What do we know about adult mortality and data quality in Peru? Mortality coverage levels and trends from recent decades

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Abstract

Accurate knowledge of adult mortality levels and trends in the developing world is hampered by its widespread lack of complete vital registration systems. Although knowledge of infant and child mortality was once affect by the same problem, survey-based techniques have been more successful in estimating child and infant than adult mortality. The main objective of this paper is to estimate mortality rates for the population aged 5 and above, in Peru by sex. The study evaluates the degree of coverage, and corrects the level of mortality, when necessary, using different methodologies. The literature does not indicate the best method to investigate mortality data problems. Thus, the implementation of alternative methods will improve the understanding of the mortality levels and trends in Peru in recent decades.

Key words: Peru, adult mortality, demographic methods.

Resumen

¿Qué sabemos acerca de la mortalidad y calidad de datos en Perú? Niveles de cobertura de mortalidad y tendencias en décadas recientes

El conocimiento preciso sobre los niveles de mortalidad en adultos y sus tendencias en países en desarrollo ha sido detenido por una falta generalizada de sistemas de registros vitales. A pesar que el conocimiento sobre mortalidad infantil se vio alguna vez afectado por el mismo problema, técnicas basadas en encuestas han sido más efectivas al estimar la mortalidad infantil y adulta. El principal objetivo de este artículo es estimar las tasas de mortalidad para la población de cinco años y más, por sexo, en Perú. El estudio evalúa el grado de cobertura y corrige el nivel de mortalidad, cuando es necesario, usando diferentes metodologías. La literatura no indica el mejor método para investigar problemas de datos sobre mortalidad. De esta forma, la implementación de métodos alternativos mejorará la comprensión de los niveles de mortalidad y sus tendencias en Perú en décadas recientes.

Palabras clave: Perú, mortalidad adulta, métodos demográficos.

Introduction

The knowledge of the levels and trends of adult mortality in developing countries is limited by the quality of available data, for both death counts and population. The most common problems faced by developing countries are incomplete coverage of the vital registration system, errors in age declaration for both population and death (United Nations, 1983; Preston, Elo, Stewart, 1999).

Latin America, and Peru specifically, have undergone major demographic changes (Chackiel and Plaut,1996; Chackiel, 1999). Although mortality levels are still high, in comparison to the developed world, Peru observed a rapidly decline in child and infant mortality because of medical and other technological changes. In addition, economic modernization and changes in social and cultural norms are related to a rapid decline in fertility and important changes on how parents relate and invest in their children. Those two elements (fertility and infant mortality) of the demographic transition have been widely studied in the area (INEI, 1986; Guzman,1989; Chackiel,2004; Celade,2004; INEI, 2005)

Adult mortality, however, compared to fertility and infant and child mortality is much less understood in the large majority of developing countries, and Peru is no exception (Timeaus, 1996). Nevertheless, it is important and relevant to study and understand levels and patterns of adult mortality in a scenario of rapid population aging and major changes in the socioeconomic scenario.

The main objective of this paper is to estimate mortality rates for the population aged 5 and above, in Peru by sex. The study evaluates the degree of coverage, and corrects the level of mortality, when necessary, using different methodologies. The literature does not indicate the best method to investigate mortality data problems. Thus, the implementation of alternative methods will improve the understanding of the mortality levels and trends in Peru in recent decades.

Data

Estimating adult mortality using census and vital registration data requires the application of a variety of evaluation methods, adjust them, if necessary, and some key assumptions that are discussed in the following section. The data needed are two population age and sex distributions from successive censuses, and an age and sex distribution of deaths reported either in the population census or some sort administrative data record (vital registration).

We obtained population distribution by age and sex from the population censuses for 1993 and 2005. The National Statistics Office run the census in 1836, 1850, 1862, 1876, 1940, 1961, 1972, 1981, 1993 and 2005. The first 4 censuses listed only provide population totals by political division and sex without an age breakdown. From 1940, censuses provide age group distributions of the population, nevertheless age declaration in the

1940 census is very inaccurate and an improvement was observed in 1961 census (Arriaga, 1966). It is important to remark that the age declaration has been improving with time (Arriaga, 1966; Moser 1985).

TABLE 1
DATA AVAILABILITY

First census	1993
Date	11/07/1993
Age range for population	0-98
Second census	2005
Date	15/06/2005
Age range for population	0-98
Age range for deaths	0-100+
Time period of deaths	2000-2004

An examination of 1961-1981 census data shows a slight deficit of males for almost all age groups, except the youngest (Moser, 1985). For 1993 and 2005 censuses we find the same pattern observed by Moser (1985). A closer comparison of both single age distributions suggest an under enumeration of population aged 0-2 in 1993 census, the number of survivors of those born from 1991 to 1993 in 2005 census was greater than the observed in 1993 census.

We obtain mortality data from vital registration, the data correspond to the years 2000-2004. Historically, vital system statistics are considered of bad quality (Arriaga, 1966; Jaspers and Orellana, 1996). A detailed revision of the coverage of death registration systems for Latin America was performed by Jaspers and Orellana (1996). In the specific case of Peru, they showed that the omission rate was around 45 per cent in the period between 1960 and 1985 and it appears to have not dropped since then.

We also used mortality estimates from the AMDC project (reference here). Hill & Choi (2004) estimated vital registration coverage and analyzed data quality for a series of developing countries in the world. They produced estimates for Peru from the early 1960 to the 1990s. We use their estimates to analyze the recent trend in Peruvian mortality.

Methods

The death distribution methods are widely used to estimate adult mortality (Timaeus, 1991). They compare the distribution of deaths by age with the age distribution of the living and provide age patterns of mortality in a defined reference period. There are two major approaches: the General Growth Balance Methods (Hill, 1987), and the Synthetic Extinct Generation method (Benneth & Horiuchi, 1981). The death distribution methods make several strong assumptions: that the population is closed to migration that the completeness of recording of deaths is constant by age, that the completeness of recording of population is constant by age, and that ages of the living and the dead are reported without error.

The Bennett and Horiuchi (1981) method is a synthetic cohort analog of Vincent's (1951) method of extinct generations, known as Synthetic Extinct Generations (SEG) method. In these methods, age-specific growth rates are used to convert an observed distribution of deaths by age into the corresponding stationary population age distribution. Since in a stationary population the deaths above each age *x* are equal to the population aged *x,* the deaths in the stationary population above age *x* provide an estimate of the population of age x. The completeness of death registration relative to population is estimated by the ratio of the death-based estimate of population aged *x* to the observed population aged *x*. The synthetic estimate of the population aged *x* is given by:

$$\hat{N}(x) = \int D(y) e^{\int r(z) dz} dy \tag{1}$$

where $N(x)$ is the estimated population aged *x*, $D(y)$ is the observed number of deaths at age *y*, and $r(z)$ is the age-specific growth rate of the population at age *z*.

