

Incidence and Prevalence of Septic Arthritis in Thailand: A Database from the Ministry of Public Health

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Background: A better understanding of the epidemiological profile of septic arthritis or pyogenic arthritis in Thais could improve care and provide information for better infectious control. We aimed to determine the incidence and prevalence of septic arthritis in Thailand between 2017 and 2020.

Methods: A descriptive epidemiological study was performed using demographic data from patients over 18 years of age having a primary diagnosis of M00 pyogenic arthritis between 2017 and 2020. Data were sourced from the Information and Communication Technology Center, Ministry of Public Health database. The incidence and prevalence of septic arthritis were calculated, and their respective 95% confidence interval (CI).

Results: The number of patients with septic arthritis in 2017 was 26,878 from a total Thai population of 65,204,797. The prevalence of septic arthritis in 2017 was 41.2 per 100,000 (95% CI 40.7–41.7). The prevalence of septic arthritis among women was slightly higher than among men (42.2 vs 40.2 per 100,000). The incidence of septic arthritis slightly increased from 2018 to 2019 but was stable in 2020 (22.6, 23.3, and 23.1 per 100,000 person-years, respectively). The incidence was highest in the southern region between 2018 and 2019 but highest in the northeast in 2020. The peak was in the elderly population 60 and older (56.4, 59.5, and 57.3 per 100,000 person-years in 2018, 2019, and 2020, respectively). The incidence increased with age and the maximum rate was in those ≥ 70 years (70.2 per 100,000 person-years in 2019).

Conclusion: Septic arthritis commonly presents in the elderly and is comparable between men and women. The disease was found mainly in the northeastern and southern regions. The incidence remained stable during the study period.

Keywords: septic arthritis, pyogenic arthritis, infectious arthritis, epidemiology, observational study

Introduction

Septic arthritis or pyogenic arthritis is a medical emergency requiring prompt diagnosis and treatment. If left untreated, the bacteria responsible for septic arthritis can rapidly destroy joints and cause joint disability. Acute bacterial arthritis is usually caused by gonococcal or nongonococcal septic arthritis. The most common cause of non-gonococcal septic arthritis in all age groups is *Staphylococcus aureus*.¹ Key symptoms of septic arthritis include high fever, pain, swelling, and warmth around the infected joint. Detecting pathogens from synovial fluid through staining and/or culture is crucial to diagnosing the condition. Infected synovial fluid is typically cloudy or purulent, and the white blood cell count is usually elevated to more than 50,000 cells/mm³.² Both nongonococcal and gonococcal septic arthritis have their clinical features and prognosis differ. Non-gonococcal septic arthritis tends to be more severe and has a worse prognosis than gonococcal septic arthritis.

It is recommended that all patients with suspected bacterial arthritis, whether it is caused by gonorrhea or non-gonorrhea, be admitted for observation and treatment with intravenous antibiotics.³ A clinical study conducted in

Thailand in 2010 found that septic arthritis was the third most common rheumatic disease leading to hospitalization, following osteoarthritis and gout. The prevalence rate was 13.5 per 100,000 population, with higher rates in the northern and northeastern regions, particularly among individuals over 60.⁴ Since there have been no recent reports of the incidence of septic arthritis in Thailand, we felt it prudent to update the incidence and prevalence of bacterial arthritis for a more comprehensive epidemiological picture in Thailand. We reasoned an epidemiological study comparing past and current data should yield valuable insights into the epidemiology of septic arthritis in the Thai population and contribute to better care planning for patients with bacterial arthritis, as well as help in manpower planning and the allocation of public health policy budgets for the care of septic arthritis.

Methods

A descriptive epidemiological study was conducted among patients over 18 with a primary diagnosis of M00 pyogenic arthritis using the International Classification of Diseases, Tenth Revision (ICD-10). Data were recorded in the Information and Communication Technology Center, Ministry of Public Health database between 2017 and 2020.

