



# Rates and Age Patterns of Suicide and Undetermined Death in Thailand

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**Abstract**

**Background:** The World Health Organization (WHO) highlights sizeable rates of ‘undetermined deaths’ in Thailand. These are assigned ICD-10 codes, referred to by WHO as ‘garbage codes’. Many such deaths may have been ‘hidden suicides’. WHO estimates Thailand’s suicide rates to be twice the officially reported rates.

**Methods:** Mortality data provided to WHO by Thai government authorities are published on-line in WHO’s Mortality Database. The present study extracted data on numbers of male and female deaths in 5-year age groups in Thailand in 1998-2000 and 2013-2016, coded (using ICD-10) as suicides, Event of Undetermined Intent (EUI), accidental drowning or poisoning, or ill-defined/unknown cause (R99). Using population figures, crude mortality rates per 100,000 in each of these categories were calculated; age patterns were graphed.

**Results:** Thailand’s officially reported rates of “ill-defined or unknown” deaths were higher than those of any other country, with exponential increases in late life. Rates of Event of Undetermined Intent (EUI) were higher than those in most countries. The crude suicide rate in Thailand was 5.62 per 100,000 (male 9.7, female 2.4). If the suicide and EUI rates are combined and the age patterns graphed, the rates and patterns are similar to those manifested when graphing WHO estimates of Thailand’s suicide rates. The accidental drowning rate is high but the suicide drowning rate is almost zero. The suicide rate of young persons in Thailand has halved since 2000. The gender ratio and age patterns of suicide are more like those of Western than East Asian nations.

**Conclusions:** High rates of ‘undetermined deaths’ in Thailand point to high rates of ‘hidden suicides’. High rates may be partly attributable to variably poor resourcing and training in relation to certifying and coding deaths. Use of verbal, psychological and/or forensic autopsy would reduce inaccuracies in recording suicide numbers in Thailand.

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Keywords: Suicide; Mortality rates; Age patterns; Undetermined deaths; Thailand; World Health Organization.



## Introduction

The World Health Organization (WHO) estimates that Thailand's age-standardized suicide rate is more than double that reported by the Thai Ministry of Public Health (MOPH) [1]. Little has been published or discussed in psychiatric or other literature about this discrepancy, nor about whether the rates and age patterns of suicide in Thailand have changed recently, during what has been called contemporary Thailand's "epidemiological transition" [2,3]. This study explores evidence of undercounting of suicides, and whether this is attributable to incomplete gathering of data and/or miscoding of causes of death [4].

Each year, information about causes of death (coded using the International Classification of Diseases; ICD-10 [5]) is submitted to WHO by Member States and published in WHO's Mortality Database [6]. From such data it should be possible to calculate the proportion of cases in which Thai authorities have found the ICD cause of death remained *unexplained* (i.e. having *undetermined cause*) after relevant investigations and assessments had been completed. Also, in a proportion of apparent accidents or self-injury cases, authorities report that although the mode of death was clear, *intent was undetermined* (and will have coded the case accordingly). It is believed that among deaths where cause and/or intent have remained undetermined there is a proportion that are 'hidden suicides'.

The major aim of this study was to calculate rates of suicide, and compare them with rates of deaths coded to what could be conjectured as ICD-10 havens for hidden suicides, the commoner ones being accidental death, 'Event of Undetermined Intent' (EUI), and 'ill-defined or unknown cause' deaths (most of the latter being coded R99 in ICD-10). A further aim was to examine evidence for changes in age patterns of identified suicide during the last two decades

## Method

At the time this paper was drafted, the latest year for which numbers of registered deaths in Thailand were recorded in WHO's Mortality Database was 2016. Data on numbers of deaths per year in 2013-2016, in each male and female 5-year age group from 10-14 to 80-84 years, plus 85+ years, that had been assigned the following ICD-10 codes, were extracted from WHO's Mortality Database [6]: (1) suicide (codes X60-84), (2) Event of Undetermined Intent (EUI; Y10-34), (3) ill-defined or unknown cause (R99), (4) accidental drowning (W75-84), and (5) accidental poisoning (X40-49). Total numbers of deaths per year in Thailand in 1998-2000 and 2013-2016, and of deaths coded as suicide, EUI, R99 deaths, accidental drowning or accidental poisoning, were extracted (males and females separately). Total numbers of deaths coded as due to other non-transport accidents were also noted.