The General Growth Balance (GGB) method (Hill 1987) is a generalization to all closed populations of the Brass (1975) Growth Balance method. The Demographic Balancing Equation expresses the identity that the growth rate of the population is equal to the difference between the entry rate and the exit rate. This identity holds for open-ended age segments *x+*. The entry rate *x+* minus the growth rate *x+* provides a residual estimate of the death rate *x+*. We can then estimate the residual from population data from two population censuses and compared to a direct estimate using the recorded deaths (from the census or vital registration), and comparing these two records we can estimate the completeness of death recording relative to population (Hill, 2003).

Hill (1987) shows that:

$$\frac{({}_5N1_{x-5} * {}_5N2_x)^{0.5}}{5*(N1_{x+} * N2_{x+})^{0.5}} - \frac{1}{t}\ln\left(\frac{N2_{x+}}{N1_{x+}}\right) \approx \frac{1}{t}\ln\left(\frac{k_1}{k_2}\right) + \frac{(k_1 * k_2)^{0.5}}{c} * \frac{D(x+)}{t*(N1_{x+} * N2_{x+})^{0.5}} \tag{2}$$

Where *N1* and *N2* are population counts at two time points separated by *t* years, *D* are recorded intercensal deaths, and k1, k2, and c are respectively the completeness of the first and second population counts and the intercensal deaths.

Hill and Choi (2004) proposed that the combination of SEG and GGB might be more robust than either one individually. The combined method consists of first applying GGB to estimate any changes in census coverage (k1/k2), using the estimate to adjust one or other census to make the two consistent, and then applying SEG using the adjusted population data in place of the reported.

The death distribution method has also an important limitation. Since they compare a distribution of deaths to an intercensal population, they estimate intercensal completeness of mortality estimates, and not the completeness at the beginning or end of the intercensal period. This matter is of particular importance when a distribution of deaths comes from data from the latest census or when vital registration is available for recent years (Hill et al, 2009). For example, in the case of Peru we obtained mortality data from 2000 to 2004. Thus, the age pattern of mortality reflects the age distribution of the population around the time of the the second census, not to the average age distribution of the population over the intercensal period. In order to take this into account, we should first used the deaths and the population from the second census to calculate age-specific death rates, and then estimated average annual deaths for the intercensal period by applying the death rates to an estimate of the age distribution of the intercensal population.

The assumption of both the SEG and GGB methods that the population is closed to migration is also of importance to Peru, since it has experienced recent net emigration (INEI, 2009). Both the SEG and GGB methods use information on deaths and growth rates cumulated above a series of ages *x*. If there is some age *x* above which net migration is negligible, the performance of the methods above that age will be unaffected. The intercept and slope of the GGB method were obtained by orthogonal regression to points for the ages 35+ to 75+. The coverage of deaths for the SEG method was obtained by averaging the estimates for the age ranges 35+ to 75+. Finally the combined method was applied by using GGB estimates to adjust the data for the estimated census coverage change and then applying the SEG method.

Measures of adult mortality

We also show summary measures of adult mortality to illustrate our analysis. We assume that adult mortality can be defined as starting at age 15, about the inflection point at which declining mortality risk in childhood are replaced by rising risks in adulthood. The primary measure of adult mortality used in this paper is the probability of dying between the age 15 and 60, ${}_{45}q_{15}$. This measure covers a substantial age range, but avoids the problems inherent in the measurement of old age mortality (Hill, 2003).

Results

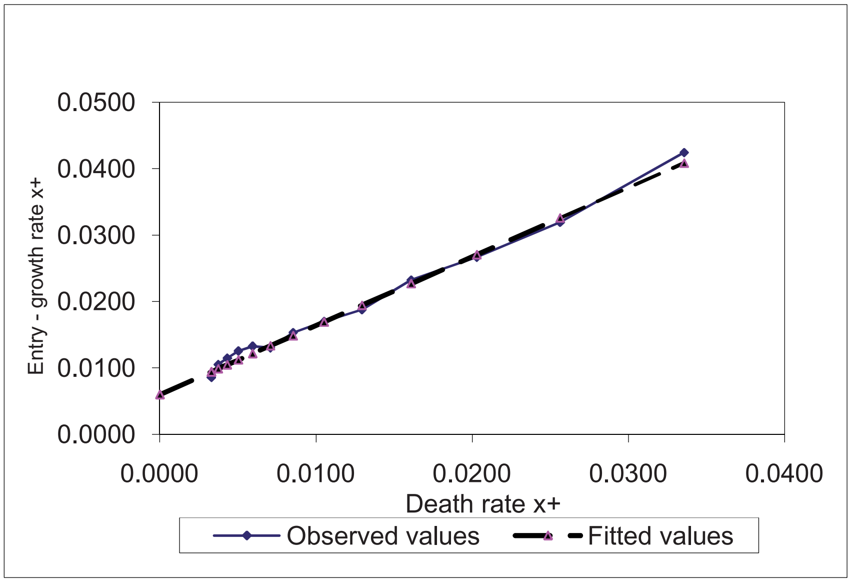
National Levels

The performance of the evaluation methods are better seem graphically, Figure 1 to 3 show the results for GGB, SEG and SEG-adjusted. Figure 1 shows the dignostic plot for the General Growth Balance method. For the GGB method, the x-axis shows the observed death rate for ages x+, and the y-axis represents the death rates for ages x+ obtained by residual. The results from the SEG method are presented in Figure 2 and Figure 3. For the SEG method, the figure show the ratio of the death-based estimate of population aged *x* to the observed population aged *x.*