Information Resources and Statistical Analysis

The study was carried out using the Information and Communication Technology Center, Ministry of Public Health database, which comprises healthcare paid for by (i) the National Health Security Office (NHSO), (ii) the Civil Servant Medical Benefit Scheme of the Comptroller General's Department; (iii) the Social Security Office; and (iv) self-payment. Databases were constituted from a collection of data submitted by hospitals. The diagnosis was coded using ICD-10. Epidemiological data from patients with a primary diagnosis of M00 pyogenic arthritis between 2017 and 2020 were extracted and reviewed. Data included age on the date of diagnosis of septic arthritis, sex, year of visit, hospital name, municipal district (Amphoe), and province. Duplicate entries were removed. The incidence and cumulative incidence of septic arthritis were analyzed, including the respective 95% confidence interval (CI). The data included an overall national and regional perspective (viz., the northern, eastern, northeastern, southern, and central regions). Population data for disease prevalence came from the National Statistical Office of Thailand.⁵ Categorical data were presented as numbers and percentages of observed events (septic arthritis). The continuous data that exhibited a symmetrical distribution without skew by the Shapiro–Wilk test were presented as means and standard deviations (SD). The results were presented as median with interquartile range (IQR) for data with an abnormal distribution. All data analyses were performed with STATA version 16.0 (StataCorp., College Station, TX, USA).⁶

Results

Between 2017 and 2020, 72,005 cases from the database had a primary diagnosis of M00 pyogenic arthritis. In 2017, the number of patients with septic arthritis was 26,878 cases, from a total Thai population of 65,204,797, including 31,966,108 men and 33,238,689 women. Thus, the prevalence of septic arthritis in 2017 was 41.2 per 100,000 (95% CI 40.7–41.7). The proportion of females was slightly higher than that of males. The respective number of septic arthritis in 2017 in Thai women and men was 14,034 and 12,844 cases, with a prevalence of 42.2 per 100,000 (95% CI 41.5–42.9) and 40.2 per 100,000 (95% CI 39.5–40.9). The overall mean age of the prevalence cases in 2017 was 54.9±19.2 years.

The incidence of septic arthritis in Thailand increased slightly from 2018 to 2019 but trended to be stable between 2019 and 2020 and was slightly higher in women than men. The respective incidence of septic arthritis in 2018, 2019, and 2020 was 22.6 per 100,000 person-years (95% CI 22.2–23.0), 23.3 per 100,000 person-years (95% CI 22.9–23.6), and 23.1 per 100,000 person-years (95% CI 22.7–23.4). The number of new cases of septic arthritis and the total Thai population stratified by year are presented in [Table 1](#), and the incidence of septic arthritis stratified by year is presented in [Table 2](#).

The mean age of incidence cases from 2018 to 2020 was comparable to that of the prevalence cases in 2017. The incidence was highest in those 60 and older, and the findings were similar over a 3-year period. The southern region had the highest incidence of septic arthritis between 2018 and 2019, but it was highest in the northeastern region in 2020 ([Table 2](#)).

Table 1 Data from Septic Arthritis Cases Between 2017 and 2020 (n=72,005)

Variable	Year			
	2017 ^a n = 26,878 n (%)	2018 ^b n = 14,777 n (%)	2019 ^b n = 15,256 n (%)	2020 ^b n = 15,094 n (%)
Total Population	65,204,797	65,406,320	65,557,054	65,421,139
Age (years)				
≤ 29	3,044 (11.3)	1,625 (11.0)	1,635 (10.7)	1,374 (9.1)
30 to 39	2,282 (8.5)	1,249 (8.5)	1,339 (8.8)	1,309 (8.7)
40 to 49	4,154 (15.5)	2,502 (16.9)	2,291 (15.0)	2,391 (15.8)
50 to 59	5,916 (22.0)	3,386 (22.9)	3,362 (22.0)	3,356 (22.2)
60 to 69	5,442 (20.3)	2,891 (19.6)	3,243 (21.3)	3,271 (21.7)
≥ 70	6,040 (22.5)	3,124 (21.1)	3,386 (22.2)	3,393 (22.5)
Mean±SD	54.9 ± 19.2	54.7 ± 18.5	55.3 ± 18.8	55.8 ± 18.2
Sex				
Male	12,844 (47.8)	6,899 (46.7)	7,312 (47.8)	7,183 (47.6)
Female	14,034 (52.2)	7,878 (53.3)	7,944 (52.1)	7,911 (52.4)
Region				
Northern	3,217 (12.0)	1,332 (9.0)	1,441 (9.5)	1,409 (9.3)
Central	6,578 (24.5)	3,255 (22.0)	4,018 (26.3)	3,837 (25.4)
Northeastern	11,186 (41.6)	7,246 (49.0)	6,580 (43.1)	7,116 (47.1)
Eastern	1,386 (5.2)	694 (4.7)	677 (4.4)	752 (5.0)
Western	1,978 (7.4)	923 (6.3)	991 (6.5)	834 (5.5)
Southern	2,533 (9.4)	1,327 (9.0)	1,549 (10.2)	1,146 (7.6)

Notes: ^aPrevalence cases. ^bIncidence cases.

