

ORIGINAL ARTICLES

## Current mortality situation in Bac Ninh province in the period 2017-2020

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### ABSTRACT

**Objective:** This study aims at describing the mortality situation in Bac Ninh province from 2017-2020

**Methods:** A cross-sectional study design was applied. Data regarding individual mortality during 2017-2020 in Bac Ninh province was collected from mortality registration system (namely A6/YTCS). In particular, information about each mortality was collected, including: age, gender, address, date of mortality and cause of mortality. Descriptive statistics was used to show the mortality rate between age groups and gender. A log-scale was used to show the pattern across age groups in each male and female mortality.

**Results:** The results show that the mortality rate (per 1,000 people) of children under 5 years old was lowest among age groups in 2019 compared to other years (0.73 mortality per 1,000 people). However, when comparing the under-5-mortality rate across four years, the mentioned figure was higher than 2017, 2018 and 2020. During the entire period 2017-2020, the age group over 80 years old had the highest mortality rate (per 1,000 people) from 40.82 (in 2017) to 69.90 (in 2020). For gender comparison, male had higher mortality rates than female in all age groups

**Conclusions:** Among children under 5 years old, the mortality rate were highest in 2019 when comparing with the other years, including 2017, 2018 and 2019. Conversely, the lowest mortality trend was observed in 2017 across most age groups, except for the 20-24 and 35-39 age groups. Throughout the period, the mortality rate consistently rose in the over 80 age group.

**Keywords:** Current situation, mortality, mortality rate.

### INTRODUCTION

Mortality rate is one of the crucial indicators to measure public health. The mortality rate is used to evaluate the level of mortality of a specific population, a region, a country, or worldwide (1). In addition, the mortality rate also evaluates mortality attributed to a diseases or risk factors (2,3). This index can also reflect the actual prevalence of a disease

and may be used to assess the effectiveness of medical care in each nation (2). For example, the United States of America (USA) used the reduction in cancer mortality rate as an implication of the improvement in the access to health care (4) the American Cancer Society estimates the numbers of new cancer cases and deaths that will occur in the United States in the current year and compiles the most recent data on cancer incidence,



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mortality, and survival. Incidence data were collected by the Surveillance, Epidemiology, and End Results Program; the National Program of Cancer Registries; and the North American Association of Central Cancer Registries. Mortality data were collected by the National Center for Health Statistics. In 2017, 1,688,780 new cancer cases and 600,920 cancer deaths are projected to occur in the United States. For all sites combined, the cancer incidence rate is 20% higher in men than in women, while the cancer death rate is 40% higher. However, sex disparities vary by cancer type. For example, thyroid cancer incidence rates are 3-fold higher in women than in men (21 vs 7 per 100,000 population). The author shown that due to this enhancement, the mortality rate of cancer had dropped from its peak of 215.1 (per 100,000 population) in 1991 to 161.2 in 2014 (per 100,000 population), equivalent to 25% (4) the American Cancer Society estimates the numbers of new cancer cases and deaths that will occur in the United States in the current year and compiles the most recent data on cancer incidence, mortality, and survival. Incidence data were collected by the Surveillance, Epidemiology, and End Results Program; the National Program of Cancer Registries; and the North American Association of Central Cancer Registries. Mortality data were collected by the National Center for Health Statistics. In 2017, 1,688,780 new cancer cases and 600,920 cancer deaths are projected to occur in the United States. For all sites combined, the cancer incidence rate is 20% higher in men than in women, while the cancer death rate is 40% higher. However, sex disparities vary by cancer type. For example, thyroid cancer incidence rates are 3-fold higher in women than in men (21 vs 7 per 100,000 population). Recent study in the USA also claimed that a 2.4% reduction in cancer mortality rate during 2017-2018 as an indicator for the effectiveness of early

detection and improved cancer treatment (5). In Vietnam, the mortality rate due to non-communicable diseases accounted for 77% of the total number of mortality in 2016. Among these cases, 44% were individuals over 70 years old (6). Based on data from the Health Statistics Yearbook, the mortality rate of infants under the age of one was between 13.9 and 14.4 mortality per 1,000 live births during the period from 2017 to 2019 (7–9).

