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Child Mortality Inequality between Thais and Hilltribes in Thailand: Study from Population and Housing Census 2000

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Introduction

Health inequality has become prominent on global policy agenda. Disparities in health status and health care among various populations are manifest in both developed countries and developing countries (Ajwani et al., 2003; Gakidou and King, 2000). It is typically evaluated in three dimensions of health outcomes; morbidity, disability, and mortality (World Health Organization, 2000). Among all outcomes, mortality is the ultimate outcome of health. Mortality in early childhood is a crucial indicator of the health status and socioeconomic development of a population. It is broadly used for assessing socioeconomic and health situations in developing countries (Minujin and Delamonica, 2002).

The existence of socioeconomic inequalities in child mortality is documented by most studies (Hosseinpoor et al., 2005; Mwageni et al., 2005; Nathan et al., 2005; Schulpen, Steenbergen, and Driel, 2001). The relationship between socioeconomic status and child mortality was highly significant, with the high mortality rate frequently concentrated in the worse-off. These inequalities existed according to all measures of socioeconomic position; household wealth or income, maternal education, occupational class in the household, as well as geographical setting.

The main concern in reducing inequalities in child mortality is focused on the poor or disadvantaged groups. Ethnic minorities have been exposed to considerable maternal and child health problems. Much evidence indicates that ethnic minorities in various countries have high level of child mortality rates, including African Americans, American Indians/ Alaska Natives, and Hispanics in the United States (Berglas and Lim, 1998; Federal Interagency Forum on Child and Family Statistics, 2005), Maori in New Zealand (Ajwani et al., 2003), Zang, Weiwuer, Yi, Buyi, and Miao in China

(Yusuf and Byrnes, 1994), and several ethnic groups in sub-Saharan Africa (Brocherhoff and Hewett, 2000).

In Thailand, under-five mortality rates (U5MR) have substantially declined from 148 per 1,000 live births in 1960 to 21 in 2004 (United Nations Children's Fund, 2006). In accordance with Goal 4 of Millennium Development Goal, Thailand aims to reduce U5MR by two-thirds during 1990 to 2015 to achieve this goal. For the general Thais, the rates are fairly low but are still high in disadvantaged groups. Therefore, the policy makers have shifted their attention to focus on vulnerable groups, minorities, and more neglected regions. Ethnic hilltribes are the target groups in highland areas underlying the forth goal.

Even though the goal of reducing inequality in child mortality among ethnic minorities has been proposed as national policy for several years, studies in terms of health inequality mostly focus on the general Thai population (Fhaumnouyphol, 2000; Benjakul, 2004). There are few studies on mortality in ethnic hilltribes and most of them were conducted using an anthropological approach. Exploration of these groups has been limited because the studies focused on a single village or tribe. The full picture and comparison between Thais and ethnic hilltribes has been rarely studied.

This study is undertaken first to explore levels and trends of child mortality at a national level among majority Thais and ethnic hilltribes, second to estimate child mortality across socioeconomic groups, and third to assess the gap of child mortality between low and high socioeconomic groups.

Data and Methods

Data

Data on mortality in ethnic hilltribes is rarely provided in Thailand. The National Statistic Office had conducted the Surveys of the Hill Tribe Population in 1985, 1986, and 1987. These surveys included all hilltribe persons and households. The data comprised three categories: community data, individual data, and household data. Regrettably, these sources of data are outdated and contain fluctuations (Aguettant, 1996). Recently, the Highland Health Development Center has conducted surveys on

the health status of hilltribe peoples since 1993. Even though this survey focused on maternal and child health, the data on child mortality is unavailable. However, the data on children death among hilltribes can be drawn from the national census by using indirect demographic techniques. The census used in this study is described below.

The Population and Housing Census

The population census was first conducted in Thailand in 1909 by the Ministry of Interior. Four subsequent censuses followed in 1919, 1929, 1937 and 1947. Since 1960, the responsibility for population census every ten years has been undertaken by the National Statistical Office (NSO). For the purpose of international comparison recommended by the United Nations, the national census is undertaken in the year ending with 0 (zero). Since then, Thailand has conducted its census in 1970, 1980, 1990, and 2000. The first housing census was conducted simultaneously with the population census in 1970. The 2000 population and housing census is the tenth population census and fourth housing census of Thailand. The census provides a comprehensive update of information on the major characteristics of population and housing at the national and sub-national levels. The population included in the census coverage is all Thai nationals residing in the country as of the census date (1st of April) and persons having their usual residence in Thailand including civilian citizens of foreign countries. Hilltribes having no permanent place of residence and refugees or illegal immigrants located in camps provided by the government have not yet been included in the census (National Statistical Office, 2002).