Population figures (totals plus 10-year age groups) were obtained from the WHO Mortality Database, and (5-year age groups) from on-line Population Pyramid [7]. These figures enabled calculation of mortality rates of the different age groups and of total populations. Age patterns were graphed.

Additionally, the latest available WHO Mortality Database statistics on R99-coded deaths in 30 larger countries were extracted in order to calculate rates per 100,000.

Suicide numbers for the years 2013-2017 were obtained from annual reports of Thailand's Department of Mental Health, confirming that the 2013-2016 figures provided by WHO were the

same as those initially recorded in Thailand. The 2017 figures were not included in this study's analysis since details about coding of undetermined deaths in 2017 had not yet been made available.

All data obtained for this study were in the public domain. Ethics approval was therefore not sought.

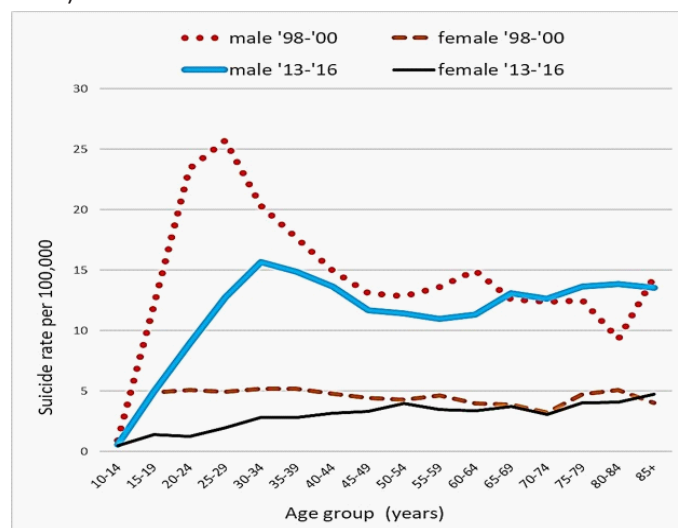
## Results

In this paper, all death rates are documented as numbers per 100,000 persons.

In 2016, WHO's Mortality Database showed that the 4131 suicides constituted 0.88% of the deaths in Thailand (1.24% of male and 0.42% of female deaths), the crude rate being 5.62 per 100,000 (male 9.58, female 1.90). Some 70.7% of suicides were by hanging, 23.7% by poisoning (rate 1.33), 3.3% by fire-arms and the remainder by other or unspecified means. Of the poisonings, 76.3% were by ingestion of pesticides (rate 1.01).

In 2013-2016 the mean number of suicides per year in Thailand was 3984, and there was little variation in rates by different methods. The age pattern of the male suicide rates was bimodal (Figure 1), with peaks at age 30-34 years (15.65 per 100,000) and 80-84 years (13.82). The graph of the female 2013-2016 pattern rose progressively to a peak at age 50-54 years (3.95) and was then relatively uniform into late life.

Figure 1 shows there had been a considerable change between 1998-2000 and 2013-2016. The male suicide rate at 15-29 years in 1998-2000 was twice the rate it was in 2013-2016, the peak being at 25-29 years (25.73), with a subsequent decrease to 12.81 in middle age. The female rate in youth and young adult years was similarly higher in the earlier period (Figure 1).



**Figure 1:** Age patterns of male and female suicide rates in Thailand, 1998-2000 and 2013-2016, Source of data: WHO Mortality Database [6].

Table 1 shows the average number of deaths per year of males and females in 2013-2016, and of suicides, EUI deaths, R99-coded deaths, and accidental drowning and poisoning deaths. The male to female ratios were: suicides 4.8: 1, EUI deaths 3.7: 1, accidental drowning 4.4: 1, accidental poisoning 1.9: 1, and R99 deaths 1.2: 1.

The recorded rates of accidental poisoning and of EUI poisoning in Thailand have remained low, at around 0.10 and 0.20,

respectively. There were 10 drowning suicides in 2013-2016 (only one in 2016), and only 4 EUI drowning deaths, but the average number of deaths per year coded as accidental drowning in 2013-2016 was 3507 (male 2820, female 687; rate 5.07); in the previous ten years the average was 4194. Relatively few deaths by hanging, falling from heights, firearms discharge or cutting were coded as accidental.