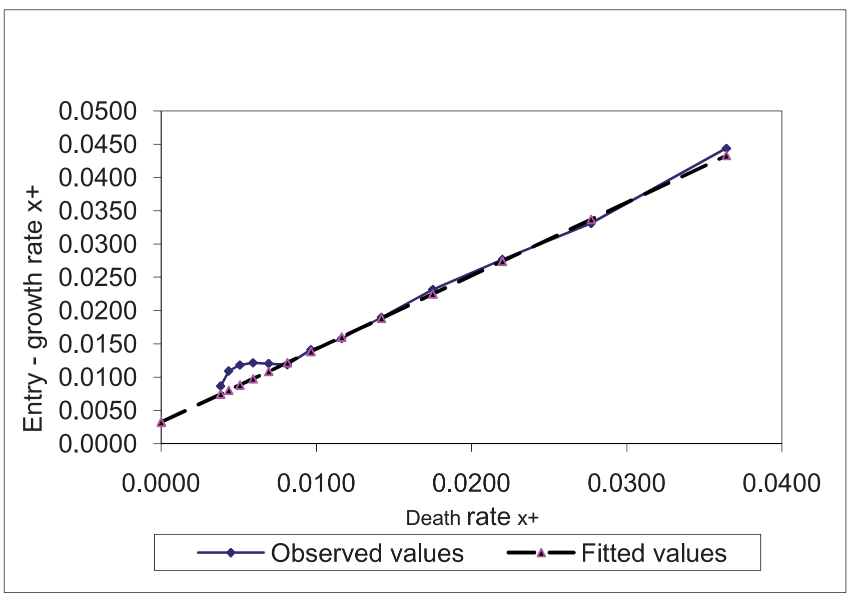
Following Bhat (1990), we fitted a orthogonal regression to estimate a straight line to the points for the age segments considered in the GGB estimation. The slope of the fitted to the points estimates the adjustment factor necessary to correct observed death rates to the death rates estimated by residual. The intercept of the line provides an estimate of the relative coverage between the two censuses used in the analysis. The analysis of the graph confirms our concern about the assumption of closed population in Peru. The points at young ages or both males and females are very irregular and off the fitted line, and the estimate of census coverage indicates better coverage in the first census what is consistent with problems arising from net emigration (Hill & Choi, 2004). Overall, the fit of the observations (death rates) are quite good, and improve over time and for age groups 35 and above the results imply that age reporting is surprisingly good and the assumptions of the GGB method are met.

FIGURE 1
ESTIMATION OF COMPLETENESS OF DEATH RECORDING BY GENERAL GROWTH BALANCE METHOD. PERU 1993-2005

Females



Males



Source: Registered Deaths and Population age distribuition: from data at the Central Statistical Office (INEI), Peru 2005.

TABLE 2
SUMMARY ESTIMATES OF COVERAGE AND THE ADJUSTED PROBABILITIES OF DYING BETWEEN 15 AND 60, $_{45}Q_{15}$, RESULTING FROM THE APPLICATION OF METHOD OF SYNTHETIC EXTINCT GENERATIONS, PERU 2000-2004

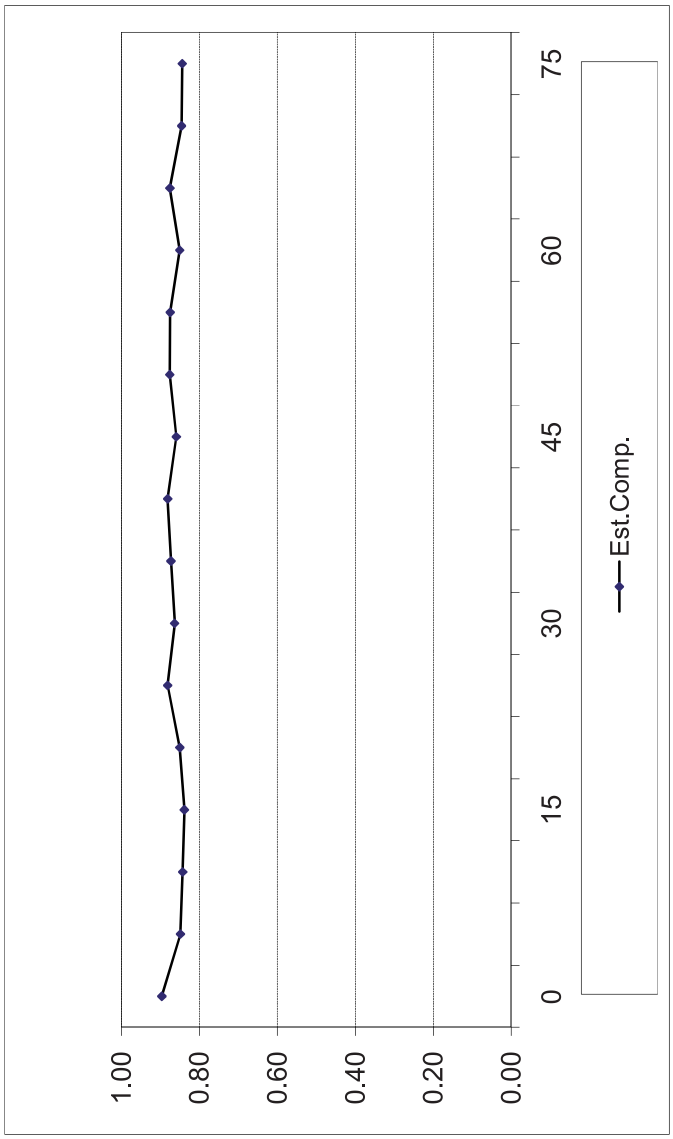
Fitting range and result	Males	Females
Age range 5+ to 75+		
Average completeness	0.7367	0.7062
Adjusted $_{45}q_{15}$	0.1518	0.1148
Age range 5+ to 75+ Adjusted for GGB estimate of coverage change		
Average completeness	0.8983	0.9435
Adjusted $_{45}q_{15}$	0.1295	0.0904
Age range 35+ to 75+		
Average completeness	0.7821	0.7653
Adjusted $_{45}q_{15}$	0.1436	0.1064
Age range 35+ to 75+ Adjusted for GGB estimate of coverage change		
Average completeness	0.8654	0.9308
Adjusted $_{45}q_{15}$	0.1331	0.0914

The results for the slope, for both males and females, and census coverage are show in Table 3. The results indicate that death registration in Peru is almost complete, the slope of the line indicates a small adjustment of 1,07 to the death rates for males and 1.02 for females, indicating coverage of 93 per cent for males and 98 per cent for females. The results hold also when we fitted the method to the open-ended interval 35 and over to avoid possible distortions caused by migration. The probability of dying between ages 15 and 60, considering the adjustment factors, are 0.1248 and 0,085 for males and females, respectively.