Data on ethnic hilltribes as a figure of the whole country can be obtained from censuses. Even though data on ethnicity is unavailable on this source of data, the ethnicity of hilltribes can be determined from data on language usually spoken in the household. As this variable is collected at the household level, the ethnicity is attributed to all members of the household. However, it was only in the latest 2 rounds, 1990 and 2000, that data on languages are accessible. The later round was selected for this study. The data on death also is not recorded in this source of data, but under-five mortality can be estimated through the number of children ever born (CEB) and children living using an indirect technique.

Sample selection

Tribal peoples of Thailand are officially recognized in nine principal hilltribes: Karen, Hmong, Lahu, Akha, Lua, Lisu, Yao, Khamu, and Htin. Samples of all nine ethnic hilltribes, together with the majority Thais were selected for analysis. The methodology used in the 2000 census was that all persons and households were listed and simultaneously enumerated with the short form questionnaire, except for the sample households (20% for Bangkok, municipal and non-municipal areas) which were enumerated with the long form questionnaire. The data on both forms was needed for this study. Because the proportion of ethnic hilltribes under the study was far smaller than Thais, the sample size of these groups had to be large enough to yield reliable results. Therefore, all cases of ethnic hilltribes and only 2 % of Thais were a sufficient sample for estimation (see Table 1)**.**

Table 1 Sample sizes of household and population by ethnicity, the 2000 Census

Ethnicity	Sample size	
	Number of households	Number of woman aged 15-49 years
Thai	307 373	315 058
Karen	15 550	18 400
Hmong	4 246	5 493
Lahu	3 447	4 197
Akha	2 450	3 023
Lua	1 510	1 841
Lisu	1 101	1 265
Yao (Mien)	914	1 181
Khamu	367	420
Htin (Kachin)	122	146

Measurement

(a) Mortality analysis

The Trussell version of the original Brass indirect method (United Nations, 1983) was utilized to estimate child mortality. This indirect method is based on the formula for converting proportions dead among children ever born as reported by women in certain age groups into estimates of the probability of dying before attaining

certain exact childhood ages. The basic form of the estimation equation proposed by Brass is

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

where $q(x)$ is the probability of dying between birth and exact age x
$D(i)$ is the proportion dead among children ever born to women in Age group i
$k(i)$ is multipliers for adjusting non-mortality factors determining the value of D(i)

This method yields estimates of $q(1)$, $q(2)$, $q(3)$, $q(5)$, $q(10)$, $q(15)$, and $q(20)$. This study selected only probability of dying yielded from women aged 25-49 years ($q(3)$, $q(5)$, $q(10)$, $q(15)$, and $q(20)$), on average, to periods approximately for 4, 6, 9, 12 and 15 years before the date of the survey for display levels and trends among 10 ethnic groups. The estimates from age group 15-19 and 20-24 were excluded because of the quality of data and for reasons associated with physical immaturity, inexperience, and social capital deficiency of young mothers.

The West model of the Coale-Demeny family of model life tables which was considered by several studies (Vapattanawong et al., 2007; Hill et al., 2006; Hill, 1995) as the most appropriate model for Thailand was applied for converting probabilities of dying to mortality levels. Even though the study involved with ethnic minorities which have high levels of child mortality, 'The West model' was still appropriate for estimations rather than other models. Because this model is developed from the largest number and broadest variety of cases, it is presumed to represent the most general mortality pattern (United Nations, 1983).

(b) Estimation of standard error in U5MR

Simple Variance Estimate proposed by Mendoza and Kalsbeek (1983) was employed to estimate standard errors in U5MR. They applied multiplicative factor which is a linear function of the estimated parity ratio generated by Sullivan and Trussell as the adjustments. The estimation is obtained by the general form as

$$\mathrm{var}_x(\theta) = k_i^2\, D_i(1\text{-}D_i) / n_i$$

where k_i is the constant coefficients to women in the *i-th* age group (calculate from step of child mortality estimation)

D_i is the proportion of death among children ever born to women in the *i-th* age group

n_i is the number of children ever born to women in the the *i-th* age group

(c) Measurement of socioeconomic index

The 2000 Population and Housing Census does not provide income or consumption data but does have detailed information on land and household ownership, accessibility of a variety of consumer goods, and sanitary amenities. According to literature and available data, 15 variables can be recognized as a particular socioeconomic dimension for ethnic groups in Thailand. The selected variables refer to SES in three respects. The first regards to household asset (e.g. television, radio, refrigerator, etc). The second is housing characteristics and the last relates to sanitary amenities (e.g. water supply and toilet). All indicators of the socioeconomic status of the household were recoded and dichotomized.