The highest number of patients in 2017 was in the northeastern region (11,186 cases; 41.6%) according to the number of patients with septic arthritis per 100,000 based on hospital visits, followed by the central region (6,578 cases; 24.5%), and the northern region (3,217; 12.0%) (Figure 1A). New cases of septic arthritis were found mainly in the northeast region, mainly in Khon Kaen province in 2018–2019, with a respective incidence of 149.4 and 87.7 per 100,000 person-years, while Phichit province, in the north-central region, had the highest incidence of septic arthritis in 2020 (88.3 per 100,000 person-years). Few cases were reported in the western, southern, and eastern regions (Figures 1B–D).

The most prevalent causative organisms among Thais were species of *Staphylococcus*, with the knee joint being the most frequently affected. Details regarding the common causative organisms and joint involvements in the prevalence cases of 2017 are presented in Table 3.

Two thousand eight hundred twenty-seven patients with septic arthritis died in 2017–2020, with a median age of 70.0 years (IQR 59.6–81.0). The most common cause of non-survived septic arthritis was sepsis and septic shock (285 cases), followed by pneumonia (114 cases), hypertension (99 cases), type 2 diabetes mellitus (97 cases), and chronic kidney disease (CKD) (73 cases). The majority of the non-survived cases were elderly patients 60 and over. Age group classified by common causes of death is presented in Figure 2.

Table 2 Prevalence and Incidence of Septic Arthritis per 100,000 Person-Years with 95% CI in Thailand from 2017 to 2020

Variable	Year							
	2017		2018		2019		2020	
	N	Prevalence (95% CI)	N	Incidence (95% CI)	N	Incidence (95% CI)	N	Incidence (95% CI)
Total	65,204,797	41.2 (40.7–41.7)	65,406,320	22.6 (22.2–23.0)	65,557,054	23.3 (22.9–23.6)	65,421,139	23.1 (22.7–23.4)
Age (years)*								
≤ 29	24,924,019	12.2 (11.8–12.7)	24,667,116	6.6 (6.3–6.9)	24,356,422	6.7 (6.4–7.1)	23,979,631	5.7 (5.4–6.0)
30 to 39	9,804,544	23.3 (22.3–24.3)	9,667,494	12.9 (12.2–13.7)	9,517,260	14.1 (13.3–14.8)	9,408,601	13.9 (13.7–14.7)
40 to 49	10,473,467	39.7 (38.5–40.9)	10,374,192	24.1 (23.2–25.1)	10,342,715	22.2 (21.3–23.1)	10,293,850	23.2 (22.3–24.2)
50 to 59	9,200,113	64.3 (62.7–66.0)	9,441,220	35.9 (34.7–37.1)	9,576,697	35.1 (33.9–36.3)	9,692,194	34.6 (33.5–35.8)
60 to 69	5,830,611	93.3 (90.9–95.9)	6,068,469	47.6 (45.9–49.4)	6,313,454	51.4 (49.6–53.2)	6,579,893	49.7 (48.0–51.5)
≥ 70	4,394,711	137.4 (134–141.0)	4,598,334	67.9 (35.6–70.4)	4,822,605	70.2 (67.9–72.6)	5,053,295	67.1 (64.9–69.4)
Gender								
Male	31,966,108	40.2 (39.5–40.9)	32,043,770	21.5 (21.0–22.0)	32,094,943	22.8 (22.3–23.3)	31,992,542	22.5 (21.9–23.0)
Female	33,238,689	42.2 (41.5–42.9)	33,362,550	23.6 (23.1–24.1)	33,462,111	23.7 (23.2–24.3)	33,428,597	23.7 (23.2–24.2)
Region								
Northern	11,670,987	27.6 (26.6–28.5)	11,677,636	11.4 (10.8–12.0)	11,671,188	12.4 (11.7–13.0)	11,607,754	12.1 (11.5–12.8)
Central	17,373,692	37.9 (37.0–38.8)	17,427,846	18.7 (18.0–19.3)	17,474,244	23.0 (22.3–23.7)	17,442,982	22.0 (21.3–22.7)
Northeastern	21,925,925	51.0 (50.1–52.0)	21,958,131	33.0 (32.2–33.8)	21,967,951	30.0 (29.2–30.7)	21,882,786	35.5 (31.8–33.3)
Eastern	4,919,656	28.2 (26.7–29.7)	4,976,443	14.0 (12.9–15.0)	5,033,484	13.5 (12.5–14.5)	5,071,123	14.8 (13.8–15.9)
Western	5,565,256	35.5 (34.0–37.1)	5,588,577	16.5 (15.5–17.6)	5,607,281	17.7 (16.6–18.8)	5,606,153	14.9 (13.9–15.9)
Southern	3,749,281	67.6 (65.0–70.2)	3,777,687	35.1 (33.3–37.1)	3,802,906	40.7 (38.7–42.8)	3,810,341	30.0 (28.4–31.9)