Mortality indices are essential for quantifying population health status and measuring the health development of a country (2). Mortality rates also measure the burden and compare the impact of disease (10). Variations in mortality rates over time reflect evolving patterns in the causes of mortality over time (2). Therefore, mortality data has always been an important research field in demography and many other scientific disciplines, including epidemiology, public health and statistics, etc. The purpose of common research is to gain the scientific knowledge necessary to improve lives through the implementation of appropriate programs and policies (2). In demographic research, mortality plays an important role, because the level of mortality and the level of birth is an important factor determining the growth rate of the population (11–13).

Bac Ninh is located in northern Vietnam, situated in the Red River Delta region, within the key economic triangle of Ha Noi - Hai Phong - Quang Ninh, and serves as the northeastern gateway to the capital city of Ha Noi (14). Investigating mortality rates in Bac Ninh province can support evidence-based disease, accident prevention and treatment programs through suitable programs and policies (15). Besides, investigating mortality rates is an important step that is helpful in properly allocating resources. This helps improve health effectively, reduce health care costs and improve quality of life (10). Therefore, we conducted this topic to describe

the current mortality situation in Bac Ninh province in the period 2017-2020. This study might create a basis for future assessments and intervention programs in this locality.

## METHODS

**Research design:** The cross-sectional study.

**Research subjects:** The study was conducted on all human mortality in Bac Ninh province.

**Study site and time:** Bac Ninh, a province in the Hong River Delta region of Vietnam, spans an area of 822.7 Km<sup>2</sup> and has a population density of approximately 1,725 people/Km<sup>2</sup> (14). It comprises eight districts, including Bac Ninh City, Tu Son City, Que Vo Town, Thuan Thanh Town, Yen Phong District, Tien Du District, Gia Binh District, and Luong Tai District. The province experiences four distinct seasons - Spring, Summer, Fall, and Winter - due to its humid subtropical climate (16). Summers are hot and humid, while winters are dry and cold, with an average annual temperature of around 23.3 degrees Celsius. Our research spanned the years 2017-2020 (16).

### Data source

**Mortality data:** Mortality data for each individual during the period 01/01/2017-12/31/2020 was collected from mortality registration system (namely A6/YTCS). A6/YTCS notebooks are designed to collect information about mortality, including the number of mortality and the main causes of mortality as specified in Circular 27/2014/TT-BYT (17). In particular, information about each mortality is collected including age, gender, date of mortality recorded and cause of mortality. Healthcare professionals such as doctors, nurses, or medical researchers are responsible for recording and collecting data.

**Population data:** Population data is the total population in the area (as of December 31 every year) in the period 2017-2020. This data is collected from the Department of Population and Family Planning of Bac Ninh province. The total population is divided by gender and 5-year-old groups (0-4 years old, 5-9 years old, 10-14 years old, ..., 75-79 years old, ≥ 80 years old).

**Data analysis:** Mortality data of each record were cleaned on Microsoft Excel software. The causes of mortality of each record are coded by local healthcare professionals according to the International Classification of Diseases, Causes of Mortality Coding (International Classification of Diseases version 10 – ICD10). Then, the number of mortality for each year from 2017-2020 was calculated for each age group (5-year age groups are similar to population data) and sex groups. Mortality rate (per 1,000 population) is calculated for age groups and sex according to the formula:

$$M_{ij} = \frac{D_{ij}}{N_{ij}} * 1000$$

In which,  $M_{ij}$ ,  $D_{ij}$  and  $N_{ij}$  are the mortality rate (per 1000 population), number of mortality and population of age group  $i$  and sex group  $j$ , respectively. Descriptive statistics were used to describe the number of mortality and mortality rates by groups over the years 2017-2020.

To compare the trend in mortality rate between male and female across age groups, we present the logarithmic graph of this indicators. This method is usually used to show vital statistical indicators (such as mortality rate) to reveal the underlying trend (18). The graph included the age group in horizontal axis, and the logarithmic scale of mortality rates in the vertical axis according to the formula as followed:  $y = \log(M_{ij})$ .