In 2016, EUI deaths and R99-coded deaths constituted 1.95% and 16.65%, respectively, of all deaths in Thailand. Of deaths at age 75+ years, 39,950 (21.45% of deaths at that age) were coded R99. This was far more than in the quinquennium 1994-1998, when the mean total number of deaths coded R99 was 18809 (rate 31.27), and they comprised 5.5% of all deaths. The annual number of R99-coded deaths increased substantially in 1999, and since then the number of R99-coded deaths per year has varied between 51866 (13.5% of all deaths) in 2003

and 103458 (23.2%) in 2015. In 2016, 36,566 deaths (8% of all deaths) were coded as due to age-related disability (R54).

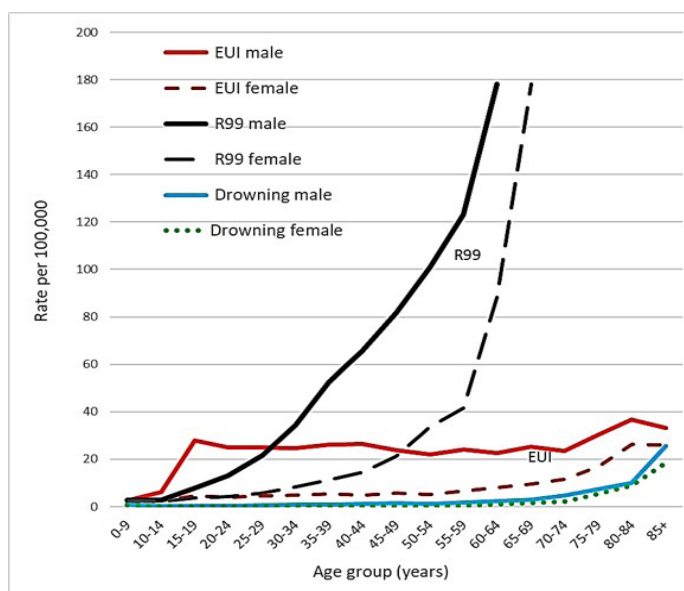
Of 30 countries with populations greater than ten million that reported numbers of deaths at least once in 2014-2016 to WHO's Mortality Database, only five had R99 rates calculated as more than 20 per 100,000: These were Thailand (rate 119.87, 16.6% of deaths in 2016), South Africa (rate 97.60, 11.73% of deaths), France (rate 33.03, 3.89% of deaths), Argentina (28.17, 3.70% of deaths) and Portugal (27.28, 2.70% of deaths). The R99 rate in Korea was 11.43, Philippines 11.00, Japan 8.05, United Kingdom (UK) 2.08.

Age patterns of EUI, R99-coded and accidental drowning deaths in 2016 were graphed (Figure 2). R99 rates increase exponentially with age, reaching above 2300 per 100,000 at 85+ years; rates above 180 are not shown on the graphs.

**Figure 1:** Number per year and rates of deaths from suicide, EUI, ill-defined/unknown cause and accidental drowning and poisoning in 2013-2016, and % of all deaths.

Deaths	MALE			FEMALE		
	Mean number per year	Rate per 100,000	% of total deaths	Mean number per year	Rate per 100,000	% of total deaths
Total deaths In 2013-2016	251,366			192,819		
Suicide deaths per year	3207	9.58	1.28	668	1.90	0.35
EUI deaths	6602	19.73	2.63	1766	5.03	0.92
R99 deaths	41,705	124.60	16.6	35753	101.78	18.5
Accidental drowning	2850 387 aged <10 years	8.47	1.07	650 125 aged <10 years	1.84	0.32
Accidental poisoning	38	0.11	0.01	20	0.06	0.01

Source: WHO Mortality Database



Source: WHO Mortality Database [6].

**Figure 2:** Age patterns of male and female suicide rates in Thailand, 1998-2000 and 2013-2016, Source of data: WHO Mortality Database [6].

### Discussion

This study presents two sets of findings. Thailand's recent suicide statistics are presented. Since 2000 the suicide rates of young males and females have halved. However, studies carried out in Thailand have questioned the quality and patterns of data reported by the country's civil registration and vital statistics systems [8,9]. Doubts about the 'usability' of Thailand's mortality data [1] make it important to discuss the degree to which the age patterns graphed from those data accurately reflect the way Thai suicide rates vary across the age range.

