Mortality rate for Children under 5 years old in Thailand from 2000 to 2009

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Abstract

Our study describes the pattern of deaths and classifies death rates of all cause for children under 5 years old by gender and location in Thailand from 2000 to 2009. Reported death data were obtained from the Bureau of Health Policy and Strategy, Thai Ministry of Public Health. Death rates separated by year, Public Health Area (PHA), and gender were calculated. Multiple linear regression was used to identify the factors associated with deaths rate for children under 5 year of age. During the period from 2000-2009, 84,227 deaths were reported. Of these, 57,366 (56.5%) were boys. Death rates peaked in 2001. The highest death rate was in PHA 12. Gender, year and Public Health Area were associated with the death rates for children under 5 years of age. The boy mortality rate was higher than girls in all year and every PHA. Death rates in year 2005-2009 tend to decrease. Death rates in PHA5 were lower than other PHAs. Death rates in PHA2, PHA3, PHA4, PHA10 and PHA12 were higher than the average death rate whereas death rates in PHA5, PHA6, PHA7, PHA11 and PHA13 were lower than the average. Death rates in PHA1, PHA8 and PHA9 were not different from the average.

Keywords: Mortality rate, retrospective study, Public health area

Introduction

Globally 7.6 million children died in 2010 before reaching their fifth birthday (Liu et al 2012). The mortality rate per 1000 live births for children under 5 years of age was 57 (decreased from 88 in 1990), showing improved child survival at the global level in the past decade. The highest mortality rates occured in Sub-Saharan Africa, followed by South Asia and Middle East, and North Africa, respectively. The average in industrialized countries was 6 (decreased from 10 in 1990), whereas the average in developing countries was 63 (decreased from 97 in 1990) (UNICEF 2012). The mortality rate in Thailand was 9.8 (decreased from 12.8 in 1990) (Ministry of Public Health of Thailand 2010).

The aim of UN Millennium Development Goals report 2010 is to reduce mortality of children younger than 5 years by two-thirds between 1990 and 2015, but many countries are not on track to meet this target (Black et al 2010, Liu et al 2012). To know that we are on track to meet this goal, demand is increasingly on analysis of mortality national data.

The aim of this study was to analyze the patterns of death rates under 5 years of age in Thailand and classify death rates for children under 5 years of age by gender and location in 2000 to 2009 in Thailand.

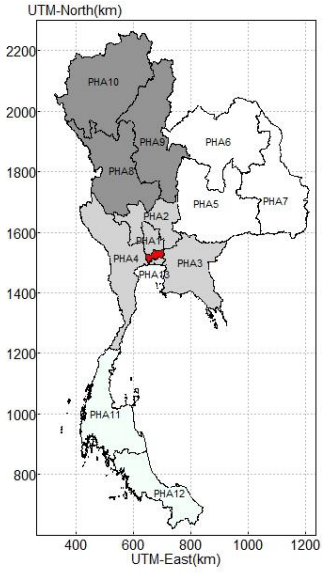

Figure 1 Public Health Area (PHA) map of Thailand

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Methodology

Data sources

Numbers of deaths based on death certificates in the years 2000-2009 were obtained from the Bureau of Health Policy and Strategy, Thai Ministry of Public Health. Projected population at risk by gender, year and province were obtained from the Institute of Population Studies at Mahidol University.

The determinants of this study are gender, year and Public health Area (PHA). In Thailand, PHA was classified into 13 areas. Each PHA comprises approximately five to seven provinces except PHA13 (Bangkok) as shown in Figure 1. PHA1-4 are in Central, PHA5-7 are in Northeastern, PHA8-10 are in Northern, PHA11-12 are in Southern regions and PHA13 is Bangkok. The outcome is the death rate (deaths per 100,000 population).

Death rates (y_{ijt}) was computed as the number of deaths for children under 5 years of age divided by the number of mid–year projected population and multiply by 100,000 population, given by

$$y_{ijt} = \frac{D_{ijt}}{P_{ijt}} \times K \qquad (1)$$

where D_{ijt} is the number of deaths in region (i) (i= 1, 2, 3, …,13), gender (j) (j= 1, 2) and year (t) (t= 2000, 2001, 2002, …, 2009). P_{ijt} is the population at middle year and K is as specified constant, here equal to 100,000.

Multiple linear regression

Since death rate for children under 5 years of age was considered as a continuous outcome and the determinants comprise gender, year, and PHA. Multiple linear regression analysis was the appropriate method for statistical modeling. The additive model for death rates takes the form

$$y_{ijt} = \mu + \alpha_i + \beta_j + \gamma_t \qquad (2)$$

when y_{ijt} is the death rates, μ is the overall effect, α_i is the effect of region i, β_j is the effect of gender j, and γ_t is the effect of year t. The model is fitted to the data using least squares, which minimizes the sum of squares of the residuals. Linear regression analysis resets on three assumptions including the association is linear, the variability of the errors (in the outcome variable) is uniform and these errors are normal distributed. If these assumptions were not met, the data may need to be transformed.