**Ethics approval:** This research is funded by the National Foundation for Science and

Technology Development (NAFOSTED) under project code 105.08-2019.331. This study was approved by the Ethics Committee of the University of Public Health under Decision No. 020-265/DD-YTCC.

## RESULTS

In Bac Ninh, there were approximately 19011 records were retrieved from the A6/YTCS in this study (Table 1). The mortality rate (per 1,000 people) of children under 5 years

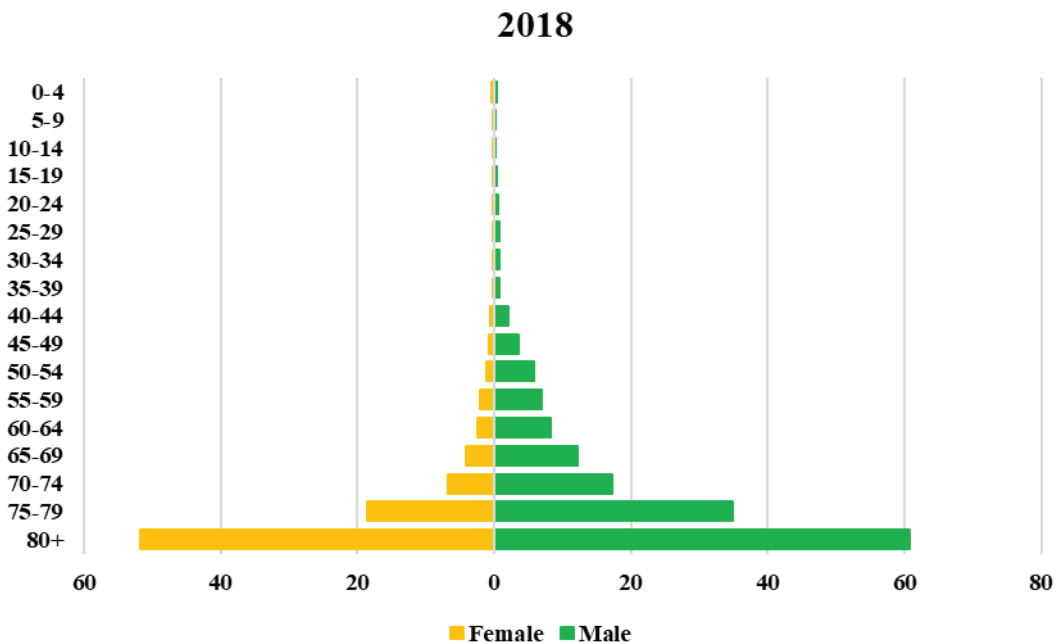
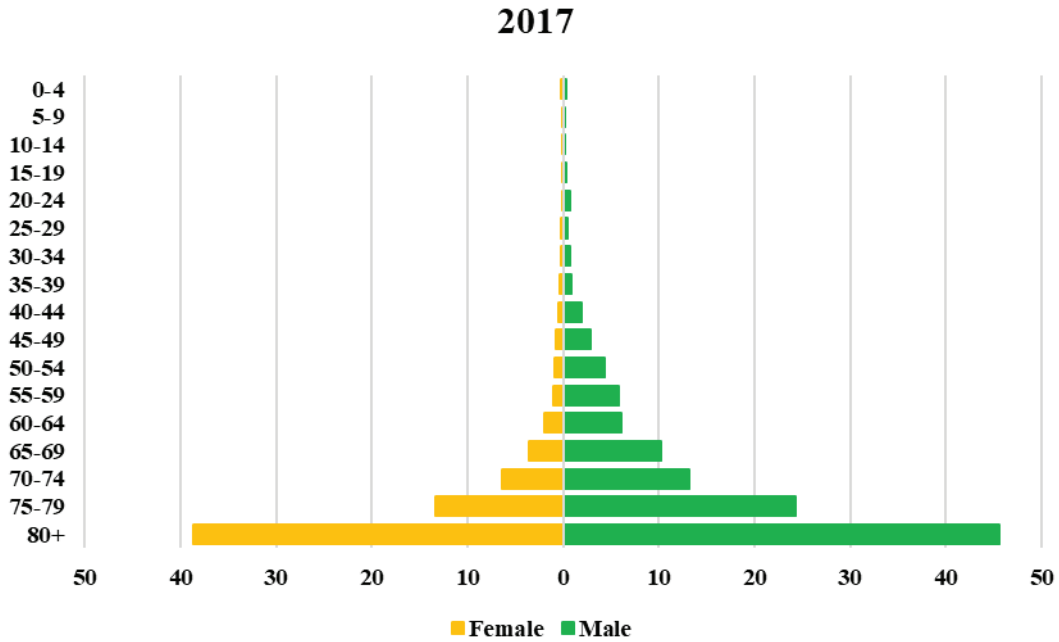
old in 2019 was the highest (0.73 cases per 1,000 people). This trend is similar in age groups from 45 to 79 years old. However, the mortality rate among people over 80 years old was highest in 2020 with about 69.9 cases per 1,000 people. The mortality rate per 1,000 people was lowest in 2017 in most age groups except the 20-24 years old group and the 35-39 years old group. In particular, the mortality rate in the 20-24 years old group in 2017 was the highest in the 2017-2020 period (0.44 cases per 1,000 people).