The second set of findings relate to misclassified suicides. It is widely agreed that suicide rates around the world are undercounted [10,11]. A list of the often complex reasons for miscoding has been proposed [12]. The term 'Garbage Codes' (GC) has been used for codes (such as those signifying heart failure or confusion) that should not be used on death certificates or by coders to label the underlying cause of death [13]. If underlying cause is ill-defined or undetermined in a large percentage of deaths, between-nation comparisons and analysis of causative factors are frustrated. EUI and "ill-defined or unknown cause" (R99) have been included in lists of GCs [13]. Key findings of the present study are that rates of EUI and R99-coded deaths in Thailand are higher than those of most other countries. It is claimed that undercounting of suicides is most commonly attributable to their being 'hidden' (sometimes knowingly, but how often is unknown) in categories of 'deaths of undeter-

mined intent', 'accidents' and 'ill-defined and unknown cause of mortality' [14].

### EUI deaths

As shown in Table 1, over the four years from 2013 to 2016, the percentage of male and female deaths in Thailand coded as EUI deaths was over twice the percentage coded as suicides. The average number of EUI deaths per year in Thailand in those years was 8368, the rate being 12.3, which is higher than that in most other nations. In the UK and some other countries, numbers of EUI deaths and suicides are added when calculating official suicide rates. The mean EUI rate in the UK in 2013-2015 was 2.03 per 100,000. Almost all of 23 Western European countries reported mean EUI rates of under 4 per 100,000 in 2013-2015 and in 16 it was less than 2 [15]. Rates in some Eastern European and Western Asian countries were higher than 4, but most were under 12. The rate reported by Ukraine in 2005 was 18.62, and Belarus's in 2001 was 19.95. Andreev et al calculated that the EUI rate in Russia in 2000-2011 was 28.0 but suggested that a large proportion of the deaths were attributable to homicide [16].

Värnik et al developed a "2-20 benchmark" to assess suicide registration quality across various countries [17]. The primary indicator of acceptable quality is a rate of <2 deaths per 100,000 coded Y10-34 (EUI); the second is a ratio of <2 EUI deaths to 10 suicides. In 2016, Thailand recorded a rate of 12.1 EUI deaths per 100,000 and a ratio of 21.6 EUI deaths to every 10 suicides. If EUI data are regarded as indicative of quality, the quality of Thailand's data is unacceptable.

### R99 deaths

Rockett et al had previously suggested that quality should be judged by a ratio of combined numbers of EUI and R99 deaths to number of suicides [10]. As shown above, Thailand reports a higher R99 rate than any other nation that submits its mortality rates for inclusion in WHO's Mortality Database. The ratio of combined EUI and R99 numbers in 2016 to the number of suicides was just over 22 to 1. However, although the high R99 rate indicates considerable misclassification of deaths in Thailand, it does not necessarily mean that a substantial number of R99 deaths were hidden suicides. Evidence suggests that the vast majority of R99-coded deaths are not suicides. The age pattern and gender ratio of R99 death rates in Thailand (Figure 2) are very different to those of suicides. The age-associated increase in R99-coded deaths is at least partly attributable to increased diagnostic difficulty in late life patients. After detailed investigations in relation to 2756 deaths of unknown cause in Tel Aviv, Bakst et al reported that only 53 (1.9%) were probable suicides [18], but in spite of this percentage being so low, these authors concluded that "the residual and imprecise natural cause mortality category of 'unknown causes' emerged as a prime contender for containing misclassified suicides".

### GC codes

The EUI codes and R99 code are included in the list of GCs produced by WHO and the Global Burden of Disease study [13,19]. So are the other R codes, including those for age-related disability (R54) and cachexia (R64), and codes for ill-defined cardiovascular diseases. In some countries it is accepted that most deaths coded as EUIs were 'hidden suicides' [20]. However, in the vast majority of cases assigned a GC (including R54 and R99) there would be nothing to suggest suicide. It is understandable that GCs are assigned more commonly in regions/

countries where there are limited resources and training to investigate, certify and code deaths, and when insufficient history is available to make a definitive diagnosis. A validation study in Thailand showed that use of Verbal Autopsy (VA) led to a big drop in the percentage of deaths coded as due to ill-defined diseases [21], but lack of training has restricted use of VA in Thailand.