Table 2 and Figure 2 shows the results obtained from application of SEG Method. The results are very different from the application of the General Growth Balance. SEG estimates death coverage of about 80 per cent for both sexes. The results obtained in the GGB estimation indicated census coverage changes in Peru for the period. The ascending completeness of mortality record by age, shown in Figure 2, is a result of the change in census coverage discussed before Hill & Choi (2004).

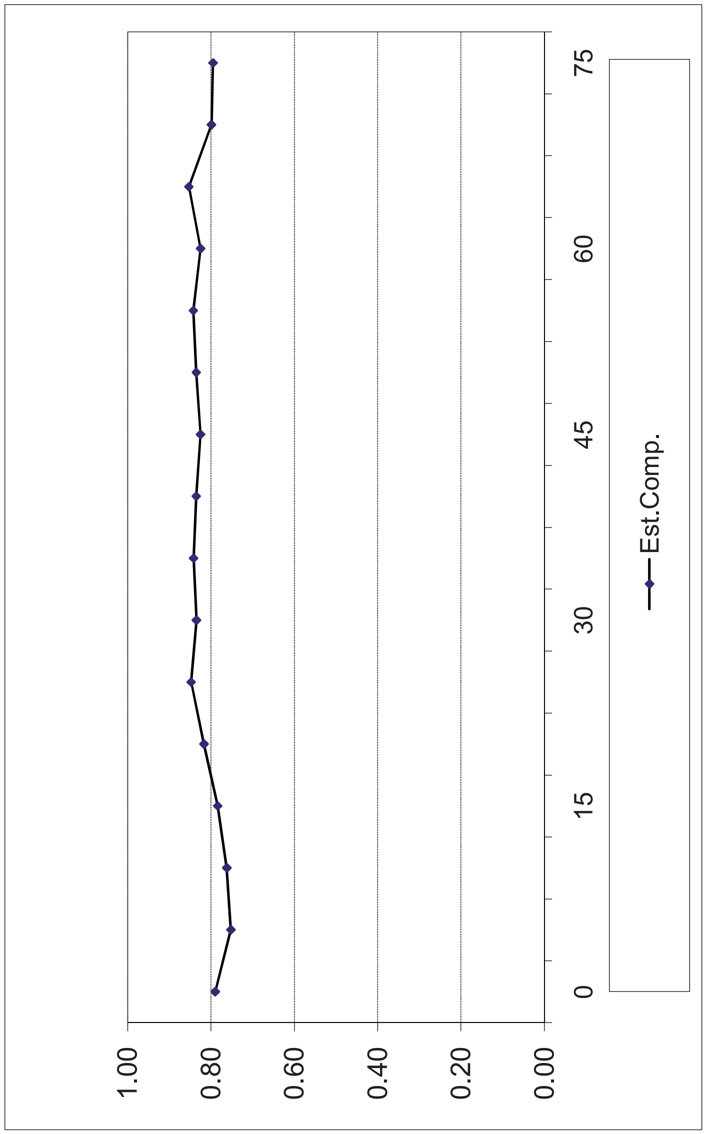
We used the procedure developed by Hill and Choi (2004) to overcome this limitation. Figure 3 shows the death coverage by age without the ascending pattern observed before. By applying a correction to census coverage, we estimated completeness of death registered at 86 per cent for men and 93 per cent for females, much closer to what was obtained using the GGB method.

FIGURE 2
ESTIMATION OF COMPLETENESS OF DEATH RECORDING BY METHOD OF EXTINCT GENERATIONS. PERU 1993-2005 (MALES)



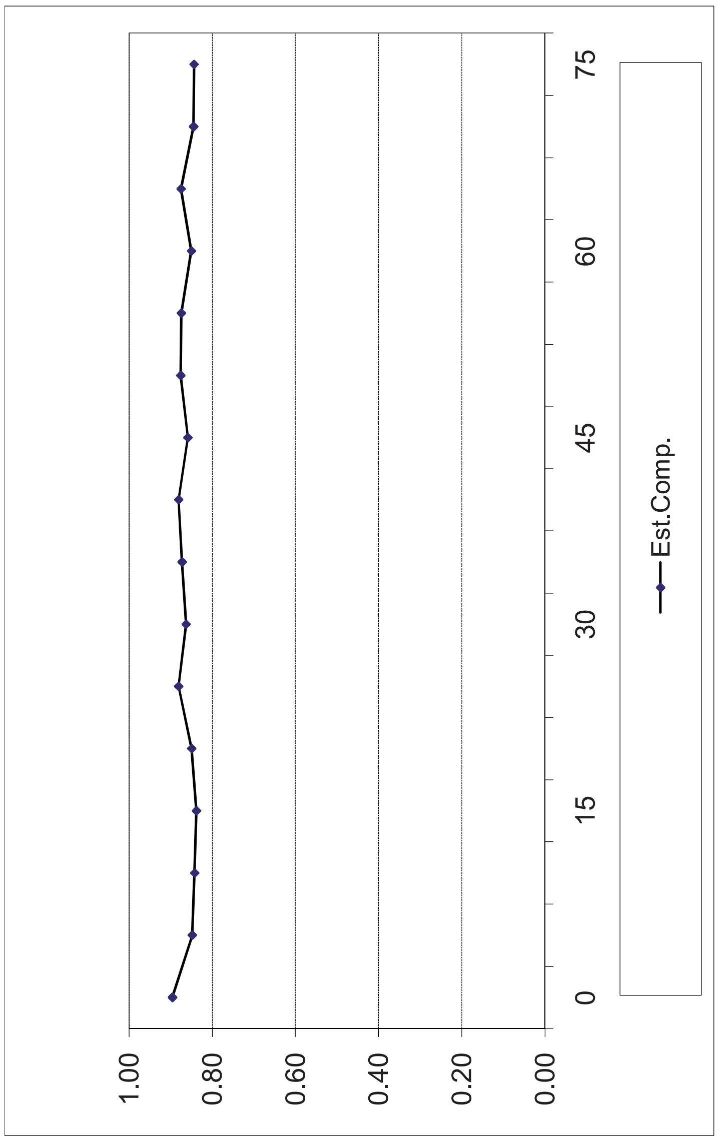
Source: Registered Deaths and Population age distribuition: from data at the Central Statistical Office (INEI), Peru 2005.