The Principal Component Analysis (PCA) which is closely related to factor analysis was employed to estimate the index of socioeconomic status. Based on Filmer and Pritchett (1998), PCA was applied to determine the weighting for an index of the socioeconomic variables. The result of principal components is an SES index for each household (*Aj).*

$$A_j = f_i (a_{ji}-a_1) / (S_1) +\ldots+ f_N (a_{iN}- a_N) / S_N)$$

where f_{1-N} is the scoring factor or weighting for the *i*-th variable (1 to N)

a_j is the *i*-th household value for the the *i*-th variable (1 to N)

a_{1-N} is the mean of the *i*-th variable (1 to N) over all households

S_{1-N} is the standard deviation of the *i*-th variable (1 to N) over all households

The first principal component was used to develop SES index. It explains 33.2% of the variation in the fifteen socioeconomic variables. Based on the constructed indices, all households were classified into socioeconomic quartiles (Q_1 to Q_4), that is, forth quartile (Q_4) comprises a group with the highest scores (highest socioeconomic status) and first quartile (Q_1) comprises a group with the lowest score (lowest socioeconomic status).

Then, to acquire SES of each ethnic group, the households were assembled along with their ethnic affiliation. Simple cross-tabulations were utilized to explore the existence and magnitude of socioeconomic disparities among ethnic groups. Chi-squared tests were performed to assess the significance of these disparities.

Once each ethnic group was classified into SES quartiles, the numbers of death in high socioeconomic strata of various ethnic hilltribes were minute and unreliable to calculate (the majority of them were concentrated at the lowest SES). As a means to obtain sufficient number of deaths for the estimates of mortality differentials across SES, all ethnic hilltribes were pooled together and socioeconomic strata were reclassified into 2 groups, low SES and high SES by pooling the first and second stratum together (Q_1+Q_2) for the former group and pooling the third and the forth stratum (Q_3+Q_4) for the latter group.

(d) Measures of mortality inequalities: Rate ratios and absolute differences

Among a wide variety measures for the magnitude of socioeconomic inequality in health, the measurement of both rate ratio and absolute differences were applied for this study in order to capture the gap of SES by household characteristics and of U5MR by socioeconomic strata. Rate ratio is the relative difference between two extreme groups with the rate for the top group which is expressed as a multiple of the bottom group disregarding information contained in the middle two quartiles (low/high) while the absolute summarizes the difference between its own value of the highest socioeconomic status and the lowest socioeconomic status (low-high).

Results

Background characteristics of household by ethnicity

A total of 337,080 households from the majority Thais and nine ethnic hilltribes in the 2000 Population and Housing Census were included in the analysis. Table 2 presents selected characteristics of ten ethnic groups, covering demographic characteristics, educational status, legal status, and geographical setting. The statistics reveal large differentials in each ethnic group.

The percentage of female headed households for Thais was comparatively higher than ethnic hilltribes, with about one-forth (25%) of household heads being females, while the percentages for ethnic hilltribes were fairly low averaging between 13-19%. Almost all Thais were Buddhists but religious affiliation varied among ethnic hilltribes. In the past, they were allied to animism, but later Buddhism and Christianity become predominant among them, with about 70-94 % of Karen, Hmong, Lua, Yao, and Htin being Buddhists and approximately a half of Lahu and Akha being Christians. For others religious, animism might be popular among hilltribe peoples who still adhered to old traditional beliefs.

The majority of household heads in all ethnic hilltribes worked in the agricultural sector and the rest worked as merchants and employees in construction, manufacturing, and service industries, whereas more than a half of Thais worked outside the agriculture sector. They worked on trade, manufacturing, and public administration. Interestingly, household heads in ethnic hilltribes were born in Thailand almost exclusively. Akha had the lowest percentage of household head who were native born (88%).

In Thailand, nationality determines the rights of citizenship. Nationality of the household head relates to poverty through a combination of social discrimination, limited legal status, and restricted access to services including education, welfare, and health service. Most of household heads in ethnic hilltribes have obtained Thai nationality with the percentage higher than 90 but for Akha and Lahu, the percentages of household heads with Thai nationality was quite lower than other hilltribes, only 44% in Akha and 68% in Lahu. When comparing the percentage of household heads who were born in Thailand and their nationality, it was noted that the differences were quite significant for Lahu and Akha. It suggests that even though they were born in Thailand, they could not receive Thai citizenship.

The literacy of household heads varied enormously between Thais and hilltribes. Almost all Thais were able to read and write Thai language. Among ethnic hilltribes, Khamu and Htin had a higher level of literacy than the others, whereas Lahu and Akha had the lowest percentage of literacy with about 14% and 11%, respectively.

Table 2: Percentage and mean of the household according to background characteristics by ethnicity