Variable use of GCs across countries limits meaningful comparisons of data regarding causes of death [13]. To maximise the public health utility of cause-of-death data, WHO issues revised compilations of data from nations if the quality of submitted data is deemed unacceptable because of high percentages of GCs. Having adjusted for incomplete recording of deaths, those assigned to GCs are identified and redistributed [13,19]. WHO assesses the likeliest cause of death, using statistical models and algorithms for each age-sex-location-year group, and then estimates rates of suicide and other deaths [22]. It was estimated that there were 9945 suicides in Thailand in 2016. This would equate to some 2% of all deaths that year, i.e. similar to corresponding percentages in various English-speaking countries. In effect, the WHO estimates of Thai suicide rates in 2016 were made by re-coding (as suicides) 5814 deaths that had been given ICD-10 GCs, and adding them to the 4131 identified by Thailand as suicides. There was no mention of how many of the 5814 were previously included among the 8368 EUI deaths and how many had previously been assigned other GC codes. The age-standardized suicide rate per 100,000 in 2016 was estimated as 12.9 (male 21.4, female 4.8); the crude rate was 14.4 (male 23.4, female 5.9) [1]. These estimates can be contrasted with the figures reported to WHO by Thailand (Table 1).

### Suicides

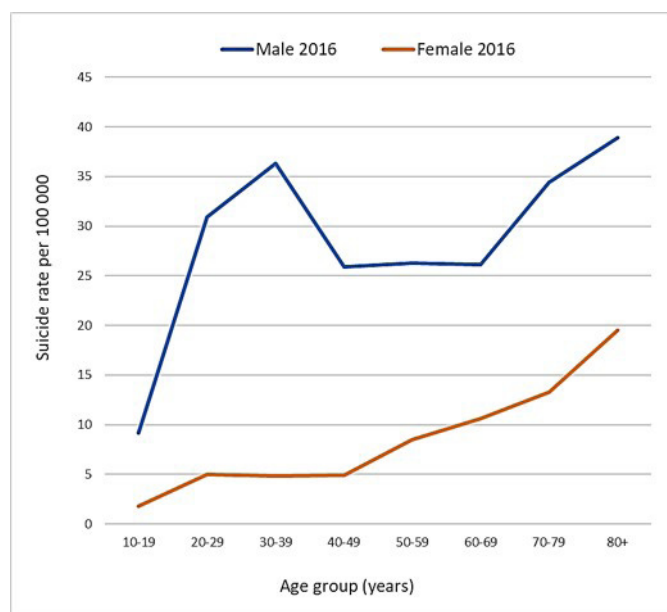
This study of Thailand's reported data lends support to WHO's belief that suicide numbers in Thailand are undercounted, this being largely because cause of death is commonly labelled as "undetermined". The study shows no definite evidence that the *patterns* of rates across age groups, genders and methods used for suicide, as reported by Thailand, would be different from those derived by substituting the WHO estimates. However, the fact that Thailand has persistently reported very low drowning suicide rates raises doubts about accuracy. The high rate of drowning deaths in Thailand (5.07) accords with an earlier finding that accidental drowning rates across the age range in Thailand were among the highest compared to 59 other nations [23]. A later study found that Japan had the highest drowning mortality rate (4.35) out of 32 OECD countries [24]. Latest figures show the Japanese drowning rate as 7.09 (accidental drowning 5.97, EUI 0.62, suicide 0.50) [6]. Corresponding drowning rates in Korea were 1.28, 0.56 and 0.89. The striking difference from Thailand's reported data is that Thailand's suicide drowning rate has been almost zero for many years. The Philippines and Malaysia also report hardly any suicides by drowning but substantial accidental drowning rates [6]. Maybe drowning is culturally less acceptable as a method of suicide in some countries. Alternatively, maybe there are reasons why drowning suicides are not recognised or coded as such in some countries; in Thailand, some accidental drownings may have been 'hidden suicides'.

Transport accident data were not examined in this study, though probably some single-car crashes coded as accidental were suicidal. Most fall deaths coded as accidental were deemed to be genuinely accidental, though it was noted that in Tel Aviv a number of fatal falls were coded as deaths of un-

known cause [18]. Deaths coded as accidental due to firearms discharge, burning, cutting, etc., were very infrequent.