FIGURE 2
ESTIMATION OF COMPLETENESS OF DEATH RECORDING BY METHOD OF EXTINCT GENERATIONS. PERU 1993-2005 (FEMALES)



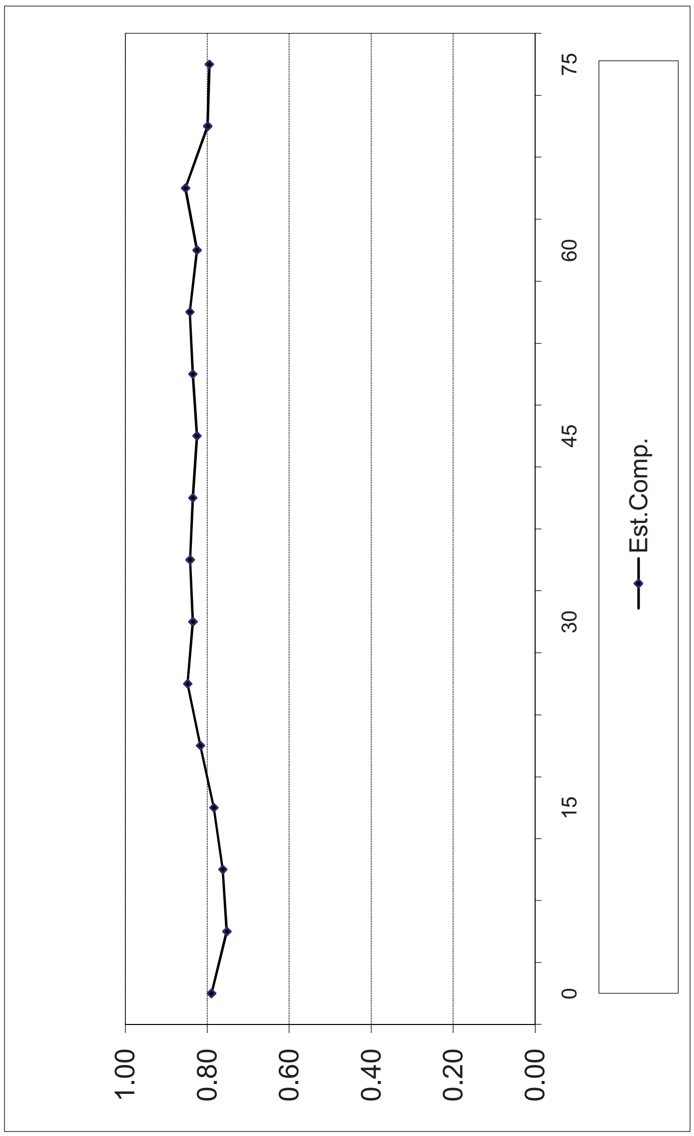
Source: Registered Deaths and Population age distribuition: from data at the Central Statistical Office (INEI), Peru 2005.

FIGURE 3
ESTIMATION OF COMPLETENESS OF DEATH RECORDING BY METHOD OF EXTINCT GENERATIONS (ADJUSTED). PERU 1993-2005 (FEMALES)



Source: Registered Deaths and Population age distribution: from data at the Central Statistical Office (INEI), Peru 2005.

FIGURE 3
ESTIMATION OF COMPLETENESS OF DEATH RECORDING BY METHOD OF EXTINCT GENERATIONS (ADJUSTED). PERU 1993-2005 (MALES)



Source: Registered Deaths and Population age distribution: from data at the Central Statistical Office (INEI), Peru 2005.

TABLE 3
SUMMARY ESTIMATES OF COVERAGE AND THE ADJUSTED PROBABILITIES OF DYING BETWEEN 15 AND 60, ${}_{45}Q_{15}$, OF APPLICATION OF GENERAL GROWTH BALANCE METHOD, PERU 2000-2004

Fitting range and result	Males	Females	Total
Age range 5+ to 75+			
Slope of fitted line	1.0677	1.0292	1.0478
Intercept of fitedd line	0.0045	0.0064	0.0055
Coverage of census 1 relative to census 2	1.0556	1.0787	1.0675
Adjusted ${}_{45}q_{15}$	0.1214	0.0848	0.1027
Age range 355+ to 75+			
Slope of fitted line	1.0989	1.0381	1.0989
Intercept of fitedd line	0.0033	0.0060	0.0060
Coverage of census 1 relative to census 2	1.0396	1.0741	1.0741
Adjusted ${}_{45}q_{15}$	0.1248	0.0855	0.0855

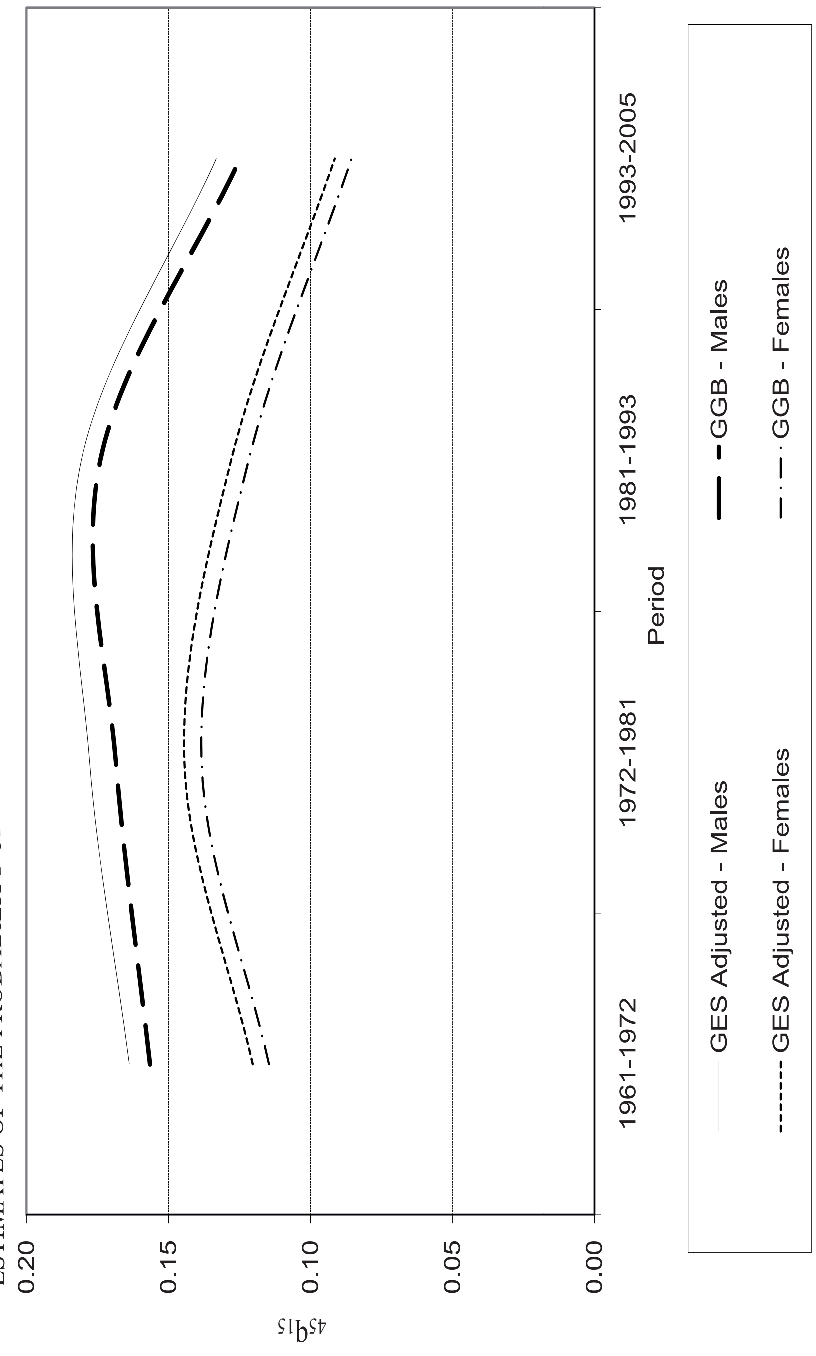
Figure 3 shows the results for men and female, and in both cases it can be observed that there is a better consistency between the completeness of death registration and the age. The ascending pattern in coverage by age, that was cause by changes in census coverage, is not observed and results are very consistent with GGB estimation.

