Validity and completeness of death reporting and registration in a rural district of Vietnam

Tran Quang Huy¹,⁵, Nguyen Hoang Long², Dinh Phuong Hoa³, Peter Byass⁴ and Bo Eriksson⁵

¹Vietnam-Sweden Uong Bi General Hospital, Uong Bi, Vietnam, ²Health Policy Unit, Ministry of Health, Hanoi, Vietnam, ³National Institute for Protection of Child Health, Hanoi, Vietnam, ⁴Umeå International School of Public Health, Umeå University, Umeå, Sweden, ⁵Nordic School of Public Health, Göteborg, Sweden


Aims: Assessment was made of the validity of mortality estimates based on data collected during 1999–2000 by quarterly follow-up visits and compared with other methods (re-census, communal death registration, and neighbourhood survey).

Methods: This study was carried out within a longitudinal epidemiological laboratory in Bavi District, Vietnam (called FilaBavi), covering a sample of 11,089 households with 51,024 inhabitants. Deaths within FilaBavi during 1999–2000 were collected by four methods and compared: quarterly household follow-ups, the re-census carried out in 2001, the Commune Population Registration System (CPRS), and a neighbourhood survey.

Results: Within these four methods, a total of 471 deaths were detected in the FilaBavi sample. Quarterly household follow-ups detected 470 deaths (99.8%). The re-census missed 19 deaths, of which eight were infants, and two-thirds of the missed deaths fell in 1999. The CPRS missed 89 cases (19%), the majority being infant and elderly deaths. The neighbourhood survey over-reported deaths.

Conclusions: Quarterly follow-ups were the best method for death registration. The re-census approach was less complete, with problems of recall bias. The completeness and quality of death registration by CPRS was low, especially for infant and elderly mortality.

Key words: census, death registration, demography, household survey, mortality, validity, Vietnam.

INTRODUCTION

Mortality is one of the most important aggregate indicators for measuring health status of a population and the quality of healthcare services. It also has an important relationship with socioeconomic conditions in a society. It provides essential information for health planners as well as politicians for making healthcare and socioeconomic development plans. Mortality data, especially child and maternal mortality, are very commonly used for comparisons between communities or nations and for assessing trends over time (1, 2).

In spite of its importance and common use, the validity of mortality data in many countries is questionable. Different countries use different methods for death registration, such as health facility-based registration, community registration, periodic census, cross-sectional surveys, and follow-up systems. Each of these methods has its own advantages and disadvantages. Community registration is a classic method for recording births and deaths as well as migration. However, experiences from many countries have shown that the validity of death registration by this system is low (3–6).

The periodic census is another way to collect demographic information, but it cannot be conducted frequently because it consumes a lot of resources and needs extensive technical support. Furthermore, this method has the inherent limitation of tending to under-report important events such as perinatal and neonatal deaths as well as elderly mortality, especially among women (3, 7).

Although, in the long run, active follow-up can be an effective approach, it has also been criticized as being expensive, and time-consuming (7), especially for the poor countries, unless it can be meaningfully extrapolated into the surrounding 100-fold population (8). However, most Demographic Surveillance Systems (DSS) still use this method within a defined local area and it is considered to be a relevant and efficient approach to data collection that satisfies the objectives of such epidemiological field laboratories (9–11).

It is estimated that about two-thirds of the world’s population, generally in low-income countries, remain
outside any kind of systematic health surveillance (12), and a significant proportion of global deaths pass unrecorded (8). Vietnam is not exceptional in this respect, even though it has a relatively good healthcare system (13, 14).

In Vietnam, at commune level there is a system called the “Commune Population Register System” (CPRS). This CPRS is responsible for recording demographic data including mortality data in the community. In each village, a person (usually a female) is assigned to work as a population counsellor, a part-time job with a monthly incentive and a role of reporting demographic information on a monthly basis to a local supervisor.

A longitudinal demographic surveillance system has been established in Bavi District, a rural area in northern Vietnam, since 1999 (hereafter called FilaBavi) (15). Its overall objectives were to generate health and healthcare data, provide information for health planning, serve as a background and sampling frame for specific (particularly intervention) studies, and constitute a setting for epidemiological and public health training. Bavi is a District with an area of 410 km², divided into 32 communes. The whole population of Bavi was approximately 235,000 in 1999. A sample of 67 clusters was selected using a stratified random sampling technique, consisting initially of 11,089 households with 51,024 inhabitants for surveillance.