Household characteristics	Ethnic affiliation									
	Thai	Karen	Hmong	Lahu	Akha	Lua	Lisu	Yao	Khamu	Htin
% of female headed household	25.4	15.6	12.9	15.3	19.1	15.0	17.6	18.3	17.2	13.9
% religion of head of household										
- Buddhism	96.9	75.1	70.9	50.4	35.5	88.8	64.8	82.7	64.0	93.5
- Islam	2.0	0.3	0.1	0.3	0.2	0.1	0.8	0.1	1.4	1.6
- Christianity	0.4	21.9	8.9	43.1	51.5	4.4	26.1	10.6	6.8	4.1
- Others	0.7	2.7	20.1	6.2	12.8	6.7	8.3	6.6	27.8	0.8
% of head of household works in agricultural sector	45.4	84.9	83.3	89.2	83.6	83.9	84.2	83.0	79.0	76.2
% of head of household with native born	99.4	92.6	92.7	92.4	87.6	93.2	92.2	94.3	98.4	98.4
% head of household with Thai nationality	99.7	93.8	91.6	67.6	44.4	95.6	76.9	92.6	94.3	96.7
% literacy of head of household	93.5	23.9	34.7	14.2	11.1	36.4	20.5	36.0	59.1	55.7
% of household in urban area	31.0	1.3	8.7	1.7	1.7	3.9	3.7	0.5	1.4	3.3
Mean of household size (SD)	3.6 (1.6)	4.2 (1.8)	5.9 (2.7)	4.4 (1.8)	4.6 (2.0)	4.3 (1.6)	4.6 (2.0)	5.0 (2.3)	4.0 (1.6)	4.0 (1.4)
Mean of CEB (SD)	2.5 (2.0)	2.8 (2.1)	3.8 (2.0)	2.8 (2.0)	2.8 (1.9)	3.2 (2.5)	3.3 (2.2)	3.2 (1.9)	2.7 (1.5)	1.9 (1.4)

A growing body of evidence indicates that ethnic inequalities are related to geographical setting, which is recognized as a disproportionate contribution of each country's material resources relative to the spatial distribution of national populations (Brockerhoff and Hewett, 2000; Gugler, 1996). There were vast disparities in living area, with only about 0.5- 9% of hilltribes and 31% of Thais living in urban areas. A large number of ethnic hilltribes generally lived in remote upland sites, particularly northern provinces.

Household size of Hmong was greater than other ethnic groups, followed by Yao, averaging 6 and 5, respectively. Likewise, the average number of children ever born of Hmong was highest when compared to the others (3.8). Thais had the lowest mean number of members in a household and children ever born, that was 3.6 and 2.5, respectively. Other hilltribes, except Htin, had slightly greater number of children ever born than Thais, averaging 2.7-3.3.

Socioeconomic differentials

There was a remarkable difference in socioeconomic status between Thais and ethnic hilltribes. The percentages for Thai households were often raised in a continuous linear gradient from the lowest to the highest socioeconomic status. By contrast, the percentage increased in a reverse direction in hilltribes. The distribution of percentage in each SES strata showed not much difference in Thais, whereas most households in all ethnic hilltribes were in the lowest SES, with a range between 71-87%. Among 9 hilltribes, the SES of Yao was somewhat better than the others followed by Htin, Khamu, and Hmong, while Karen and Lahu were the lowest groups in SES.

Table 3: Percentage distribution of household by ethnicity and socioeconomic status

Ethnicity	% of population according to socioeconomic status			
	Q1 (lowest)	Q2	Q3	Q4 (highest)
Thai	19.2	26.4	27.1	27.3
Karen	86.7	9.5	2.8	1.0
Hmong	79.6	14.1	4.7	1.6
Lahu	87.0	9.6	2.5	0.9
Akha	84.2	11.2	3.0	1.6
Lua	83.4	10.2	3.6	2.8
Lisu	81.8	11.5	4.8	1.9
Yao	69.6	19.5	7.0	3.9
Khamu	77.1	17.2	4.1	1.6
Htin	71.2	19.7	6.6	2.5

According to table 4, comparing the differences of SES by household characteristics, there was no significant variation of nationality across the socioeconomic quartiles in Thai, Lua, Khamu and Htin. For other ethnic groups, the

percentage of households tended to increase consistently with SES levels. However, the lowest-highest ratios closed to unity (0.7- 0.9). Except for Akha, the percentage gap of household heads with Thai nationality was relatively different between highest and lowest SES. Akha with Thai nationality tends to achieve high SES.

A statistically significant correlation between literacy of household heads and SES was observed (except Khamu). Literacy of the heads of households in all ethnic groups shows a clear gradual increase along all the quartiles of the socioeconomic index. The heads of households with high socioeconomic status were more literate than their low socioeconomic counterparts. The lowest-highest ratio for Thais closed to unity (0.9), whereas it appeared slightly large among hilltribes, about 0.2-0.6.