The quality of mortality data in Peru improved steadily over the last half-century. Death registration coverage in the 1960s was about 84 per cent for males and 90 per cent for females (estimation not shown), reaching over 93 per cent for both sexes in the most recent period. Overall, the results indicate that the death registration coverage for Peru have improved significantly over time.

Figure 4 shows the probabilities of dying between the ages of 15 and 60 by sex by decade for Peru. The probability of dying increases from the 1960s to the 1980s, especially for males, and starts a steadly decline since them. The increase in the probability of dying for males, from about 0,14 to about 0,17 can be explained by the impressive increase in the external causes of deaths observed during that time in Peru (Guibovich & Gonzales, 2008).

FIGURE 4

ESTIMATES OF THE PROBABILITY OF DYING BETWEEN AGES 15 AND 60 BY SEX, PERU 1961-2005



Source: Registered Deaths from 1961-1980 : Adult Mortality in Development Countries Project.
Registered Deaths from 2000-2004 and age distribution population: Central Statistical Office (INEI).

TABLE 4
SUMMARY ESTIMATES OF COVERAGE AND DATA QUALITY, REGION PERU, 2004 (MALES)

Region	Mean[a]	Estimated coverage			
		GGB	SEG	Adjusted SEG	Classification[b]
Amazonas	0.65	0.66	0.46	0.64	Deficient
Ancash	0.54	0.55	0.44	0.52	Deficient
Apurimate	0.66	0.67	0.62	0.64	Deficient
Arequipa	0.86	0.92	0.86	0.80	Satisfactory
Ayacucho	0.49	0.51	0.60	0.46	Deficient
Cajamarca	0.62	0.64	0.49	0.60	Deficient
Callao	1.04	1.09	0.91	0.99	Good
Cuzco	0.91	0.93	0.78	0.90	Good
Huancavelica	0.47	0.48	0.46	0.45	Deficient
Huanuco	0.87	0.89	0.73	0.84	Satisfactory
Ica	1.09	1.14	0.94	1.05	Good
Junín	0.86	0.88	0.66	0.84	Satisfactory
La Libertad	0.89	0.93	0.85	0.84	Satisfactory
Lambayeque	0.99	1.05	0.91	0.94	Good
Lima	1.08	1.14	0.90	1.02	Good
Loreto	0.52	0.52	0.43	0.51	Deficient
Madre de Dios	1.04	1.09	0.75	0.99	Good
Moquegua	0.92	1.01	0.85	0.83	Good
Pasco	0.68	0.70	0.53	0.67	Deficient
Piura	0.86	0.89	0.76	0.83	Satisfactory
Puno	0.69	0.70	0.75	0.67	Deficient
San Martin	0.72	0.74	0.56	0.69	Fair
Tacna	1.03	1.07	0.91	0.99	Good
Tumbes	0.92	0.97	0.83	0.87	Good
Ucayali	0.98	1.02	0.75	0.95	Good

[a] Mean of GGB and Adjusted GES.
[b] Final classification was obtained from mean coverage value.
Source: Registered deaths from 2000-2004, Ministerio de Salud (MINSA), Peru. Age distribution population, Instituto Nacional de Estadística, Peru (INEI).

Regional levels and differentials

The data obtained from the National Statistics office allows us to study regional differentials in registration coverage in Peru. Since the country is marked by high income inequality and regional differences we now concentrate state level results. Death coverage varies widely across regions in Peru from 45 per cent in Huacavelica to 105 per cent in Ica. The methods adjustment also shows a wide variation, since small areas are less suitable for the assumption of closed population.

TABLE 4
SUMMARY ESTIMATES OF COVERAGE AND DATA QUALITY, REGION PERU, 2004 (FEMALES)

			Estimated coverage		
Region	Mean[a]	GGB	EG	Adjusted SEG	Classification[b]
Amazonas	0.75	0.76	0.76	0.43	Fair
Ancash	0.58	0.59	0.59	0.42	Deficient
Apurimate	0.81	0.82	0.82	0.57	Satisfactory
Arequipa	0.88	0.93	0.93	0.85	Satisfactory
Ayacucho	0.58	0.60	0.60	0.55	Deficient
Cajamarca	0.68	0.67	0.67	0.46	Deficient
Callao	1.06	1.11	1.11	0.90	Good
Cuzco	1.14	1.16	1.16	0.81	Good
Huancavelica	0.74	0.77	0.77	0.55	Fair
Huanuco	1.06	1.08	1.08	0.71	Good
Ica	1.15	1.19	1.19	0.93	Good
Junín	0.94	0.95	0.95	0.62	Good
La Libertad	0.94	0.98	0.98	0.80	Good
Lambayeque	1.09	1.15	1.15	0.88	Good
Lima	1.08	1.14	1.14	0.90	Good
Loreto	0.58	0.59	0.59	0.42	Deficient
Madre de Dios	1.23	1.32	1.32	0.87	Good
Moquegua	0.95	1.01	1.01	0.97	Good
Pasco	0.79	0.79	0.79	0.54	Fair
Piura	0.89	0.90	0.90	0.72	Satisfactory
Puno	0.81	0.81	0.81	0.69	Satisfactory
San Martín	0.81	0.84	0.84	0.60	Satisfactory
Tacna	1.14	1.19	1.19	1.04	Good
Tumbes	1.03	1.07	1.07	0.89	Good
Ucayali	1.04	1.07	1.07	0.77	Good

[a] Mean of GGB and Adjusted GES.
[b] Final classification was obtained from mean coverage value.
Source: Registered deaths from 2000-2004, Ministerio de Salud (MINSA), Peru. Age distribution population, Instituto Nacional de Estadística, Peru (INEI).

