

# Incompleteness of Registration Data on Centenarians in Thailand

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*This study aims to estimate the number of centenarians—the population aged 100 years and over, and to assess the quality of registration data about the elderly population in Thailand. Data were taken from population censuses, life tables constructed from the Survey of Population Change (SPC), regional model life tables, and records in civil registration. Life expectancies of centenarian cohorts were derived from SPC life tables. Model life tables of corresponding levels were applied to determine survival ratios. These ratios were then applied to census population data for 2000 to estimate the number of centenarians still surviving in 2010. These demographic procedures yielded an estimate of about 1,700 surviving centenarians in 2010, which was only 12 percent of the number recorded in official civil registration figures. The inflated estimates of the centenarian population recorded by the civil registration system were investigated by in-depth interviews of the centenarians, village/sub-district headmen, registrars, and relatives of deceased persons in two selected provinces. Names and addresses of centenarians were acquired from civil registration and were followed up to evaluate their accuracy. It was found from this study that incompleteness of death registration and incorrect age recording were the main causes of the inflated figures of centenarians found in registration data in Thailand.*

**Keywords:** elderly, centenarian, survival ratio, incompleteness of civil registration, Thailand

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## Background

The population of Thailand has been aging rapidly over the last half century due to declines in fertility, and mortality. The total fertility rate of Thai women has decreased from over 6 children born per woman 50 years ago to 1.5 per woman in 2011. Meanwhile, the life expectancy at birth has increased from less than 50 years in the 1960s to 74 years in 2011 (Prasartkul & Vapattanawong, 2011). These changes in fertility and mortality have led to major shifts in the age structure of Thailand's population with significant increases in the number and proportion of the elderly population. According to the 1960 census, there were about 1.2 million people aged 60 years and over (National Statistical Office, 1962), which accounted for 4.7 percent of the total population of 26 million of Thailand. The number of people aged 60 and over in the Thailand reached 8.5 million in 2010, which was 13 percent of the total population of 65.9 million (National Statistical Office, 2011). In addition, the oldest population (80 years old and over) has almost doubled over the past 50 years, from 0.7 million in 1960 to 1.1 million in 2010 (National Statistical Office, 1962; National Statistical Office, 2011). The oldest old population, i.e. people aged over 100 years (referred as 'centenarians' throughout this paper), is an interesting group, since they reflect the greatest longevity. In recent decades, the number and proportion of the world's centenarians are likely to increase following extended longevity of the population. The United Nations estimated that there were 292,000 centenarians worldwide in 2010, and the number would reach 906,900 in 2025 (United Nations, 2010). However, the number of centenarians in Thailand is still in question.

Civil registration is one of the main sources of population data in Thailand and includes birth and death records. The recorded Thai centenarians in 1994 were about 60 thousands and recorded about 40 thousands in 2000. Similarly, the number of centenarians decreased to 14,493 in 2010 (Department of Provincial Administration, 2011). It was found that the number of centenarians has been increasing all over the world but civil registration data shows Thai centenarians has decreased over time. This raises the question about the quality of data. Although it might be expected that the quality of the civil registration system has improved over time, several recent studies have found continuing incompleteness of death registration and have recommend further improvements (Hill et al., 2007; Prasartkul & Vapattanawong, 2006; Preston & Hill, 1980; Rukumnuaykit, 2006; Saito et al., 2012; Tangcharoensathien et al., 2006; Vapattanawong & Prasartkul, 2011). When death

registration figures are incomplete, estimates of the number of surviving centenarians is likely to be inflated. The aim of this study is to provide a more accurate estimate of the population aged 100 years and over, and to assess the quality of registration data on centenarians.

## Method and Data:

This study used both quantitative and qualitative research methods to estimate the number of surviving centenarians and to assess the quality of population data on centenarians recorded in civil registration of Thailand. Life table survival ratios were used to estimate the number of centenarians. The population estimates were based on several sources of data which include the 2000 Population Census (National Statistical Office, 2002), a life table constructed by using mortality data from the Survey of Population Change (SPC) during the period 2005-2006 (National Statistical Office, 2008), and Coale and Guo's new regional model life tables (Coale & Guo, 1991). Lastly, qualitative fieldwork was conducted to verify the number of centenarians recorded in the registration system of two sampled provinces. The qualitative data are meant to provide reasons for incorrectness of registration data. In-depth interviews with village/sub-district headmen, registrars, and relatives of deceased persons were conducted.