Notes: *Around 0.9% of the population was excluded from the analysis because no definite age was defined in the National Statistical Office of Thailand.

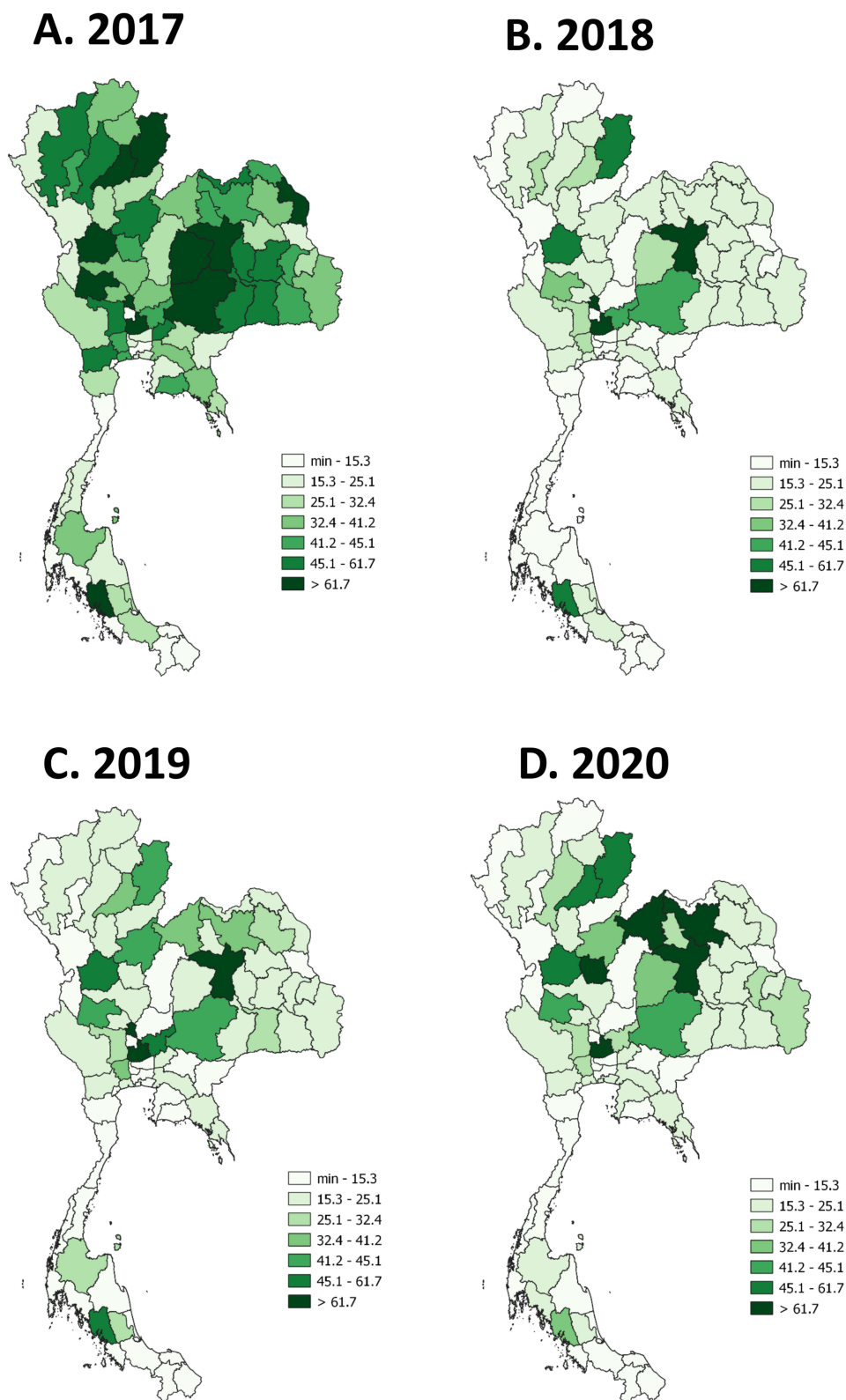


Figure 1 Number of patients with septic arthritis per 100,000 by hospital-based visit. (QGIS software version 3.8.2: an open source and free software of geographic data system information was used for generating the maps; <https://www.qgis.org/en/site/>). **(A)** Number of septic arthritis in 2017 (prevalence cases). **(B)** Number of new cases of septic arthritis in 2018 (incidence cases). **(C)** Number of new cases of septic arthritis in 2019 (incidence cases). **(D)** Number of new cases of septic arthritis in 2020 (incidence cases).

Abbreviation: Min; minimum.

Table 3 Common Causative Organisms and Affected Joints in the 2017

Common Causative Organisms	Affected Joints	n = 26,878 n (%)