In order to summarize the situation in Peru, we adopt the classification system proposed by Jaspers and Orellana (1996). According with that system, coverage of registered deaths are rated as follows (see Table 4):

- 'Good', when coverage is greater than 90 per cent.
- 'Satisfactory', when it is between 80 and 89 per cent.
- 'Fair', when it is between 70 and 79 per cent.
- 'Deficient', when it is lower than 70 per cent.

The distribution of quality of death reporting follows very closely the level of development and distance to Lima. The regions located near to the ocean show a much higher coverage than the regions in the interior of the country. In general, poverty levels seem to have strong correlation with data quality and death recording. The more developed regions such as Lima, Callao, Arequipa and Tacna have death coverage above 90 per cent whereas the poorest areas of the country, such as Ayacucho, Cajamarca and Loreto, have coverage levels below 70 per cent.

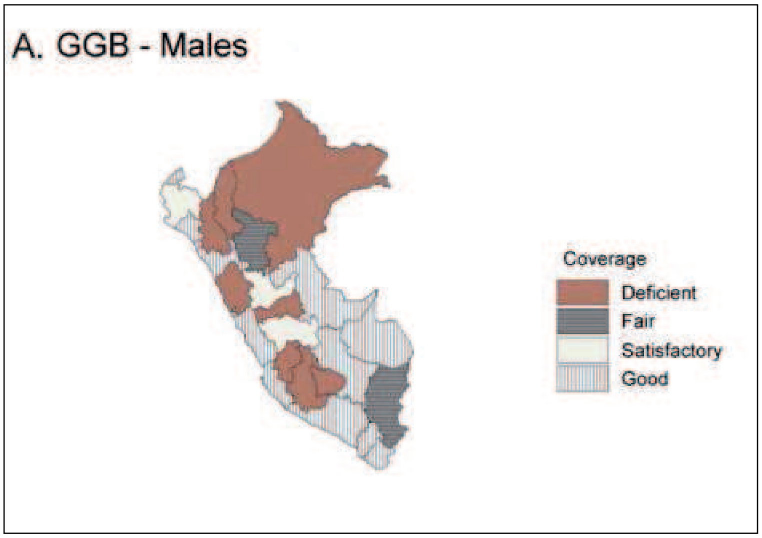
Discussion and conclusion

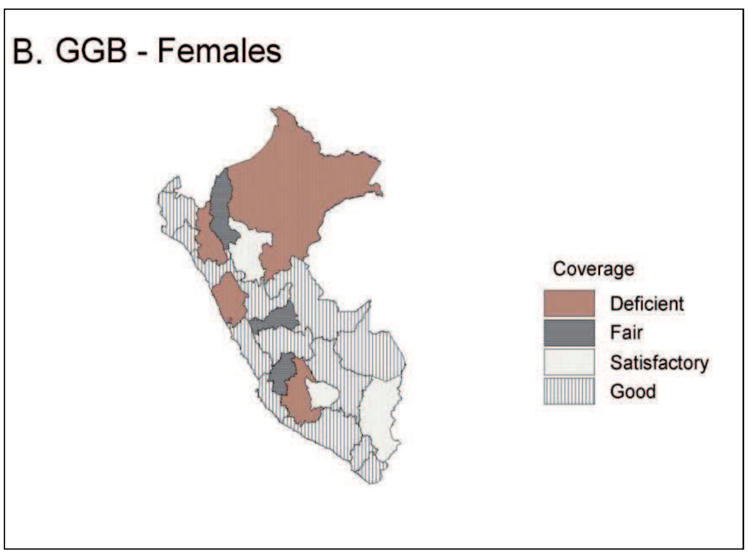
The knowledge of the levels and trends of adult mortality in developing countries is limited by the quality of available data, for both death counts and population. The most common problems faced by developing countries are incomplete coverage of the vital registration system, errors in age declaration for both population and death. However, it is extremely important to produce estimates of data quality and death rates for they are important to elaborate public policies and to evaluate the impact of socioeconomic changes and policies. The purpose of this paper has been to apply the methods to Peru and produce an systematic analysis of mortality data quality, record coverage, and produce estimates of adult mortality by sex and region of Peru.

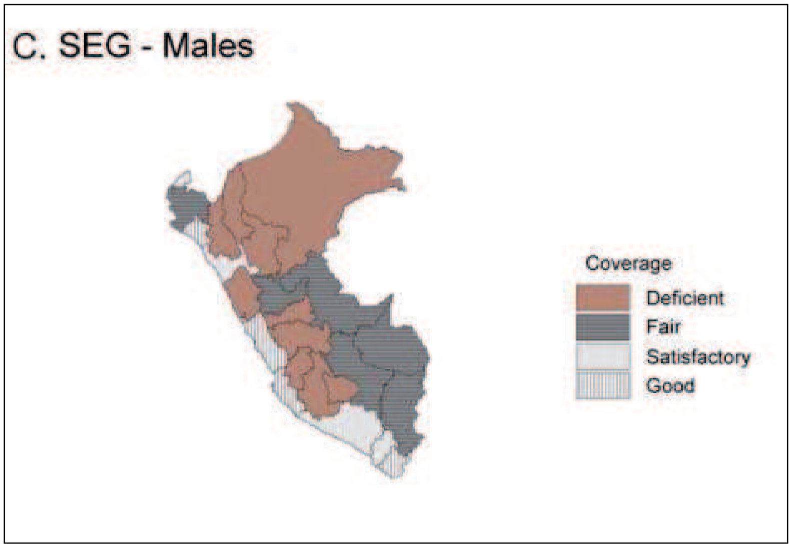
The quality of the diagnostic plots and the consistency of the adult mortality estimates in these applications suggest that the methods are working well. Nevertheless, it is important to discuss some important issues when applying the Death Distribution methods to developing nations: a) the methods seem to work well, but with considerable uncertainty, thus it is important to produce more work on how to deal with these uncertainty; b) as discussed by Hill & Choi (2004), different data limitations affect GGB and SEG methods differently and results should be carefully analyzed. For example, SEG is strongly affect by changes in census coverage whereas GGB shows some advantage by allowing for systematic errors.