## Estimation of Thai Centenarians

This study used survival ratios ( $S_x$ ) based on West model life tables to estimate the number of surviving centenarians in 2010. Coale and Guo's (1991) new regional West model life tables were employed to estimate survival ratios for the elderly population. The 2005-2006 SPC life expectancies at age 60 ( $e_{60}$ ) for both sexes were used to estimate the level of mortality of the West model life table. Linear interpolation was used to obtain an appropriate level of mortality of the West model life table to correspond to  $e_{60}$  from the SPC life table. The survival ratio ( $S_x$ ) expressed the probability of surviving to an older age. Survival ratios at age 90 ( $S_{90}$ ) were used to estimate the number of surviving centenarians of both sexes in 2010. They were computed by using the values of total number of person years at age  $x+n$  ( $T_{x+n}$ ) divided by those at age  $x$  ( $T_x$ ) from the appropriate level of mortality of the West model life table.  $S_{90}$  of both sexes were then multiplied by the population aged 90

years and over in the 2000 census to determine the estimated number of centenarians in 2010. The steps used to estimate the numbers of centenarians in Thailand are listed as follows:

1.  $e_{60}$  from the SPC life table in 2005-2006 was used. Since this study focused on the elderly population,  $e_{60}$  was chosen based on an assumption that the life expectancy at this old age is unaffected by mortality at younger ages especially during the infancy and childhood.
2.  $e_{60}$  from the SPC life table was applied at corresponding levels of mortality to the West model life table. Since the West model regional life table was constructed from a large number of life tables from many countries in Europe, North America, Asia, Africa, and Australia (Coale & Demeny, 1966). It is assumed that they could be representative of mortality patterns in Thailand. The West model life table used in this study was from Coale and Guo's (1991) new model life tables which was revised by extending mortality to lower levels. The upper-most level of old model was level 24 which gives an  $e_0$  of 77.5 years for females and 73.9 for males. The new model extended to level 27 which gives an  $e_0$  of 85.0 years for females and 78.9 years for males. Moreover, this new model extended age groups from ending at 85 in the old model to 100 years of age in the new model. The West model life table had been used in many studies (Coale, 1985; Coale & Ellen Eliason, 1986; Garson, 1991). In Thailand, most mortality studies also used this West model life table (Bundhamcharoen et al., 2011; Hill, et al., 2007; Prasartkul & Rakchanyaban, 2002; Vapattanawong et al., 2007), although some used the North model life table (Fulton, 1979; Hirschman et al., 1994; Luther & Dhanasakdi, 1986; Pejaranonda et al., 1983). Nevertheless, a study by Knodel and Chamrathirong, which compared the estimation of infant and child mortality in Thailand based on the West and North model life tables, found that there was not much variation in the results from both models (Knodel & Chamrathirong, 1978).
3. Appropriate mortality levels in Thailand for males and females were interpolated separately using the West model life table.
4. Thai  $S_{90}$  was calculated by using  $T_x$  from the West model life table at the corresponding levels obtained in step 3.  $S_{90}$  were derived by taking  $T_{100}$  as the numerator and  $T_{90}$  as the denominator.

5. The number of surviving centenarians in 2010 ( ${}_{2010}P_{100+}$ ) was estimated by multiplying interpolated Thai survival ratios (step 4) by the population aged 90 years and over from the 2000 census ( ${}_{2000}P_{90+}$ ). This calculation followed the formula below.

$${}_{2010}P_{100+} = {}_{\infty}S_{90}^{10} \times {}_{2000}P_{90+} ; \text{ or } {}_{\infty}S_{90}^{10} \times {}_{2000}P_{90+}$$

The steps followed to calculate the estimate of the number of centenarians are listed in Table 1.

According to 2005-2006 SPC life tables, the life expectancy at age 60 for males were 19.41 years, and for females 21.91 years. These life expectancies imply that the mortality level of the West model life table was 25-26 for males, and at 24-25 for females. Based on the mortality levels of the West model life table, the mortality level for Thailand was interpolated and found to be at corresponding levels of 25.4 for males and 24.4 for females. At these levels, survival ratios for males and females aged 90 years and over were 0.01747 and 0.02187, respectively. After this step, survival ratios for both sexes were multiplied by the population aged 90 years and over in 2000. The calculation resulted in an estimate of 1,711 centenarians in 2010, with 1,200 (70 percent) females and 511 (30 percent) males.