Staphylococcus species	Shoulder	882 (3.28)
	Elbow	499 (1.86)
	Wrist	357 (1.33)
	Hand	556 (2.07)
	Hip	299 (1.11)
	Knee	3,924 (14.60)
	Ankle and foot	1,625 (6.05)
	Unspecified joint	2,320 (8.63)
	Polyarthritis	1,464 (5.44)
<i>Streptococcus pneumoniae</i>	Shoulder	45 (0.17)
	Elbow	19 (0.07)
	Wrist	29 (0.11)
	Hand	37 (0.14)
	Hip	24 (0.09)
	Knee	199 (0.74)
	Ankle and foot	95 (0.35)
	Unspecified joint	113 (0.42)
	Polyarthritis	127 (0.48)
Streptococcal species	Shoulder	22 (0.08)
	Elbow	7 (0.03)
	Wrist	18 (0.07)
	Hand	27 (0.10)
	Hip	16 (0.06)
	Knee	162 (0.60)
	Ankle and foot	105 (0.39)
	Unspecified joint	92 (0.34)
	Polyarthritis	166 (0.61)
<i>Burkholderia pseudomallei</i>	Shoulder	189 (0.70)
	Elbow	69 (0.26)
	Wrist	92 (0.34)
	Hand	314 (1.17)
	Hip	74 (0.28)
	Knee	840 (3.13)

(Continued)

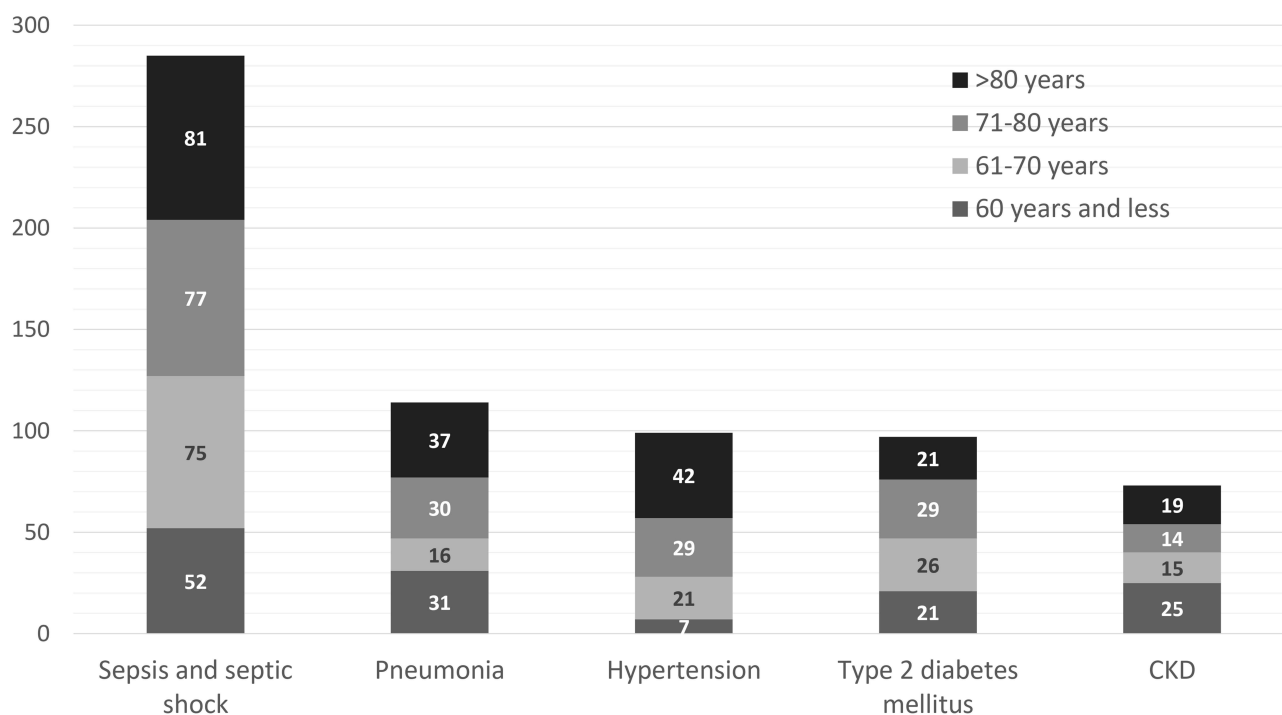
Table 3 (Continued).