In contrast to the drowning figures and to findings in many other countries, the rate of accidental poisoning has been much lower in Thailand than the rate of suicide poisoning. The EUI poisoning rate was also low. Reasons for this contrast need to be sought.

Graphs of the age patterns of rates of suicide and of EUIs in Thailand in 2013-2016 (Figures 1 & 2) show that if the suicide rates and EUI rates were combined (as is the case in the UK when publishing official suicide rates), the resulting male pattern would look much the same from age 15-19 up to 70-74 years but with rates about 22 per 100,000 higher than those shown in Figure 1. This is because the graph of the age pattern of EUIs is almost uniform and flat across the age range, with a rise at 75-79 years. The female age pattern would be upward-sloping (as in Figure 1) but with a rise that continues from middle age to late old age. WHO's estimates of male and female suicide rates of 10-year age groups are available online and have been graphed (Figure 3) [25]. The graphs appear very similar to the way age patterns of combined suicide and EUI rates in Thailand in 2013-2016 (Figures 1 & 2) would look, and provide reassurance that even with under-counted suicide numbers, it is appropriate to look for pointers to causation by examining age patterns of suicide.



Source: World Health Organization, 2018. Global Health Observatory data.

**Figure 3:** Graphs of WHO estimates of crude suicide rates of 10-year age groups in Thailand, 2016.

Age patterns of 1998-2003 suicide rates, graphed by Lotrakul [26], and comparable graphs shown in the present study (Figure 1), are of special interest since these years followed the 1997 Asian Financial Crisis and coincided with changes in use of pesticides and charcoal-burning as methods of suicide in some Asian countries. Rates rose after the 1997 financial crisis, but it was posited that male suicide rates in the early 2000s may have been highest at age 25-34 years because of chaotic sexual relationships, HIV infection and alcohol abuse [27]. Graphs of 2013-2016 age patterns demonstrate a halving of the suicide rates of young people in Thailand over recent years, possibly partly attributable to a falling HIV/AIDS mortality rate, improved

economic conditions for younger Thai citizens, and increased urbanization (a reason given for the decreased suicide rate in China [28]).

The patterns shown in Figure 1 are very different from age patterns documented in East Asian jurisdictions, as exemplified by upward-sloping male and female patterns in Taiwan, China, Hong Kong and Korea [29,30,31]. Thailand's patterns are more similar to those encountered in recent decades in various Western countries than to those of other Asian countries, and (as in most Western countries) the Male: Female exceeds 3:1. Possible explanations can be debated. Bearing in mind that suicide data from several countries in South-East Asia have been regarded as unreliable [32], it is noteworthy that graphs have shown a bimodal male suicide age-pattern in the Philippines which was similar to Thailand's, but the female pattern was downward-sloping [33].

### Strengths and limitations

The major strength of this study is the availability of so much relevant data on WHO's Mortality Database. Limitations include (1) the limited resourcing and expertise of some of those responsible for certifying and coding underlying cause of death in Thailand, and (2) the lack of studies to show what proportion of 'hidden suicides' were coded in Thailand as either EUI, R99 or accidental drowning.

### Conclusions

This study shows that over 26% of deaths in Thailand are being coded as 'undetermined deaths'. Thailand has high EUI rates, and has higher rates of "ill-defined or unknown cause" deaths than any other nation; WHO reassigns them to what they consider to be the likeliest cause when estimating 'true' rates of suicide and other deaths. EUI data should be published in Thailand at the same time as MOPH publishes Thailand's latest suicide data. Research studies concerning what percentage of accidental drowning, EUI and R99-coded deaths in Thailand were really suicides (for example, using psychological or verbal or forensic autopsy) are needed. Increased funding for investigation of ill-defined cause cases, and training of those certifying or coding deaths, is essential. From other studies it appears likely that most EUI deaths and a very small percentage of R99 deaths were hidden suicides. Age pattern graphs of combined numbers of EUI deaths and suicide are similar to comparable graphs of WHO-estimated suicide numbers. Such graphs help recognition of changes in rates of particular age groups, including the recent halving of young adult suicide rates; they show that Thai age patterns (like gender ratios) are more similar to those of Western rather than Eastern Asian nations.

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