Table 4: Household characteristics by ethnicity and socioeconomic quartile

Indicator	n	% household according to socioeconomic status				P-value	Lowest/ highest ratio
		1 (lowest)	2	3	4 (highest)		
Nationality of household head							
Thai	305 347	88.0	92.3	94.9	96.9	0.287	0.9
Karen	14 586	93.3	96.2	97.8	98.6	0.000	0.9
Hmong	3 891	90.5	95.6	95.6	98.6	0.000	0.9
Lahu	2 327	66.3	75.2	75.9	76.7	0.000	0.8
Akha	1 089	39.5	70.2	70.3	72.5	0.000	0.5
Lua	1 444	95.4	96.8	94.4	100.0	0.245	0.9
Lisu	847	75.8	80.2	79.2	100.0	0.018	0.7
Yao	846	90.3	97.8	100.0	94.4	0.000	0.9
Khamu	346	94.3	92.1	100.0	100.0	0.628	0.9
Htin	118	97.7	95.8	87.5	100.0	0.327	0.9
Literacy of household head							
Thai	287 208	88.0	92.3	94.9	96.9	0.000	0.9
Karen	3 716	19.1	50.9	65.4	71.1	0.000	0.3
Hmong	1 472	31.7	42.0	53.0	64.3	0.000	0.5
Lahu	491	11.5	28.4	39.1	60.0	0.000	0.2
Akha	273	7.1	26.9	50.0	40.0	0.000	0.2
Lua	549	29.7	59.7	83.3	88.4	0.000	0.3
Lisu	226	16.2	33.3	49.1	57.1	0.000	0.3
Yao	329	29.4	46.1	56.3	66.7	0.000	0.4
Khamu	217	57.2	63.5	60.0	100.0	0.079	0.6
Htin	68	46.0	70.8	100.0	100.0	0.000	0.5

Table 4: (Continued)

Indicator	n	% household according to socioeconomic status				P-value	Lowest/ highest ratio
		1 (lowest)	2	3	4 (highest)		
Household head worked in agricultural sector							
Thai							
Karen	135 346	58.9	59.1	45.5	17.5	0.000	3.4
Hmong	14 586	84.6	74.5	59.9	56.4	0.000	1.5
Lahu	3 459	81.7	85.3	72.0	62.9	0.000	1.3
Akha	2 946	87.6	74.3	66.7	50.0	0.000	1.8
Lua	1 968	84.3	64.7	47.3	42.5	0.000	2.0
Lisu	1 267	86.7	72.7	64.8	65.1	0.000	1.3
Yao	927	88.1	75.4	52.8	47.6	0.000	1.9
Khamu	759	86.6	79.8	65.6	66.7	0.000	1.3
Htin	290	83.0	68.3	73.3	16.7	0.000	5.0
	93	79.3	83.3		100.0	0.062	0.8
				12.5			
Living in urban area							
Thai	95 335	16.9	19.1	28.5	55.0	0.000	0.3
Karen	196	0.7	3.7	5.7	16.1	0.000	0.0**
Hmong	370	10.7	0.8	1.5	1.4	0.000	7.6
Lahu	57	1.3	1.2	11.5	13.3	0.000	0.1
Akha	42	0.7	5.5	6.8	20.0	0.000	0.0**
Lua	59	3.3	4.5	13.0	7.0	0.003	0.5
Lisu	41	1.6	7.1	20.8	33.3	0.000	0.0**
Yao	4	*	*	*	*	-	-
Khamu	5	*	*	*	*	-	-
Htin	4	*	*	*	*	-	-

* Sample sizes are too small for statistical test

** The exact value is less than zero (0.01-0.05)

The percentage of household heads who worked in the agricultural sector for all ethnic groups was more likely to concentrated in the low SES and often fell reversely with an increase of SES levels. Khamu and Thais showed comparatively large gap between lowest and highest SES, with 5.0 and 3.4, respectively, whereas the differences for other ethnic hilltribes were smaller than those two groups.

The geographical setting showed variations across the socioeconomic index. SES appeared to improve for those living in urban areas for almost all ethnic groups. The lowest-highest ratios were fairly large in Lisu, Akha, and Karen. Contrary to

Hmong, households in urban areas were more often in the lowest socioeconomic status than the highest SES.

Levels and trends in under-five mortality

Under-five mortality estimates were based on data for women aged 25-49 for the periods 4-15 years prior to the date of the 2000 census. Estimates referring to the most recent period are based on women aged 25-29 years. Results from the indirect estimation indicate that there was a declining trend in the rates of child death over time in both Thais and ethnic hilltribes (figure 1). The mortality rates in Thais gradually decreased from 33.9 per 1,000 live births in 1985 to 14.3 in 1996, while the rates of all hilltribes showed substantial decline from 74.9 to 34.4 in the same period.

Comparing the rates among hilltritbes, mortality rates varied across hilltribes. The rates in Karen and Lahu were comparatively higher than the others. Hmong seemed to have a lower rate than several ethnic hilltribes. However, the standard errors in U5MR among ethnic hilltribes were relatively large and the estimates among hilltribes with small sample sizes, Lua, Lisu, and Yao, showed severe fluctuations.