The basic design of FilaBavi was a baseline survey, re-census repeated every two years, and quarterly follow-ups. The baseline survey started at the end of 1998 and the first re-census was in 2001. In the baseline survey, information at the household level (housing conditions, water sources, latrines, income, expenditure, agricultural land, economic status of the household according to the local official classification) and individual (age, gender, ethnicity, religion, occupation, education, and marital status) were collected. Between the baseline survey and re-census, quarterly household follow-ups were carried out to update household information (e.g. new households, moved households, etc) and individual events (e.g. marital status changes, in- and out-migrations, pregnancy, births, and deaths). There was a separate form used to record each of these events.

A total of 38 surveyors and six field supervisors were employed full time. For the follow-ups, each surveyor was in charge of a particular cluster. A strict multi-step system was created to supervise data collection from the field to the project office, with a corresponding software system. As collection of mortality data was one of the major objectives of FilaBavi, as in any demographic surveillance system the collected data need to be validated. In addition, the mortality estimates for FilaBavi in 1999–2000 showed a fairly low crude mortality rate in comparison with national and regional figures (2, 13, 14). Hence, two research questions were formulated:

(i) Was there an under-reporting of deaths in FilaBavi during 1999–2000?
(ii) How does mortality information from FilaBavi surveillance compare with other methods?

The aim of the present study was thus to assess the validity of mortality estimates based on data collected during 1999–2000 by the quarterly follow-up in FilaBavi and compare with other methods (re-census, CPRS, and neighbourhood survey).

METHODS

In this study, we compared mortality data that had been collected using four different methods.

Quarterly follow-ups

All households in FilaBavi were followed-up quarterly by the field surveyors. In the follow-ups, because each surveyor was responsible for a certain number of households from the beginning, a good relationship was created between the surveyors and household members. As regards mortality data collection, at each follow-up surveyors asked in every household (usually asking the head of the household) if any death had occurred in the household since the last follow-up. If yes, a death registration form was filled, which included basic individual information, cause of death, etc.

Table I. Death rates from quarterly follow-ups in Bavi, Vietnam, 1999–2000, by gender and age group

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>Gender</th>
<th>Person-years</th>
<th>Number of deaths</th>
<th>Mortality rate (per 1,000 person-years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1</td>
<td>Male</td>
<td>71</td>
<td>23</td>
<td>32.3</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>63</td>
<td>13</td>
<td>20.3</td>
</tr>
<tr>
<td>1–4</td>
<td>Male</td>
<td>3,201</td>
<td>4</td>
<td>1.2</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>2,949</td>
<td>3</td>
<td>1.0</td>
</tr>
<tr>
<td>5–14</td>
<td>Male</td>
<td>10,854</td>
<td>9</td>
<td>0.8</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>10,444</td>
<td>5</td>
<td>0.5</td>
</tr>
<tr>
<td>15–49</td>
<td>Male</td>
<td>23,932</td>
<td>51</td>
<td>2.1</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>25,175</td>
<td>19</td>
<td>0.7</td>
</tr>
<tr>
<td>50–59</td>
<td>Male</td>
<td>2,469</td>
<td>12</td>
<td>4.9</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>2,815</td>
<td>11</td>
<td>3.9</td>
</tr>
<tr>
<td>&gt; 59</td>
<td>Male</td>
<td>3,637</td>
<td>148</td>
<td>40.7</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>6,293</td>
<td>172</td>
<td>27.3</td>
</tr>
<tr>
<td>Total</td>
<td>Male</td>
<td>44,807</td>
<td>247</td>
<td>5.51</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>48,317</td>
<td>223</td>
<td>4.62</td>
</tr>
<tr>
<td>Grand total</td>
<td></td>
<td>93,123</td>
<td>470</td>
<td>5.05</td>
</tr>
</tbody>
</table>
Re-census
The first FilaBavi re-census was conducted in April–June 2001. In this re-census, in order to minimize surveyor bias, all surveyors were temporarily reassigned to clusters where they had not had responsibility during quarterly follow-ups. Surveyors asked heads of households if any death had occurred within the household from 1 January 1999 to 31 December 2000. Surveyors were not provided with any information about names or number of deaths in the assigned clusters that had been detected by the quarterly follow-ups. If any death events had occurred, a structured form for death was filled in.

Commune Population Registration System (CPRS)
In this system, when a death occurred in a village, information was collected by the population counselor in charge, then reported to the local supervisor for registration. A death registration book was kept at the Commune People’s Committee (CPC), one in each of 32 communes of Bavi District. Twenty-nine primary school female teachers, one in each of 29 communes where FilaBavi clusters were located, were selected for the study. The major task for these surveyors was to copy all deaths during 1999–2000 registered in the death book of the CPC using a structured form. The surveyors were trained by the research group before the fieldwork was carried out and completed in April 2001. Based on basic information about the deaths available in the death registers (e.g., name, age, gender, name of a close relative, and detailed address), deaths within FilaBavi clusters were identified with consultation/support from FilaBavi surveyors, supervisors, and local key-informants.