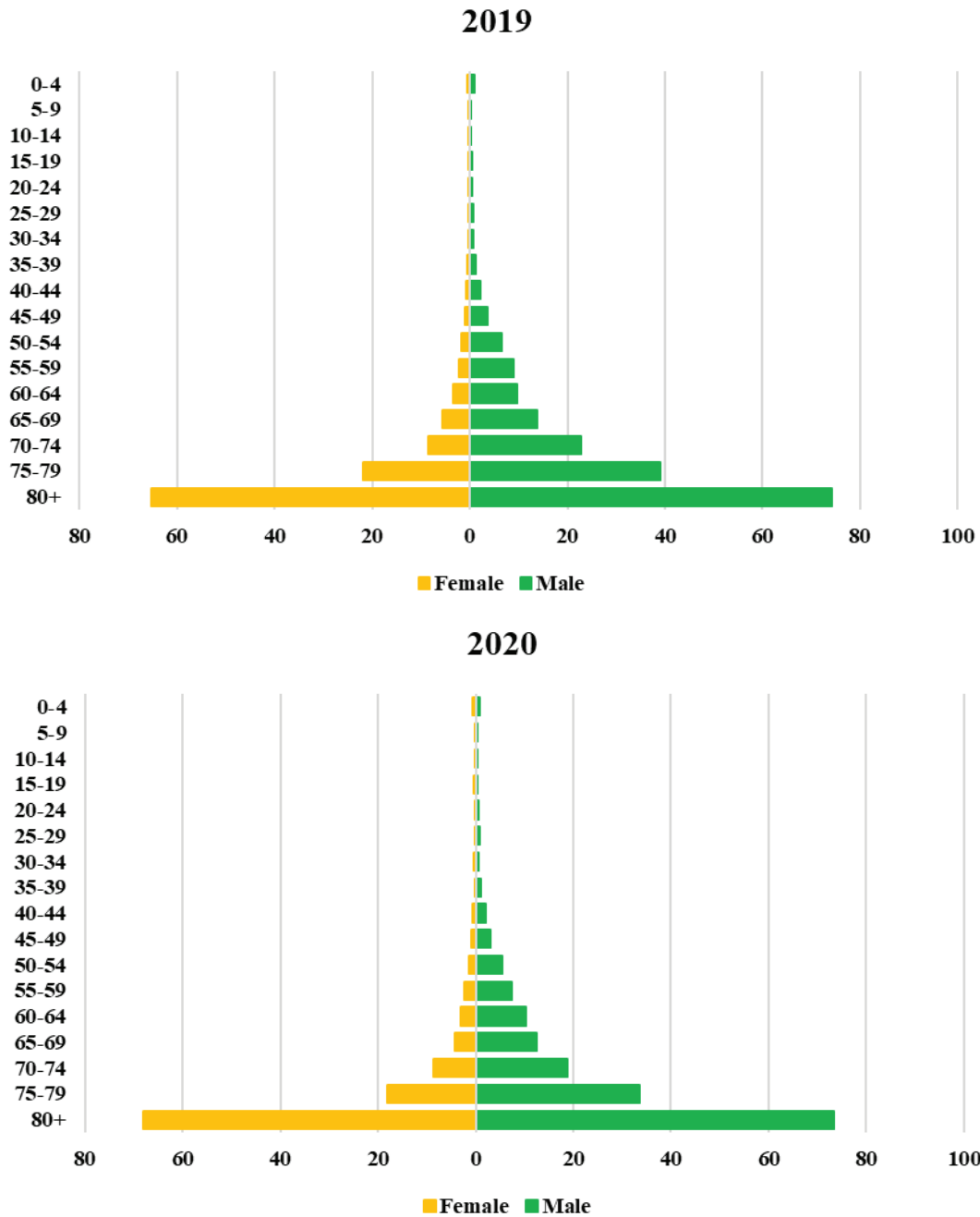
**Table 1. Number of mortality and mortality rate (per 1,000 people) by age group in Bac Ninh in 2017-2020**