**Table 1:** Steps followed to calculate the estimate of the number of Thai centenarians in 2010

Steps	Male	Female
1. $e_{60}$ taken from SPC life table during 2005-2006	19.41	21.91
2. Level applied to the West model life table	25-26	24-25
3. Corresponding mortality levels interpolated from the West model life table	25.4	24.4
4. $S_{90+}$ calculated from the corresponding model life table	0.01747	0.02187
5. Number of population aged 90+ from the 2000 census	29,271	54,845
6. Estimated number of surviving centenarians in 2010 (4)*(5)	511	1,200

**Sources:** National Statistical Office, 2008; National Statistical Office 2000; Coale and Guo, 1991

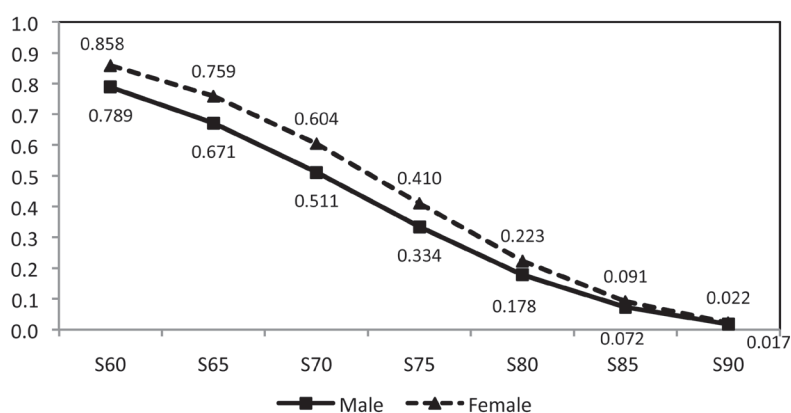
## Survival Ratios of Population Aged 60 Years Old and Over

Before estimating the number of centenarians, survival ratios for the elderly were calculated to determine the mortality patterns of the population aged 60 to 100 years. Survival ratios at different ages were calculated in the same fashion as we did for the centenarians. The survival ratios for population age groups were computed using the values of number of person years at age  $x+n$  ( $L_{x+n}$ ) divided by those at age  $x$  ( $L_x$ ). The calculation followed the formula below.

$${}_5S_{x+5}^{10} = {}_5L_{x+5} / {}_5L_x$$

Figure 1 shows survival ratios of elderly people aged 60 to 90 years and over separated by sex and into five years age groups during 2000-2010. It was found that survival patterns for both sexes followed a smooth arc. Survival ratios varied inversely with age; the younger the age, the higher the ratio. For instance, survival ratios at ages 60-64 were 0.789 for males and 0.858 for females. This means that 79 percent of males and 86 percent of females aged 60-64 survived between 2000 and 2010. It was found that the gap between male and female survival ratios was narrower at ages 80 and above. Survival ratios at age 90 and over for males and females were 0.017 and 0.022, respectively. This indicates that 1.7 percent of males and 2.2 percent of females aged 90 and over survived to age 100 years and over from 2000 to 2010. It was also found that women were more likely to survive than men at every age interval.

**Figure 1:** Survival ratios of the elderly population from 2000-2010



**Source:** Calculated based on Survey of Population Change and West model life table

Using these indirect techniques, it was estimated that there were 1,711 surviving centenarians in 2010, which represents only 12 percent of the 14,493 centenarians recorded in civil registration for the same year. The ratios of estimated percentage to reported percentage of the centenarian population were similar for men and women at 9 percent and 14 percent, respectively. These quantitative results prompted questions about the correctness of data about centenarians in civil registration. The registration data on centenarians seemed to be highly exaggerated.

**Table 2:** Comparison of numbers of estimated and registered centenarians

Sex	Estimated number <sup>1</sup>	Registration Number <sup>2</sup>	Absolute difference	% of recorded centenarians
Total	1,711	14,493	12,782	11.8
Male	511	5,541	5,030	9.2
Female	1,200	8,474	7,274	14.2

Notes: 1. Estimated using indirect techniques

2. Data were taken from the Department of Provincial Administration, 2011

## Explaining Errors in the Civil Registration Data on Centenarians

To qualitatively explain the discrepancies in the numbers of centenarians derived from the present estimate and from civil registration report, all centenarians recorded in civil registration of two sample provinces were followed up. Since no significant difference in quality of the civil registration among provinces in Thailand was assumed, two provinces in the central region, namely, Nakhon Pathom and Phetchaburi, were purposively selected to verify this. Names, sex, address, birth date, and nationality of all people aged 100 years and over in these two provinces were provided by the Office of Civil Registration, Department of Provincial Administration, Ministry of Interior. These data were current as of September 2010. Fieldwork was carried out from March to May 2011. The total number of centenarians recorded in these two provinces was 429, with 351 in Nakhon Pathom and 78 in Phetchaburi. All centenarians in these two provinces were followed up by phone calls or personal visits. Village/sub-district headmen, registrars, and relatives of deceased persons in

these two provinces were also interviewed. Information collected included socio-demographic characteristics, survival status, exact age, year of birth, and the reasons that registration errors might have occurred. The following steps were followed when collecting the data:

*Step 1:* All centenarians recorded in the registration data for Nakhon Pathom and Phetchaburi provinces were followed up.

*Step 2:* Phone calls were made to officials of the Sub-district Administration Organizations (S.A.O.), sub-district headmen, village headmen, or community leaders. The survival status and addresses of recorded centenarians were checked.

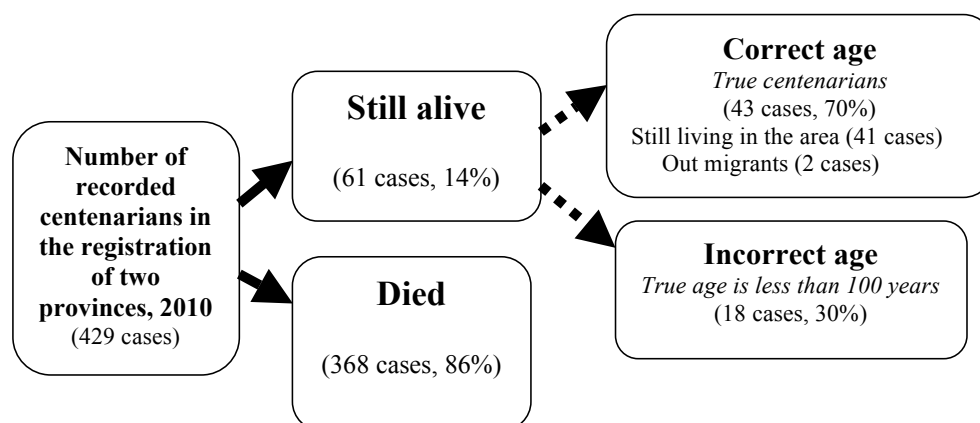
*Step 3:* The centenarians who were still alive were contacted directly or through their relatives. Information about exact age and year of birth was collected. If the person reported an age different from that recorded in civil registration, the possible reasons for the errors were investigated. Furthermore, the ages of each centenarian's first and last children as well as their age at marriage were collected to validate the ages recorded in the registration. In the cases of mismatched ages, the perceived reasons for inconsistencies were discussed during interviews.

All 429 centenarians, 138 males (32 percent) and 291 females (68 percent), from both provinces were followed up in this way. The ages of centenarians recorded in civil registration ranged from 100 to 149. Among these centenarians, 47 percent (201 cases) were aged 105 and above and 9 percent (39 cases) were aged over 120 years.

It was found that among the 429 centenarians recorded in civil registration, 368 cases (86 percent) were deceased while only 61 cases (14 percent) were still alive. It was also found that among those who were still alive, 43 cases (70 percent) had ages over 100 years, while the remaining 18 cases (30 percent) had incorrect ages of less than 100 years, as shown in Figure 2.



**Figure 2:** Survival status of the population aged 100 years and over recorded in civil registration in Nakhon Pathom and Phetchaburi provinces, Thailand



There were only 43 living individuals who were true centenarians, with an age of 100 years and over. These centenarians' ages ranged from 100 to 106. A woman aged 106 years old was the oldest living person in the two sample provinces at the time of the research. Most centenarians (39 cases) were females, and four were males. The sex ratio was one male per 10 females. Among these 43 centenarians, a majority (31 cases) were 100-102 years old. Only five centenarians were 104 years old or over (Table 3).

**Table 3:** The age and sex of true centenarians from two sample provinces in 2010

Sex and age	Number
<b>Sex</b>	
Male	4
Female	39
Total	43
<b>Ratio-Male: Female</b>	<b>1:10</b>
<b>Age</b>	
100	12
101	10
102	9
103	7
104	2
105	2
106	1
<b>Total</b>	<b>43</b>

**Source:** Field survey, 2010

## Reasons for Exaggerated Number of Centenarians in Civil Registration Data

It is certain that the number of centenarians recorded in civil registration was exaggerated. The two main reasons for this exaggeration in registration data were found: 1) incompleteness of death registration; and 2) incorrect age.

