	0: 15-19 years	6.2
2: Own	57.9	1: 20-39 years	89.6
Total	100.0	2: 40-49 years	3.5
		Missing	0.6
Private midwife's practice provision		Total	100.0
0: Low provision	49.8		
1: High provision	50.2	*Sub-district level women's education*	
Total	100.0	Percentage of women 15-49 in sub-district that have completed junior high (median)	58.9
Hospital provision			
0: Low provision	62.4	Number of cases	6,499
1: High provision	37.6	Number of sub-districts	305
Total	100.0		