Age	2017		2018		2019		2020	
	Number of records	Mortality rate	Number of records	Mortality rate	Number of records	Mortality rate	Number of records	Mortality rate
0-4	19	0.24	31	0.38	60	0.73	54	0.65
5-9	10	0.09	15	0.13	24	0.19	21	0.17
10-14	11	0.13	17	0.18	13	0.13	16	0.16
15-19	16	0.22	23	0.29	29	0.36	36	0.43
20-24	35	0.44	34	0.41	35	0.42	26	0.32
25-29	33	0.31	52	0.46	56	0.52	55	0.53
30-34	43	0.45	53	0.50	58	0.51	60	0.51
35-39	46	0.56	52	0.54	85	0.83	78	0.72
40-44	85	1.16	100	1.26	109	1.35	112	1.42
45-49	115	1.80	155	2.14	175	2.31	151	1.93
50-54	153	2.54	211	3.36	261	4.08	227	3.42
55-59	205	3.34	304	4.43	355	5.31	321	4.65
60-64	185	3.82	280	5.14	390	6.40	398	6.37
65-69	185	6.57	264	7.77	354	9.26	332	7.85
70-74	190	9.40	267	11.27	383	14.60	343	12.87
75-79	292	17.70	434	25.10	471	28.64	411	24.44
80+	1001	40.82	1503	54.62	2062	66.88	2189	69.90
<b>Total</b>	<b>2624</b>		<b>3795</b>		<b>4920</b>		<b>4830</b>	

Figure 1 shows that there is uniformity in the distribution of mortality rate per 100,000 population for each sex across age groups in the years 2017-2020. Among them, the mortality rates of people aged 80 and over

is the largest over the years. From 2017-2020, the female's mortality rate per 100,000 population were higher than that of male across age groups.