Neighbourhood survey
As is traditional in rural Vietnam, people in villages in Bavi District have a very close relationship with each other. Death is considered as a big event in the community. The size of clusters/villages is relatively small (about 200 households each) and FilaBavi clusters are clearly identified in term of geography. Therefore, deaths that occurred in the clusters are very widely recognized by community members. These were the reasons for conducting a neighbourhood survey to detect deaths in the communities. The neighbourhood survey was conducted in December 2001. Seven clusters within 69 FilaBavi clusters were selected purposively in lowland, midland, and mountainous areas, particularly because the crude death rates estimated from data collected by the follow-ups in these clusters were extremely low. It was assumed that some deaths might have been missed in these clusters. In each of the selected clusters, a focus group discussion was held with local key informants (from village leaders, women’s associations, youth unions, war veterans’ associations, and religious associations). These participants were also selected purposively because they were assumed to have widespread relationships and to be involved in many activities in the village, and therefore expected to know of events occurring in their village including deaths. In the group discussions, at first each participant was asked to list freely all deaths that occurred in their village during 1999 and 2000. Then the whole group had a discussion to get agreement on any deaths missed that should be included and on any death outside the FilaBavi clusters that should be excluded. Finally the list of deaths for the cluster was confirmed by the whole group. The focus group discussions were monitored and led by the first author of this paper.

Data analysis
Data collected in quarterly follow-up surveys, after the initial FilaBavi census and covering the period to the end of 2000, were processed and analysed using SPSS software version 10.8 (16). A list of deaths was generated for comparison with those from the other sources.

The deaths in the lists generated from the quarterly follow-ups, the re-census, and the CPRS were compared between pairs of sources, i.e., deaths in the list of one source were compared with deaths in the list of other, until deaths from all sources were reconciled together. The comparison of deaths was done manually by matching first name and surname as well as other variables such as gender, age, address, and date of death.

A group of death records copied from the CPRS were identified as “suspect cases”, relating to people living in communes partially sampled in FilaBavi, but whose status in the sample was unclear, for example because of ambiguous addresses. These records were carefully examined to see whether or not they related in any way to individuals or deaths within the sampled areas.

The deaths listed by the neighbourhood survey were compared separately with those in the lists of deaths generated from quarterly follow-ups in the respective clusters.

Ethical considerations
Ethical approval for this validation study was obtained from the Ministry of Health, Vietnam. Permission to copy the list of deaths and to conduct neighbourhood surveys was obtained from the local authorities. Informed consent was obtained from every participant in the group discussions. The Research
Ethics Committee at Umeå University has given ethical approval for the FilaBavi household surveillance system, including data collection on vital statistics (reference number 02-420).

RESULTS

From 1 January 1999 to 31 December 2000, a total of 471 deaths were detected by four methods. Among those, 470 deaths (99.8%) were detected through quarterly follow-ups, comprising 247 males and 223 females. Males and females were observed during two years for 44,807 and 48,317 person-years respectively. The crude death rate (CDR) was 5.0 per 1,000 person-years, 5.5 for men and 4.6 for women. Male mortality rates in all age groups were higher than those for females.

During these two years, there were 1,358 live-births in the FilaBavi sample (691 boys and 667 girls) and 36 infant deaths, giving an infant mortality rate (IMR) of 26.5 per 1,000 live-births (33.3 for boys and 19.5 for girls, a M:F ratio of 1.7).

Variation of deaths and death rates from quarterly follow-ups in bimonthly periods is shown in Figure 1. Fewer deaths were registered at the start, since the initial FilaBavi census was still under way; however, the rates were reasonably consistent throughout.

Comparison of deaths detected by quarterly follow-ups, re-census and CPRS

An overall comparison of deaths detected by different methods is shown in Figure 2. If we assume that the “actual” total number of deaths in the FilaBavi

Fig. 1. Number of deaths and death rates per 1,000 person-years, in bimonthly periods during 1999 and 2000 from quarterly follow-ups, in Bavi, Vietnam.

Fig. 2. Comparison of deaths detected by three data-collection methods.
sample during 1999–2000 was 471, and the quarterly household follow-up system detected 470 (99.8%), then only one death was missed (0.2%), while the CPRS missed 89 cases (18.9%), and the re-census, which can be considered as equivalent to a cross-sectional survey, missed 19 cases (4.0%).