Common Causative Organisms	Affected Joints	n = 26,878 n (%)
	Ankle and foot	480 (1.79)
	Unspecified joint	631 (2.35)
	Polyarthritis	905 (3.36)

Discussion

Herein, we report the epidemiology of septic arthritis in Thailand, including data from the National Information and Communication Technology Center the Ministry of Public Health that covers all healthcare providers. Most Thais receive health services in hospitals under the Ministry of Public Health, and their information is recorded during visits to out-and/or in-patient departments. The diagnoses per the ICD were extracted from the database (M00). Our epidemiological study explored the prevalence and incidence of septic arthritis among Thais between 2017 and 2020, which overlapped with the emergence of the COVID-19 pandemic (early January 2020).⁷

From 2018 to 2020, the prevalence and incidence of septic arthritis was approximately 41 per 100,000 population and 22–23 per 100,000 person-years. The incidence seemed higher than a previous report in the Australian population (9.2 per 100,000 person-years)⁸ but comparable to a New Zealand study.⁹ McBride et al reported the prevalence of septic arthritis among New Zealand adults from 2006 to 2013 at 21 per 100,000 person-years using ICD-10 from the electronic review.⁹ Our incidence was slightly less than among Aboriginal Australians, with 29.1 per 100,000 person-years.⁸ Modifications to the study method, such as the definition of septic arthritis and the time duration of the study, might explain the discrepancies in the findings. Unfortunately, there are no data on the epidemiology of septic arthritis in adults from Southeast Asia, where the population is comparable to Thailand's, so we do not have information on those countries to compare with ours.

**Figure 2** Age group in the top 5 common causes of death in patients with septic arthritis in 2017–2020.

The prevalence and incidence increased with age, mainly among those ≥ 60 years of age. The age group of septic arthritis in Thais was similar to the age group of septic arthritis in the Portuguese population (median age 67 years),¹⁰ the New Zealand population (mean age 60 years),¹¹ and the Maltese population (median age 66 years).¹² However, the age group was slightly higher than in a previous study of the Thai population. Teparrukkul et al¹³ reported that the median age of patients with septic arthritis between 2012 and 2014 in northeast Thailand was 55 years. The difference in the findings could be related to the causative organism and the specific area of the study. *Burkholderia pseudomallei* is a common infectious disease in northeastern Thailand^{13,14} and is found more frequently in patients with diabetes mellitus.¹⁵ Additionally, type 2 diabetes mellitus in Thais mainly presents in a late-middle-aged group, particularly 50 and older.¹⁶ We included not only patients with septic arthritis from the northeastern but also the other regions of Thailand and not limited to the causative organism. Therefore, the demographics of the disease can explain why the age group of the patients with septic arthritis in the previous study was lower than ours. Our age group was also higher than in the Brazilian population (mean age 41.6)¹⁷ and the New Zealand population (mean age 49).⁹ The difference in the study method could also explain the difference in the findings, the definition of septic arthritis, and the study period.