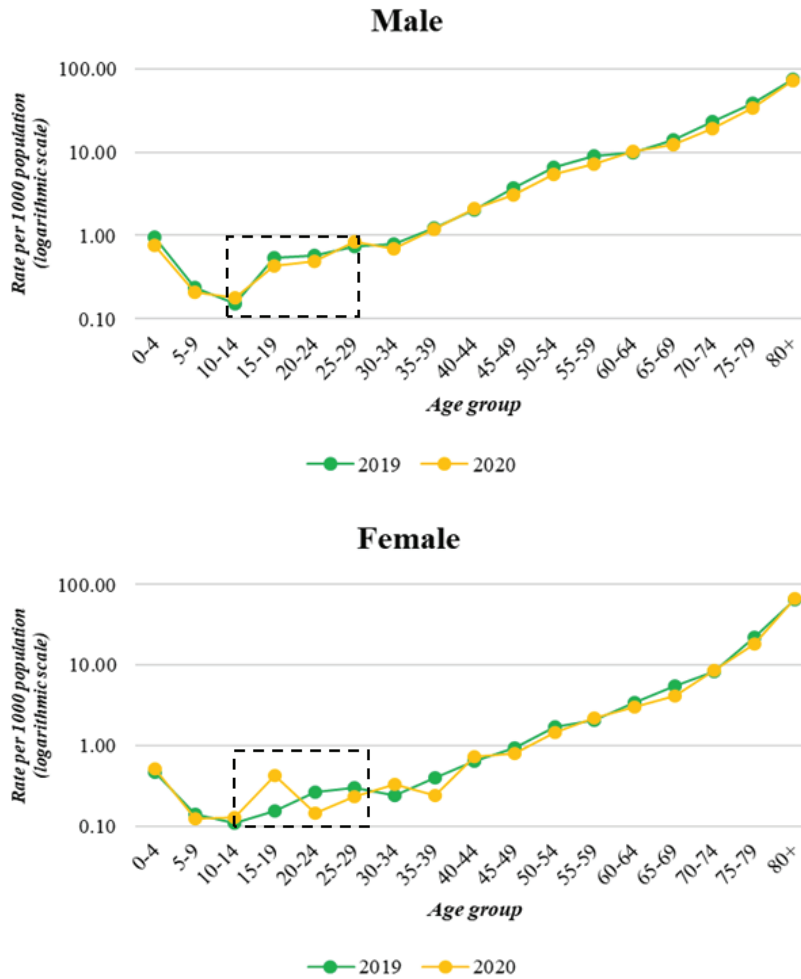




**Figure 1. Mortality rate by age groups and sex in Bac Ninh in 2017-2020**

When considering mortality rates, the distribution of mortality rates (per 1000 population) of men across age groups in 2019 was similar to that in 2020 (Figure 2). However, the mortality rate (per 1,000 people) among women in 2019 is different

from 2020 in the age groups 15-39 years old. In particular, the number of female mortality aged 15-19 was lower than that of the 20-24 years old group in 2019, contrary to the results of 2020.



**Figure 2. Mortality rate per 1000 people (on logarithmic scale) between male and female groups in Bac Ninh in 2019 and 2020**

## DISCUSSION

Since 1992, the Ministry of Health has issued the A6/YTCS document to collect all mortality in the community(13). Annually, A6/YTCS updates information on all mortality in the commune’s managed population. This is the sole data source that can provide mortality information by age, sex and cause of mortality (17). Data is recorded by commune health staff and compared by district health staff and then transferred to the district health agency. The strength of the A6 mortality reporting system is its simplicity.

The A6 system is established in all communes in Vietnam (19)very limited database of cancer information has been available to date. The aim of the present study was to examine cancer mortality pattern nationwide in Viet Nam.\nMETHODS: Descriptive cancer epidemiology was designed for the present study. Both demographic data and list of all deaths during the two years period, 2005-06, were obtained from all 10,769 commune health stations. Five indicators included name, age, sex, date of death and cause of death was collected for each case. A guideline to report demographic data of

each commune and information of each case who has been lived at least 6 months in their commune was prepared in the designed form and sent by express mail service to all the heads of 10,769 commune health stations throughout country. The data comprises all cancer mortality records at the commune-level for the period 2005-06. All obtained data of cancer deaths as well as demographic information was computed using Excel software. The Excel data was exported to STATA 8.0 for cancer analysis. Cancer case was coded following ICD-10.

**RESULTS:**

To date, 94.6% of the 10,769 communes (from the 638 of 671 districts within the 64 provinces and recording the number of mortality of people in the commune is easily applied by all commune health staffs. The A6 system is the only mortality reporting system in the country where cause-of-mortality is provided by the professionals (20). In 2002, the Ministry of Health of Vietnam included a number of mortality indicators in the list of essential health indicators at district, provincial and national levels: perinatal, neonatal and under-5 mortality rates. age, maternal mortality rate, leading causes of mortality, mortality from common infectious diseases and life expectancy at birth(21). The A6 reporting system is a low-cost system. This system could serve as a valid system for indexing all-cause mortality and could form the basis for future sentinel surveillance and related activities (20).