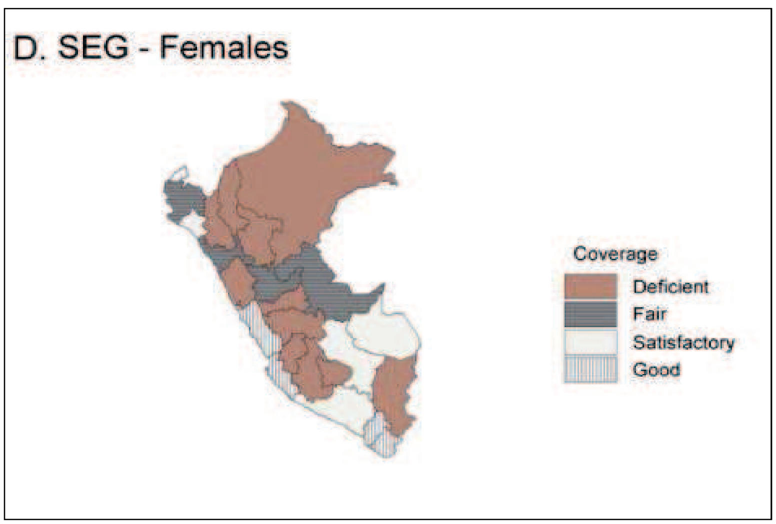
We compared our probabilities of adult mortality to estimates from the United Nations (tables not shown) as a plausibility test and find very similar results. It is important to point that they use very different methodological approach from us. We observed that after a period of increase in adult mortality, probably related to external causes, adult mortality in Peru is declining. We also find that female adult mortality is lower during all time and probability of dying between ages 15 and 60 are declining faster for females than males.

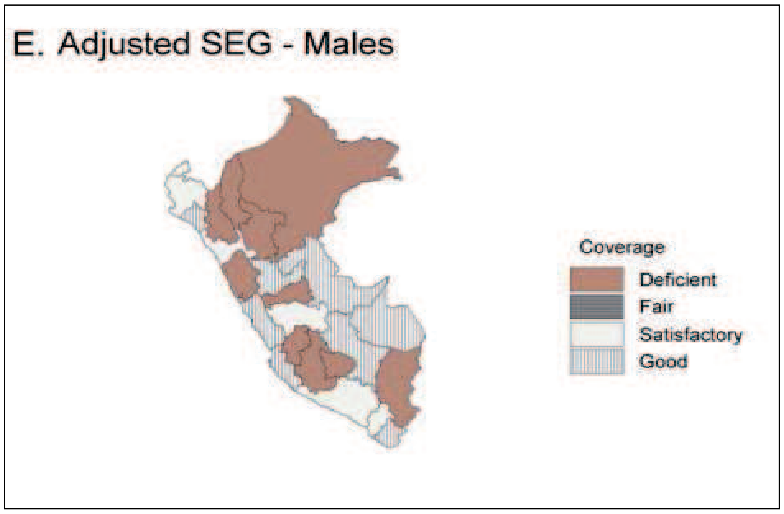
FIGURE 5
REGIONAL ESTIMATES OF COVERAGE, REGIONS, PERU, 2000

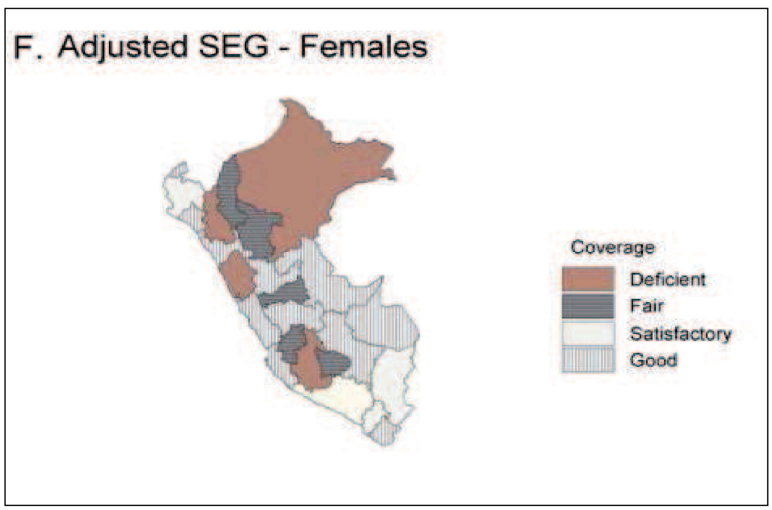





C. SEG - Males
Coverage
Deficient
Fair
Satisfactory
Good


D. SEG - Females
Coverage
Deficient
Fair
Satisfactory
Good





We find that death registration records vary widely across regions in Peru and are high correlated with development indicators. The regions located near to the ocean show a much higher coverage than the regions in the interior of the country. In general, poverty levels seem to have strong correlation with data quality and death recording. The more developed regions have death coverage above 90 per cent whereas the poorest areas of the country have coverage levels below 70 per cent. The results for small areas, however, should be carefully analyzed since they are less suitable for the assumption of closed population.

The exercise performed here suggests that the Death Distribution Methods (GGB and SEG) are a feasible way to study and understand adult mortality in developing countries. Although, new data sources, such as DHS, and o indirect methods, such as orphanhood, have been used for a long time and have improved our knowledge of adult mortality and provide information on a more regular basis. It seems from the findings that data collected from vital registration offices combine to censuses data provide a unique opportunity to study regional and, in some cases, socioeconomic differentials in adult mortality.

Nevertheless, all efforts should be directed to produce high quality vital registration records, including cause of death. In the case of Peru, the least developed regions of the countries are the one that should received largest investments, since the results indicate that less than 60 per cent of deaths are recorded in these areas. Advances in these are would produce better and more reliable estimates of mortality and improve our understanding in trends and differentials for a series of developing countries.

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