Table 5: Under-five mortality rates (95% CI) by ethnicity and reference year, the 2000 census

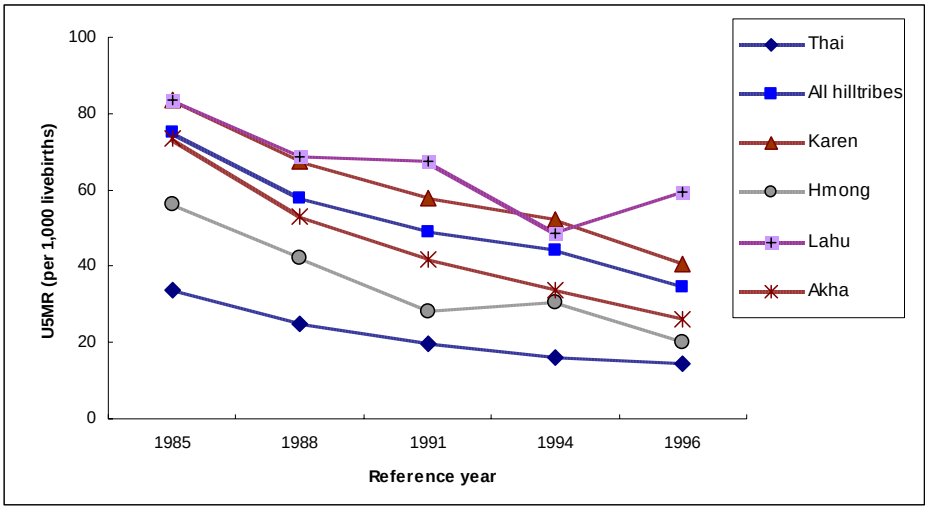
Ethnicity	Reference year				
	1985	1988	1991	1994	1996
Thai	33.9 (31.7-36.0)	24.8 (23.2-26.4)	19.6 (18.6-20.6)	16.1 (15.1-17.1)	14.3 (13.1-15.5)
All ethnic hilltribes	74.9 (70.4-79.4)	57.8 (52.5-63.1)	48.9 (42.3-55.5)	44.2 (36.3-52.1)	34.4 (23.6-45.2)
Karen	83.6 (68.2-99.1)	67.4 (55.8-79.0)	57.8 (51.6-64.0)	52.3 (46.9-57.7)	40.7 (35.5-45.9)
Hmong	56.3 (29.2-83.5)	42.2 (23.5-60.9)	28.1 (21.0-35.2)	30.4 (24.1-36.7)	20.1 (14.3-25.9)
Lahu	83.7 (49.0-118.4)	68.7 (43.0-94.3)	67.4 (54.3-80.5)	48.7 (38.1-59.3)	59.4 (45.6-73.2)

Table 5: (Continued)

Ethnicity	Reference year				
	1985	1988	1991	1994	1996
Akha	73.3 (36.1-110.6)	53.2 (26.7-79.6)	41.6 (28.9-54.3)	33.9 (22.3-45.5)	26.2 (14.1-38.3)
Lua	56.1 (17.5-94.7)	43.6 (11.4-75.7)	50.7 (23.4-77.9)	43.1 (20.4-65.7)	11.5 (0.7-23.6)
Lisu	64.9 (11.4-118.5)	44.4 (7.6-81.2)	40.7 (11.0-70.5)	41.0 (14.0-68.0)	20.9 (1.9-39.9)
Yao	46.9 (1.5-92.2)	27.2 (5.5-59.9)	12.6 (5.7-30.9)	32.9 (4.9-60.8)	9.2 (4.9-23.3)
Khamu	*	*	*	*	*
Htin	*	*	*	*	*

* Sample sizes are too small for reliable estimate

Figure 1
Under-five mortality rates by ethnicity, the 2000 census



Socioeconomic status and child mortality

The estimation could not provide reliable rates for all ethnic groups classified by SES. This shortcoming was due to insufficient number of deaths attributed to each socioeconomic stratum, predominantly the high socioeconomic level in hilltribes. To this extent, for a more robust estimate, the analysis of U5MR across SES was done by combining 9 hilltribes into one group.

Table 6 demonstrates U5MR of Thais and hilltribes across low and high SES strata. It illustrates the extent to which U5MR seemed to correlate with the socioeconomic index. In both Thais and hilltribes, children with high SES were more likely to have a higher probability of survival than their low SES counterparts. Under-five mortality rates in Thais were quite a bit lower than hilltribes, even for those in low SES groups.

Table 6: Under-five mortality rate (95% CI) in Thais and Hilltribes by SES strata and reference year, the 2000 census