### 1) Incompleteness of death registration

A large majority of centenarians recorded in civil registration were already deceased at the time of the study. However, their names were still shown in civil registration records as persons who were still alive. Many reasons for not discharging the names of deceased persons from civil registration were found during the course of this study. These reasons can be grouped into two types: 1) the death was not registered; and 2) the death was registered, but the name of the deceased person had not been discharged from civil registration.

Among those centenarians recorded in civil registration as deceased, the sub-district or village headmen gave possible reasons why no one was notified about the deaths. They mentioned that many people thought death registration was unnecessary and that there were no benefits gained from registering a death. Some registrars also mentioned that they were familiar with the names of centenarians but had never met those persons.

*"I heard this name a long time ago since I was young, but I have never seen her. I'm sure that she died already."* (Female, Registrar, Nakhon Pathom province)

*"Relatives of deceased people do not think there is any benefit of death registration. They do not think death registration is necessary."* (Female, Headman of sub-district, Nakhon Pathom province)

Some people did not know how to register a death, especially those living in villages. In addition, if the death occurred outside of the deceased's area of residence, and if people in that area did not know about the death, it would not be recorded.

Cases of registered deaths in which names were not deleted from civil registration were found. Some deaths were registered but the name of the deceased still appeared in registration records. Possible reasons for this occurrence include incomplete

registration by relatives of the deceased person due to complication process including the requirement of many documents or the inconvenience of going to the registration office.

In cases where death occurs outside the deceased's municipal area, the village headmen of the area where the person died are responsible for notifying registrars of the death. It was found that some village headmen had informed registrars about deaths in the areas for which they were responsible but the names were still shown in the list of voters. This may be because the headmen did not submit complete documents such as a death certificate or other evidence when notifying the registrars.

*"I told the registrar many times that these people already died. But the registrar needs their death certificates. I didn't have them. It is difficult to get those documents because their relatives have not lived here for a long time and (these people) died outside this area."* (Male, Village headman, Phetchaburi province)

This study also explored reasons for not discharging names of the dead persons from civil registration. Most registrars reported that they could not discharge names without death certificates because they were not sure whether or not those persons were in fact deceased. It was observed that even if a registrar personally knew about the death of a person he/ she could not discharge the name from registration without having complete legal documents. As one registrar mentioned:

*"I could not delete these names from registration. I didn't know whether those persons already. The death certificate was the first document to show the evidence."* (Female, Registrar, Nakhon Pathom province)

## 2) Incorrect age

Another reason identified during this study for an exaggerated number of centenarians in civil registration was incorrect age report. Among the 61 surviving centenarians who were recorded, 18 cases were found whose incorrect age of less than 100 years was recorded. It was also found that out of 429 recorded centenarians in civil registration in the studied provinces, 284 persons had a recorded age of 106 years and over. However, this study found that there were no living persons aged over 106 years. This indicates that the ages of all recorded centenarians of greater than 106 years were incorrect.

The study found many reasons for incorrect reporting of age. Among these reasons were the tendency to over report age by one cycle of animal years (12 years), other errors in counting age, and errors in data entry such as miskeyed or miscoded ages.

The traditional way of reporting dates of birth in Thailand is based on the lunar calendar and a twelve-year cycle in which each year is assigned an animal. This traditional calendar system would have been commonly used to record the dates of birth of people who were born approximately one hundred years ago (Knodel & Chayovan, 1991). When the civil registration system was computerized in the 1980s, birth dates recorded using the traditional calendar system of animal years and lunar months were converted to solar calendar years in Christian Era (A.D.) or Buddhist Era (B.E.). During this conversion process mistakes in age recording could have easily occurred.

The true ages of some individuals in this study were lower than the age recorded in registration data by about one cycle. This may be due to confusion between the twelve-year cycles of animal years and Western calendar years when the registration process was computerized during the 1980s. For example, one recorded centenarian woman was born in the year of the monkey, so in the year 2010 her age was recorded as 101 years old. However, her true age was only 89 years, reflecting an error of 12 years. Four cases out of a total of 61 were found to have true ages 12 years less than those recorded.