In this study, the death rates outcome was transformed by taking natural logarithms. The additive model for death rates takes the form

$$\ln(y_{ijt}) = \mu + \alpha_i + \beta_j + \gamma_t \qquad (3)$$

The parameter y_{ijt} is the death rate, μ is the overall effect, α_i is the effect of region i, β_j is the effect of gender j, and γ_t is the effect of year t. All statistical modeling and graphical displays were performed using R statistical software (R Development Core Team, 2012).

Results

During the study period, the total number of deaths was 84,227. Of these, 47,366 (56.2%) were boys and 36,861 (43.8%) were girls.

Figure 2 shows the trend of mortality rates by year, sex and PHA. The boy mortality rate was higher than girl in all year and every PHA. The mortality rate was highest in PHA12. The mortality pattern had decreased with year in PHA1, PHA3, PHA6, PHA10, and PHA13 and increased in PHA2, PHA4, PHA8, PHA9 and PHA12. The mortality rates were stable in PHA5, PHA 7 and PHA11.

Figure 3 shows the standardized residuals after fitting model (3) to the death rates for children under 5 years of age. For fitting linear regression, we calculated the death rates per 100,000 population according to

gender, year and PHA then transformed them using natural logarithm. After fitting the linear regression R-squares was obtained and used for testing goodness of fit.

For the model with three factors (region, gender and year) the R-squares was 78.7% with the number of observations are 260. It indicates that linear model had good fit.

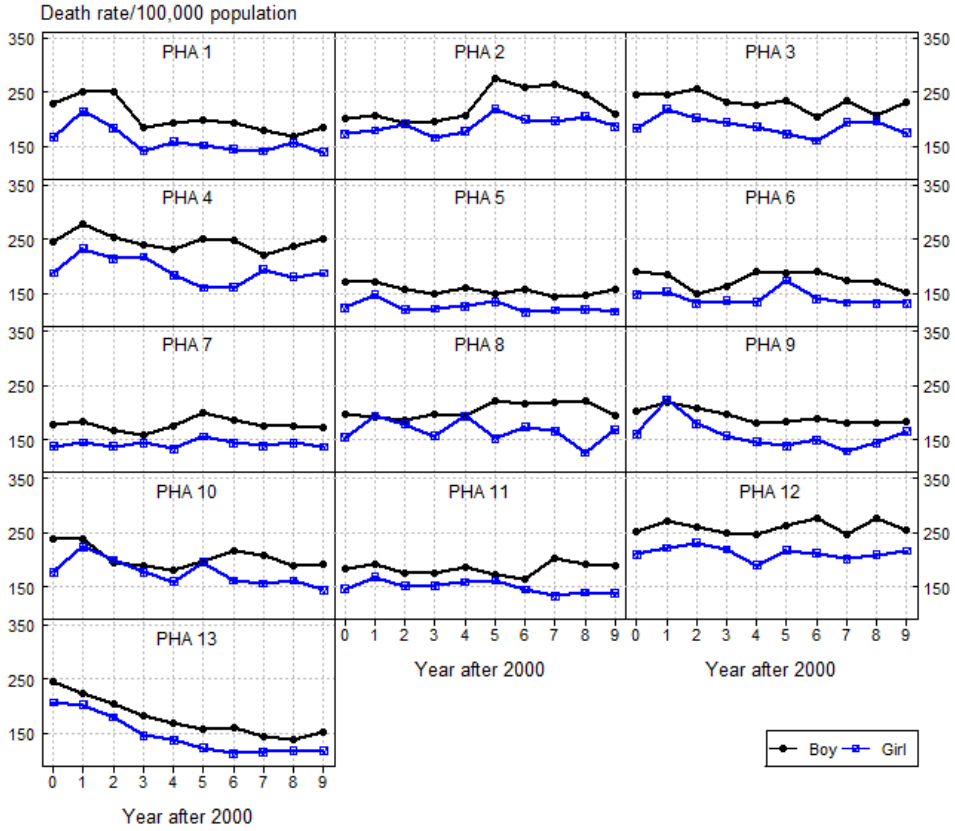

Figure 2 Death rates (per 100,000 population) for children under 5 years of age by Public Health Area (PHA).

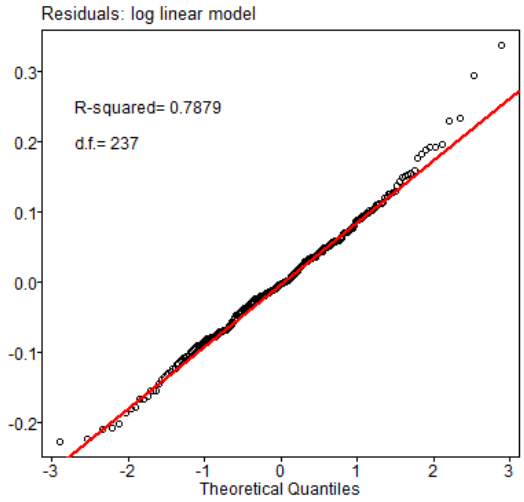

Figure 3 Residuals plot for log linear model.