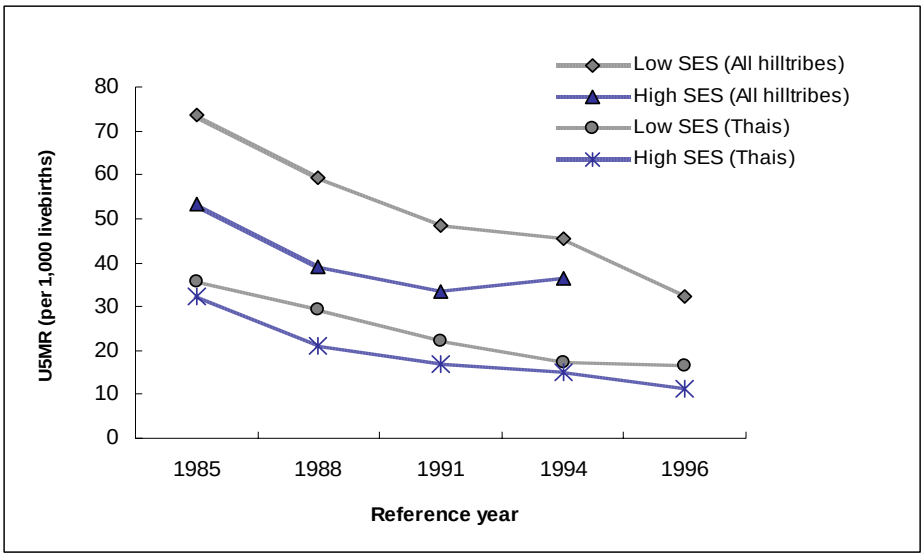
	Reference year				
	1985	1988	1991	1994	1996
Thais					
Low SES	35.7	29.2	22.3	17.1	16.7
	(34.1-37.3)	(27.6-30.8)	(20.2-24.4)	(14.5-19.7)	(13.5-19.9)
High SES	32.3	21.0	16.9	14.9	11.2
	(30.9-33.7)	(19.5-22.5)	(15.3-18.5)	(13.0-16.8)	(8.4-14.0)
Rate ratio	1.1	1.4	1.3	1.1	1.5
	(1.1-1.1)	(1.3-1.4)	(1.3-1.3)	(1.1-1.2)	(1.4-1.6)
Rate difference	3.4	8.2	5.4	2.2	5.5
	(3.2-3.6)	(8.1-8.3)	(4.9-5.9)	(1.5-2.9)	(5.1-5.9)
Hilltribes					
Low SES	73.7	59.5	48.5	45.4	32.4
	(69.1-78.3)	(53.8-65.2)	(41.6-55.4)	(36.7-54.1)	(21.1-43.7)
High SES	53.2	39.0	33.3	36.6	
	(41.7-64.7)	(17.7-60.3)	(8.5-58.1)	(8.4-64.8)	*
Rate ratio	1.4	1.5	1.5	1.2	
	(1.2-1.7)	(1.1-3.0)	(1.0-4.9)	(0.8-4.4)	*
Rate difference	20.5	20.5	15.2	8.8	
	(13.6-27.4)	(4.9-36.1)	(-2.7-33.1)	(-10.7-28.3)	*

* Sample sizes are too small for reliable estimate

Disparities in U5MR between low and high SES were observed in both groups, and appeared over time. Nevertheless, the gaps in 5 periods for Thais which were noted by both relative and absolute difference could not point to the direction of

the changes as to whether they increased or decreased because of the fluctuation of the rates. For hilltribes, there were remarkable reductions in child mortality inequality across socioeconomic strata form 1985 to 1994. Rate ratios were comparatively small in Thais, with about 1.1 to 1.5. That means Thai children who were in the lowest SES tended to die before their fifth birthday more than those who were in the high SES around 1 to 1.5 times. Similarly, the gaps of disparity in hilltribes revealed not much difference (1.2 to 1.5) but as compared with Thai, the gaps in each year were slightly higher than Thais. When considered on absolute difference, the value was noticeably different for hilltribes, with rates 8.8 to 23.0, while only 2.2 to 8.2 for Thais.

Figure 2
Under- five mortality rate in Thais and all hilltribes by SES strata, the 2000 census



Conclusions and Discussion

This is the first study to report on socioeconomic inequality in child mortality between Thais and hilltribes on a national scale. Also, it is the first study to use the national census to investigate ethnic diversity with regard to child mortality. There were various limitations that may have affected the results of this study. However, the findings are still useful for indicating the magnitude of mortality differences and identifying the groups of hilltribes requiring urgent policy attention to reduce child mortality.

In conclusion, under-five mortality rates in all ethnic hilltribes were comparatively higher than the majority Thais over time. Yet, the mortality differentials between them tended to shrink eventually. The findings have clearly identified that the variations of U5MR among studied ethnic groups rely on their socioeconomic status: the groups with a large proportion of high SES were more likely to enjoy lower death rates than their low SES counterparts. Thais with the highest socioeconomic position had the lowest rates, while Karen and Lahu ranked in the lowest socioeconomic status were the tribes that most suffered with higher rates of mortality than other tribes. Further, inequalities in child mortality were found within ethnic groups; the mortality rates often fell in a continuous linear gradient from the lowest to the highest socioeconomic status. The socioeconomic differences in child mortality were relatively large among hilltribes, but they were small among Thais. It is reasonable to conclude that SES is one of the crucial factors related to child mortality differentials among and within ethnic groups.