Elderly patients with septic arthritis had poor outcomes. Our results showed that the median age for non-survived septic arthritis cases was 70. An aging population generally has more underlying diseases and health problems that might be at risk of infection (including joint infection), resulting in higher morbidity and mortality. Septic arthritis should be examined in the elderly with fever and joint pain because of the prevalence of septic arthritis among elderly patients, the poor prognosis among those older patients, and the aging society. Once septic arthritis is diagnosed, early treatment with close monitoring is warranted to prevent disease complications and decrease morbidity and mortality among elderly patients.

The new cases of septic arthritis were revealed mainly in the Northeast region and the majority in Khon Kaen province, with a prevalence in 2018–2020 of approximately 30–35.5 per 100,000 person-years. The incidence of septic arthritis in this region was comparable to a previous report by Teparrukkul et al¹³ in which the cumulative incidence of bacteremia in patients with septic arthritis was around 31–39 per 100,000 person-years in the northeast in 2012–2014 for gram-positive bacterial septic arthritis. However, the cumulative incidence was much higher in those diagnosed with *Burkholderia pseudomallei* septic arthritis (45 per 100,000 person-years). The finding is supported by the high prevalence of *Burkholderia pseudomallei* in Northeastern Thailand (1,160 cases; 32.3%) (data not shown). Our findings might help assess the geographic distribution of septic arthritis in Thailand.

Staphylococcal septic arthritis is the most common type among Thais, with the knee joint being the most commonly affected. These findings are consistent with those of previous studies in the last decade,^{11,18} suggesting that globally there has been no change in the distribution of causative organisms and joint involvement. For patients with clinicals suspicious of septic arthritis and no definite organism identified at presentation, initial treatment should include antibiotics with *Staphylococcal aureus* coverage.

Septic arthritis in Thais was comparable between males and females, while previous studies reported a male predominance with a male-to-female ratio around 2:1 to 1.5:1.^{10,12,13,17,19} The more significant number of females in the Thai population could explain the finding⁵ as well as the longer life expectancy of Thai females over Thai males.²⁰ According to our results, wherein incidence increased with age, it is possible that elderly females might have an increased risk of septic arthritis with age.

Further study should be conducted to define the predisposing factors that can increase the risk of developing septic arthritis, such as joint trauma, invasive joint procedures, intravenous drug use, concomitant comorbid diseases, immunocompromised conditions, preexisting joint conditions, and prosthetic joints.

Our study had some limitations, including that (a) the clinical information from the database was incomplete; (b) the data were collected from almost all hospitals in Thailand, but not private clinics and some university hospitals in the central region, which usually absorb many complicated patients, so the prevalence and incidence of septic arthritis might have been underestimated; (c) the principal diagnosis in the database was coded according to the ICD-10, which does not provide a specific code for clinical features, disease complications, and treatment. So we are not able to provide detailed epidemiology of septic arthritis; and, (d) ICD-10 coding errors can occur in daily practice, so we cannot be certain that all patients in the database had a correct diagnosis. The study strengths were: (a) all necessary demographic data were

analyzed; (b) the data were sufficient to complete an overall assessment of the epidemiology of septic arthritis in Thailand; (c) the study was based on a most extensive database from the Ministry of Public Health, thereby ensuring a complete set of epidemiological characteristics for septic arthritis in Thailand; and, (d) the results can be generalized to other Southeast Asian and/or Asian-Pacific countries with similar ethnicity and geography.

Conclusion

The prevalence of septic arthritis in Thais in 2017 was 41.2 per 100,000, while the incidence remained stable during the study period, with the respective incidence in 2018, 2019, and 2020 being 22.6, 23.3, and 23.1 per 100,000 person-years. Septic arthritis commonly presents in the elderly, and the incidence is comparable between men and women. The disease is found mainly in the Northeast and South regions. Elderly patients have poor outcomes. The epidemiologic study of septic arthritis might help assess the geographic distribution, human resource planning, and allocation of public health policy budgets for treating septic arthritis in Thailand.

Data Sharing Statement

Data and material are available from the corresponding author upon reasonable request.

Ethics Approval and Consent to Participate

The Human Research Ethics Committee of Khon Kaen University reviewed and approved the study per the Helsinki Declaration and the Good Clinical Practice Guidelines (HE641592). The Human Research Ethics Committee of Khon Kaen University waived the requirement for informed consent because of the retrospective nature of the study. Participant privacy was protected by anonymized data and kept confidentiality.

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Disclosure

All authors declare that they do not have a conflict of interest.

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