*"I'm 92 years old now. I was born in year of the snake. I'm not a hundred years old yet. My age was incorrect a long time ago. My ID card shows I was born in 2438 B.E."* (Female, 105 years old recorded in registration data, Phetchaburi province)

Another reason for incorrect recording of age found in the study is that many Thai people report their age as their going-on year. Traditionally, it is quite common for the elderly to report their "going to" age, in other words, the year that they will be on their next birthday (Chamrathirong et al., 1978; Knodel & Chayovan, 1991). It was also found during the course of the study that one person of Chinese origin reported her age as counted from one year before she was born. In Chinese culture age is counted from the time that the mother becomes pregnant (Yi, 2008). In this manner of reporting, a baby is already one year old when it is born. This tradition might affect the reporting of age among Thai people with a Chinese origin.

In some cases, years of birth of centenarians was wrongly recorded. It could be due to errors in data entry, either miskeying or miscoding of age. The errors in data entry could have occurred when the registrars entered the dates of birth into the registration system. The son of a recorded centenarian mentioned:

*“My father was born in B.E. 2472 or now he is only 81 years old, but on his ID card it shows a birth date of B.E. 2427 which means he would be 126 years.”*  
(Male, Son of a centenarian in registration data, Phetchaburi province)

It was found that some individuals were aware their age was reported incorrectly in civil registration data. Some said that they had already informed officials about the mistakes but nothing had been corrected.

*“I reported the incorrect age of my father to the registrar a year ago, but they did not correct his age in the registration.”* (Female, Daughter of a centenarian, Nakhon Pathom province)

Most relatives of recorded centenarians knew their exact ages but did not attempt to correct inaccurate civil registration. The reason they gave for this was that they did not have a problem with the wrong age being recorded.

*“I know my mother is not 100 years old yet, but we have no problem the wrong age being recorded. We know exact age of my mother. She is just 84 years old but if they recorded my mother’s age as 103, there’s no problem in our life.”* (Female, Daughter of a woman with a recorded age 103 years, Phetchaburi province)

## Conclusion and Discussion

This study aimed to estimate the population aged 100 years and over and to assess the quality of registration data on centenarians. Life table survival ratios were employed to estimate the number of surviving centenarians in 2010. Centenarians recorded in civil registration data in two sample provinces were followed up to get explanation about the quality of centenarian data.

The results of this study showed that the number of centenarians (429 cases) recorded in civil registration were over reported. However, in this analysis it was estimated that there were 1,711 centenarians in Thailand in 2010, which represents only 12 percent of the centenarians actually recorded in civil registration.

All centenarians recorded in civil registration in the two provinces included in the sample group were followed in order to explain the reasons for incorrectness of the registration data. Among 429 recorded centenarians, only 43 cases (10 percent) were found to be true centenarians. Among the remaining 90 percent of recorded centenarians, most had already died and some were found to have ages of less than 100 years. The ages of all centenarians over 106 years were found to be incorrectly recorded and were over reported in all cases.

Two important causes of the inconsistencies occurring in centenarian data were incompleteness of death registration and incorrect age recording. Many reasons were found to be responsible for the incompleteness of death registration such as non-registered deaths and failure to delete the names of the deceased from registration book. Failure to notify the responsible officials of a death was found to be the main reason for not discharging the names of deceased persons from registration account. The name of a deceased person cannot be deleted from the register if the death certificate is not provided to the registrar. The process of death notification is inflexible and the multiple steps required prevent the deletion of deceased people from registration records. The results of this study were similar to the findings of a study conducted by Prasartkul and Vapattanawong (2006) in Kanchanaburi which found the requirement of multiple steps in the death registration process as the main cause of inconsistencies in registration information. This study also found that most people completed the first step of death of registration (reporting the death to the village headman or a police officer, or receiving a death certificate from the hospital) but did not report the death to registrars at the district or municipality office.

Another important reason for an exaggerated number of centenarians in civil registration was incorrect recording of age. Age mis-recording could be due to mistake in counting age and errors during data entry such as miskeying or miscoding age. These errors may lead to the misrecording of age in registration data.

The exaggeration of number of centenarians found in this study reflects the quality of registration data, especially on the oldest population. Since population data from registration are officially used as the base for several activities such as to arrange the electoral constituency, and to allocate government budget and welfare resources, its accuracy is very crucial. The finding of this study suggests many points to improve the quality of registration data. The deletion of deceased persons' names by less complicated procedure is one among others. The correction of birth date should also be done.

While the Thai society has been ageing very rapidly, many programs concerning the quality of life of the elderly are being purposed. The programs such as special welfare and value raising campaign for elderly and centenarians are recommended. In performing such programs efficiently, accurate data are needed. In Thailand, the civil registration is still the main source of population data. Thus, the improvement of registration system will certainly benefit to government and the Thai people.

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