The CPRS under-registered 45 females and 44 males, accounting for 20.1% and 17.8% of the assumed total deaths in each gender group respectively. Of these 89 missed deaths, 21 were infants, accounting for 58.3% of total deaths in this age group. The remaining cases fell into the group aged 5–14 (one case, 7.1%), 15–49 (11 cases, 15.7%), and older than 49 (56 cases, 16.3%).

The re-census missed 10 females and 9 males, accounting for 4.4% and 3.6% respectively of total deaths in each gender group. Out of 19 deaths missed in the re-census, eight were infants, accounting for 22.0% of total deaths in this age group. Ten of the 19 missed cases were older than 60 years.

In 1999, a total of 222 deaths were detected by three approaches; of those, the re-census missed 13 cases (five infants) and the CPRS missed 43 cases (11 infants). The quarterly household follow-ups missed only one case. Total deaths detected in 2000 were 249, among which the re-census under-reported six cases (three infants), and the CPRS missed 46 cases (10 infants). In the CPRS, the number of unregistered deaths did not vary between the two years but in the re-census the number of missed deaths in 1999 was more than double that in 2000.

**Comparison of deaths detected by the quarterly follow-ups and the neighbourhood survey**

In the seven clusters where the neighbourhood survey was carried out, a total of 32 deaths were detected by the quarterly follow-ups during 1999–2000. In these clusters, a total of 53 deaths were listed in the neighbourhood survey, including 30 deaths detected by quarterly follow-ups. The neighbourhood survey failed to detect two deaths, one a newborn and the other a middle-aged man who died from a traffic accident who was missed because his household did not administratively belong to the village where the neighbourhood survey was conducted.

After the neighbourhood survey, a check was done to review 23 deaths that were listed only by the neighbourhood survey but not by the quarterly follow-ups. Of these, five cases died in 1999 but before the initial census (the baseline study), three cases died in 1998 and four cases died in 2001, and 11 deceased were defined as not included in the FilaBavi sample, including three cases who died in other places and were brought home for burial.

**DISCUSSION**

Our study revealed that quarterly follow-up was the method that detected the highest number of deaths. The IMR of 26.5/1,000 estimated from the quarterly follow-ups was lower than that estimated for the whole of Vietnam from the sample of the national census conducted in 1999 (19), but was the same as that for the Red River Delta Region, which includes Bavi District. The CDR of 5.0/1,000 in FilaBavi was also close to that from the census (5.1 for the Red River Delta).

Our study also revealed extensive incompleteness of death registration in the CPRS, missing approximately 19% of total deaths. Nearly 60% of infant deaths were missed in this system. Missing infant deaths have been also reported in other countries. A study in Thailand (5) reported that all perinatal deaths and 45% of infant deaths were not registered. In Egypt, where death registration is legally compulsory, only 57% of infant deaths were reported as notified and nearly one-third of those were not found in the register (6). Under-reported infant deaths, and a tendency towards more unregistered elderly female deaths compared with males, was recognized in the CPRS. As regards maternal mortality, a recent population-based study aimed at estimating maternal mortality in Vietnam (17) found that 16% of deaths in women aged 15–49 were not reported. In Mozambique (18), a gross under-registration of maternal deaths was revealed. Merli (3) studied the registration of deaths in the 1979 and 1989 national censuses in Vietnam, where a recall period of one year was used. The results also demonstrated some incompleteness for infant and elderly deaths, especially for women. Regarding the under-registration of elderly female deaths, elderly women often live alone and therefore efforts to report their deaths are limited. Furthermore, dying at an old age is considered as “natural” which may deter relatives of the deceased from reporting the death. However, these assumptions need further study.

Under-reporting of deaths in the commune system may be due to several factors. Family members of the deceased may not be willing to report deaths because there is neither any incentive for reporting nor any legal sanction for not reporting. The concentration of under-registered deaths in certain communes suggests that the flaws in death registration are closely related to the performance of the personnel involved in the system. Reporting may be influenced by the cultural tradition of not considering an infant as fully “human” if it dies during the first days of life.

It is also common for new births in rural Vietnam not to be reported for several months after delivery. This may be even later for third or fourth children,
possibly until the child starts going to school at age six, as there is no incentive for early birth reporting and registration of third and subsequent children under Vietnam’s two-child population policy.

Furthermore, the definition of a resident differs between the FilaBavi system and the community. The FilaBavi surveillance definition is more dynamic in the sense that a person is considered as a community resident if he/she has stayed or has an intention to stay in the place for more than three months. By the commune’s definition, a person is only considered as a resident when she/he has been registered by the CPRS. This concept of residence may contribute to the high rate of under-registered deaths in general but particularly for neonatal deaths. Even though the definition of residence is well defined within FilaBavi, in this investigation we still experienced complications due to migration, which means that the more dynamic the population is, the more likely it may be that deaths are missed.