In this study, we found that mortality rates from A6/YTCS was significantly lower than that announced by the General Statistics Office – GSO (22). Particularly, the under-5-mortality rates estimated in this study were below 1 mortality (per 1,000 live births) during 2017-2019 in Bac Ninh. Meanwhile, the corresponding results provided by the GSO were 18,20 to 19.23 mortality (per 1,000 live births) (22). This heterogeneity might be

attributed to the fact that the GSO conducted estimation based on entirely different mortality registration system, namely the Department of Justice. On the one hand, the location of mortality from Department of Justice, by definition, is the final address people were living prior to their mortality, according to the Decree No. 123/2015/NĐ-CP and the Circular No. 04/2020/TT-BTP. On the other hand, the corresponding information recorded by the A6/YTCS registration system is the permanent residence. This difference might explain a much lower mortality rate in A6/YTCS registration system.

The mortality burden from infectious diseases in Vietnam is anticipated to decrease significantly from 18% in 1996 to 6% in 2026. The projected mortality burden of 6% in 2026 for infectious diseases is significantly lower than the average projected burden for other countries in Southeast Asia(23). In Bac Ninh, the mortality rate (per 1,000 people) in 2017 and 2018 tended to be lower than in 2019 and 2020 in all age groups (table 1). Especially in 2019 and 2020, the mortality rate is much higher in the age group > 75 years old.

The mortality rate pyramids from 2017 to 2019 consistently exhibit broad bases and distinct peaks, indicating a notable distribution of mortality across age groups during this period. Furthermore, analysis of mortality rates by age group and gender reveals a prevalent trend: across most age groups from 2017 to 2020, men experience higher mortality rates compared to women. However, in the group aged 80 and over, the mortality rate in women is higher. This shows that life expectancy in women is higher than in men over 80 years old. Women have higher rates of frailty than men - possibly because women tend to live longer than men and therefore the effect of age also makes women more susceptible to becoming frail (6).

The mortality rates for men across different age groups remained consistent between 2019 and 2020. In both years, the mortality rate decreases from infancy to early childhood, reaching its lowest point in the age group of 10-14 years old. However, from adolescence onwards, the mortality rate in men gradually increases, peaking in the age group of 80 years and older. Similarly, in women, the mortality rate follows a pattern of decline from infancy to early adolescence, with the lowest rate occurring in the 10-14 age group in both 2019 and 2020. However, in 2019, the mortality rate begins to increase from the age of 15-19, while in 2020, there's a decrease in the 20-24 age group followed by an increase in subsequent age groups, reaching the highest point in those aged 80 years and older. This data indicates that the highest mortality rates occur in two vulnerable age groups: infants and the elderly (80 years and older). This pattern underscores the susceptibility and heightened risk of mortality associated with these age brackets.. At the age of 0-4 years old, people are more susceptible to diseases because their bodies have an incomplete respiratory system or organs, so they are more likely to die. For the age group 80+, many body functions are gradually declining and aging, so they are susceptible to diseases and have a higher risk of mortality. Along with immunodeficiency, weakness (also called frailty) is a condition associated with old age. Asthenia is often characterized by decreased muscle strength and fatigue(6). According to research data from the Medical University of South Carolina (USA), about 10% of people over 65 years old live in a sick state. This number increases to between 25% and 50% for those over 85 years old (6).

In this study, the causes of mortality were not thoroughly analyzed due to limited data sources. Specifically, the data is only based on reports on mortality rates in book A6,

while the causes of mortality recorded at the commune level in many cases do not comply with the Ministry of Health's instructions(24). To further analyze the cause of mortality, it is necessary to perform a cause of mortality investigation (Verbal Autopsy) to confirm the information. Although mortality records are incomplete, cause-specific mortality rates at different ages provide a basis for understanding health priorities. These findings demonstrate a clear need for improved health services to control perinatal mortality and the need for evidence-based interventions to reduce mortality (24).

## CONCLUSION

In Bac Ninh, during the entire period, the mortality rate in the over 80 age group was the highest and increased gradually over the years. Based on the results, it is necessary to have specific measures to improve the quality of life and reduce the mortality rate, especially in the group of children under 5 years old.

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