The results in terms of rates for ethnic Thais are consistent with other studies (Vapattanawong et al., 2007; Hill et al., 2006). Among ethnic hilltribes, there are very few studies to support these findings, moreover most of them are outdated and focused on infant mortality rather than under-five mortality. For examples, Hmong are one of the ethnic hilltribes that most researchers study. Kunstadter, et al. (1993) estimated child survival rates using a survey of 198 Hmong communities in 10 provinces in 1987-1988. Under-five mortality rates in this group were substantially higher as compared with the general Thais. However, the rates appeared to decline about 40% between 1962-1981.

In terms of ethnic diversity in child mortality, there are no comparative studies between Thais and hilltribes in Thailand. Nonetheless, many overseas studies have verified that members of nationally prominent ethnic groups typically have much lower child mortality rates than the ethnic minorities. As such, Jatrana (2003) investigated infant mortality differentials between two ethnic groups (Meo and Non-Meos) in a backward region of North India. The result indicated that Meo infants are 32 percent more likely to die than Non-Meos. The key explanation for Meos' high rates of infant mortality is their low socio-economic status and poor household environment. Similarly, the studies among various ethnic groups in sub-Saharan Africa (Brockerhoff and Hewett, 2000), Han and twelve of the largest ethnic minorities in China (Yusuf and Byrnes, 1994), and Aboriginal and non- Aboriginal infants in Australia (Freementle et al., 2006) showed analogous results.

In fact, differentials in child mortality are not totally attributed to socioeconomic status, and may also be influenced by other factors. Some empirical evidence is provided to explain why ethnic hilltribes had higher death rates than general Thais. Importantly, it should be stressed that access to health care services may be a critical cause of inequalities. According to a survey by the Highland Health Development Center in 1996 and 2001 (Sangelek, 2002), the percentage of ante-natal care (at least 4 times) among pregnant hilltribe women was relatively low at 36% in 1996 and then increased to 70% in 2001. The percentage of deliveries attended by trained birth attendants was also low, with 53% and 76% in 1996 and 2001, respectively, while general Thais obtained these services almost exclusively. Furthermore, the percentage of babies with low birth weight (less than 2,500 grams) for ethnic hilltribes was higher than Thais about 3% and 4% in 1996 and 2001, respectively. Additionally, vaccination coverage in the late 1990s among hilltribe children less than 1 year old was approximately 60% (for diphtheria-pertussis, tetanus triple vaccine, oral polio vaccine and measles) and about 80% (for tuberculosis vaccine), whereas the percent for Thais was more than 90% in all kind of vaccines (Wibulpolprasert, 2002).

In the main, there are three limitations that must be exercised in interpreting the results. Firstly, U5MR were calculated by using retrospective survey data on the number of children ever born and the number of surviving and this was often distorted either by errors in the number of children who die or live. The rates estimated in this study seem to be under estimated and contain significant standard errors. This might be due to some defects in the extent that woman in some age groups misstated either the number of children ever born or the number of children who died or both, particularly in young and old age groups. Furthermore, about 15% of the samples did not specify the number of children ever born and died, and sample sizes of certain ethnic hilltribes were extremely small.

Secondly, the estimates of mortality inequality accessed by pooling the two lowest and the two highest socioeconomic groups could capture only a narrow range of differences. Only two levels could not yield much variation of mortality difference. If data was allowed to estimate the magnitude of relative and absolute difference using SES in quartile or quintile, it would have provided more accurate results.

Thirdly, the time periods between the time of U5MR estimates and the time of socioeconomic status have to be considered. The former was derived from periods before the time of the census, while the latter was obtained from the year of the survey. The discrepancy of time might have affected social and economic change especially in

Thais who were more active in economic activities and benefited from vigorous growth at that time. However, these shortcomings can be reasonably disregarded. Certain studies note that the economic boom in the pre-1997 period and the economic collapse of 1997 have not had much effect on socioeconomic status (Warr, 2000). Likewise, the comparative study on economic status between the 1990 and 2000 censuses (Vapattanawong et al., 2007) indicates that economic strata have shifted slightly during those 10 years.

Despite the fact that almost all hilltribe members were born in Thailand and the majority of them have been granted Thai nationality, their SES and U5MR were significantly different from Thais. Thus, there is a need to assist them to enjoy the same citizen's rights as general Thai people. The findings show a strong association between SES and child mortality, therefore, this knowledge can serve to develop policies aimed at the reduction of ethnic inequalities in child mortality. The ways to improve SES should focus on literacy or education and accessibility to public utilities with a concern for their difficulties. However, because of the limitation of the census data, the socioeconomic index in this study only covered a few dimensions of SES and could not reveal a full understanding of disparities. Hence, further studies should be conducted on more detailed data and address the ethnic distinctiveness in cultural perspectives among ethnic hilltribes. Importantly, however, the first step towards hilltribe development in any respects is the need for more regular and comprehensive data by ethnicity across a range of administrative and survey data at both local and national levels. If we do not have more detailed data on ethnic groups and accurate ethnic statistics, how can we set and meet our goals effectively?

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