Figure 4 shows the confidence intervals of death rates for children under 5 years old from the multiple regression model. The results showed that the average death rate per 100,000 population was 177.9. Gender, PHA, and year were associated with the death rates for children under 5 years old. Boys had the higher death rates than those of the girls. Death rates in PHA5 were lower than other PHAs. Death rates in PHA2, PHA3, PHA4, PHA10 and PHA12 were higher than the average death rate whereas deaths rates in PHA5, PHA6, PHA7, PHA11 and PHA13 were lower than the average. Death rates in PHA1, PHA8 and PHA9 were not different from the average.

Death rates in year 2000, 2001 and 2002 were higher than the average. Death rates in year 2005-2009 tend to decrease due to proper health management.

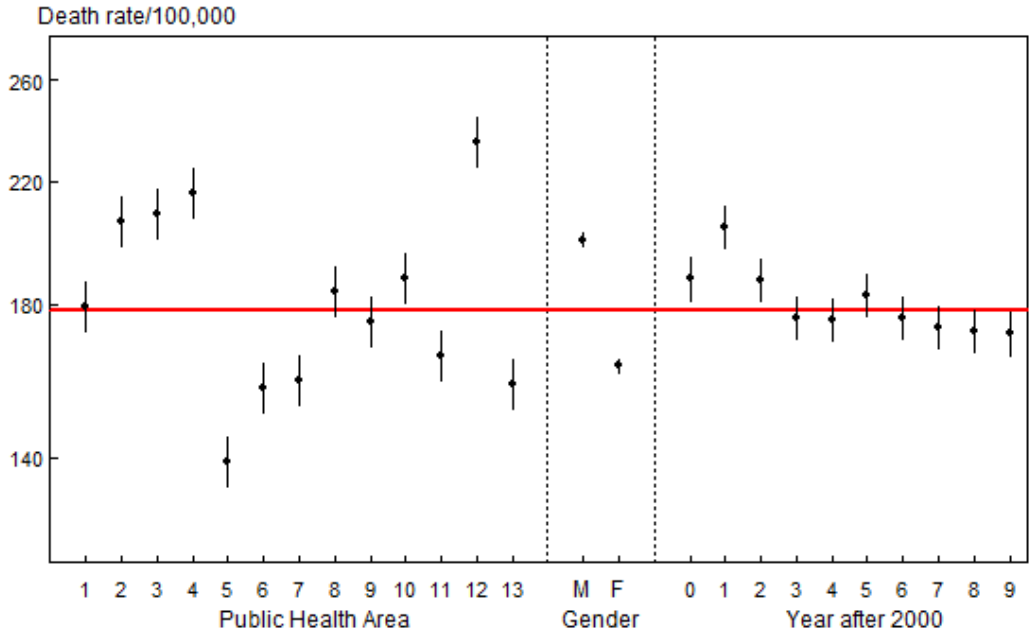

Figure 4 95% Confidence intervals plot of death rate per 100,000 population during the period 2000-2009

Discussion

The mortality rates for children under 5 years of age in our study using registration mortality data are lower than the 2010 reported rate due to the registration data are under reported (Ministry of Public Health of Thailand, 2010)

Source of data needed for estimating mortality at national level are accurate records of deaths by age, gender and causes from a civil registration system. Using the data from the vital registration system clearly underestimates under-five mortality rates (Hill et al 2012). An adjustment factor together with alternative sources such as Verbal Autopsy are needed to apply for this data.

Although absolute values of death rates are not reliable due to under report, relative figures are still useful. Also, information on patterns of mortality based on gender, public health area, and year are useful knowledge. Further studies on causes of death of children under 5 years old by locations are needed. The pattern of mortality varies with PHA might be due to cultural and religion differences, and access to health of services.

Methods use in this study can be used to analyses mortality data.

Conclusion

Based on death certificates, deaths for children under 5 years old accounted for more than 80,000 of all deaths in Thailand from 2000 to 2009. The total number of deaths was more than 7,500 per year. Boys had the higher death rates than those of the girls. Death rates in PHA5 were lower than other PHAs. Death rates in PHA2, PHA3, PHA4, PHA10 and PHA12 were higher than the average death rates whereas death rates in PHA5, PHA6, PHA6, PHA7, PHA11 and PHA13 were lower than the average. Death rates in PHA1, PHA8 and PHA9 were not different from the average. Mortality rates for children under 5 years old were associated with gender, year and region. The year effect is more

pronounce than other factors. A prevention policy for mortality rate for children under 5 years old should be targeted at the Central, Northern (PHA10) and Southern (PHA12) regions.

Acknowledgement

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