When conducting the re-census, surveyors were changed to other cluster(s) for which they had not been previously responsible to prevent “surveyor bias” (7). This meant that households were new to the surveyors, quite similar to any cross-sectional survey. Compared with the quarterly follow-ups, the re-census missed 19 deaths, of which more than two-thirds had occurred in 1999. This implies a substantial recall bias. Even though death is an important and unforgettable event, household respondents might still not recall exactly the time when it occurred. This problem may be particularly serious in rural Vietnam where people often use a lunar calendar (about a month later than the Western calendar) for important events like weddings, building houses, births, and deaths. Therefore a death occurring at the beginning of the Western calendar year could be reported as at the end of the previous lunar year.

Although the number of the missed deaths in the re-census was small in comparison with the CPRS, using this method for collecting mortality data is questionable, especially when it is done on a large scale with a longer recall period. In our re-census with professional surveyors and only a two-year recall period, it still missed 4% of total deaths and approximately 22% of infant deaths, compared with the quarterly follow-ups.

The quarterly follow-ups missed only one death in comparison with the assumed “actual” number of deaths. This may be partly due to the fact that surveyors knew a household’s members well, actively noticing anyone missing, and therefore relying less on respondents’ information. Owing to frequent visits to the households, relationships between surveyors and household members tended to become better established over time. This could have facilitated dialogues between surveyors and households’ respondents. Furthermore, recording pregnancy (included as a question in the quarterly household follow-ups) can assist surveyors to follow its outcome, hence minimizing missing births and early newborn deaths.

The quality of data was also safeguarded by means of adequate supervision, carried out regularly by field supervisors and research students. The commitment to the FilaBavi project from the local authorities and good cooperation of the households were factors that surely contributed to good data. In addition, the recall period for follow-up surveys was only three months, which probably reduced recall bias. However, there was still a suspicion of some underestimation among female infants and females in general. Our findings showed the same tendency as other surveys in Vietnam (3, 19): that the number of male infant deaths exceeded that of females while the number of males and females born was not so different. Even though all the registered deaths have been carefully validated, there still remain some concerns. This also arose in China (20), with a suspicion of the family planning policy’s influence on reporting and registration of infant deaths. Vietnam has also implemented a two-child policy and pre-set birth quotas, therefore this may need further investigation. Nevertheless, after this exhaustive search for all cases of death by different methods, it might be assumed that no significant number of deaths remains unregistered within the FilaBavi setting.

The neighbourhood survey conducted in this study was used as an additional measure to validate the mortality data collected within a sample of the quarterly household follow-ups. The neighbourhood survey also suggested that the quarterly follow-ups were the better method of detecting deaths in Bavi. On the other hand, it seems that without careful elimination there could be a possibility of over-reported deaths in neighbourhood surveys.

Our study has important implications for the design and practice of demographic surveillance operations like FilaBavi. Furthermore, it may contribute to the development of other DSS sites. So far there is no clear consensus on death registration methodology and surveillance intervals among sites in Africa and Asia undertaking surveillance similar to that of FilaBavi (21), and relatively little information on detailed methodology for these surveillance activities has been published (22). Registering deaths using quarterly household follow-up may be also useful in urban contexts, even though it could be more complicated compared with rural settings since urban populations are often unstable, and for a variety of reasons it may be more difficult to contact households for such investigations. This study has also
demonstrated that it is not possible to rely on routine death registration systems (here the CPRS) for detailed epidemiological work. Therefore caution is needed in comparing mortality between countries or settings. Health planners and epidemiologists may well need to implement their own systems to get reliable mortality data. We have also shown that regular surveillance carried out through household visits was a better approach than relying on periodic re-census operations to discover deaths. Recall bias is an important factor in this, though the less quantifiable effect of individual surveyors getting to know communities and households through regular visits, and undertaking pregnancy surveillance, may also be important in promoting data quality.

ACKNOWLEDGEMENTS

This study was conducted within the Epidemiological Field Laboratory for Health System Research (FilaBavi) in Vietnam, a collaborative research project between the Health Strategy and Policy Institute (HSPI); Hanoi Medical School; Department of Planning, Ministry of Health, Hanoi; Division of International Health (IHCAR), Karolinska Institute, Stockholm; Umeå International School of Public Health, Umeå; and the Nordic School of Public Health, Göteborg, Sweden. Financial support from Sida/SAREC, Stockholm, is gratefully acknowledged. The authors are grateful to Dr Annika Johansson for her valuable contributions in writing the manuscript.

REFERENCES
