Original Article • Journal of Southeast Asian Orthopaedics Vol 50 No 2 (2026) 137-143

Journal of Southeast Asian Orthopaedics
ISSN 2821-9848 (Print)
ISSN 2821-9864 (Online)
https://doi.org/10.56929/jseaortho-2026-0306 https://jseaortho.org

# Epidemiology and Factors Associated with Clinical Outcomes of Fragility Hip Fractures in Kamphaeng Phet Province, Thailand

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**Purpose:** This study investigated the epidemiological characteristics, incidence, and outcome-related factors of fragility hip fractures in Kamphaeng Phet Province, examined care pathway time intervals, comparing office-hour and off-hour arrivals, and identified independent predictors of in-hospital mortality.

**Methods:** This retrospective cohort study analyzed data from the provincial health database between 2020 and 2023. Eligible participants were adults aged ≥50 years with low-energy hip fractures (ICD-10: S72.0, S72.1, S72.2). Beyond Multivariate logistic regression and survival analysis (Kaplan–Meier and Cox proportional hazards model) were employed to identify independent predictors of clinical outcomes.

**Results:** This study included 901 patients (mean age; 77.3 years, 66.0% women). The average incidence rate was 89.2 per 100,000 population annually. The mean time from injury to hospital arrival was 101.4 h. Multivariate logistic regression revealed that delayed surgery (>48 h) was a significant independent predictor of in-hospital mortality (adjusted odds ratio = 2.45, 95% confidence interval; 1.20–4.98, p = 0.012). Survival analysis confirmed that age ≥ 70 years (hazard ratio [HR] = 3.10, p = 0.004) and delayed surgery (HR = 2.25, p = 0.018) significantly increased the hazard of mortality.

**Conclusions:** Although in-hospital admission processes were efficient, delayed surgery significantly increases the risk of in-hospital mortality. These findings emphasize the critical importance of the 48-h surgical window. Healthcare policies should focus on reducing pre-hospital delays and surgical waiting times to improve survival outcomes in patients with fragility hip fracture.

**Keywords:** epidemiology, fragility hip fracture, incidence, time to admission, older adults

Fragility hip fracture is a major public health concern and leading cause of disease burden in aging societies worldwide. Such fractures often result in long-term functional impairment, loss of independence, and a significantly increased mortality rate [1, 4]. With the global aging population [9], the incidence of hip fractures may increase rapidly, with the greatest increase expected in Asian countries [5].

In Thailand, recent national epidemiological studies have demonstrated an increasing trend in hip fractures over the past decade; from 112.7 per 100,000 population in 2013 to 146.9 per 100,000 population in 2023 [6]. However, national data reveal substantial geographic variation in incidence, influenced by multiple factors, including

*Article history:*
*Received: December 13, 2025 Revised: April 23, 2026*
*Accepted: June 3, 2026*
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demographic aging patterns, lifestyle characteristics, and environmental conditions [6, 17]. For example, a study conducted in Nan Province reported an incidence as high as 238.5 per 100,000 population, significantly exceeding the national average [11]. A recent study in northern Thai communities identified local context-specific risk factors among older adults, highlighting the need for localized epidemiological information [15].

Surgical fixation is the standard treatment for fragility hip fractures, with early surgery recommended to reduce complications and improve survival [16].

Although the time from hospital admission to surgery is a well-established quality-of-care indicator and has been widely investigated [13], the interval between the injury event and hospital arrival, known as the "time from injury to admission," has received less attention. Patient delay may contribute to dehydration, electrolyte imbalances, and pressure injuries, all of which adversely affect postoperative outcomes. Rungchamrussopa et al. reported that approximately one-third of patients with hip fractures presenting to Lerdsin Hospital arrived >24 h post-incident, primarily because of lack of awareness and transportation barriers [10].

Kamphaeng Phet Province, located in the lower northern region of Thailand, has an increasingly aging population [9]. However, local epidemiological data on fragility hip fractures, including detailed timelines of patient presentation and care processes, remain limited. Therefore, this study aimed to investigate the epidemiology and incidence of fragility hip fractures using provincial population data [7] and analyze key time intervals, including the time from injury to hospital arrival and time to surgery among patients in Kamphaeng Phet. The findings will contribute essential baseline information for healthcare providers and policymakers in optimizing resource allocation, improving patient care pathways, and developing prevention strategies to reduce recurrent fractures at the provincial level.

## METHODS

This retrospective cohort study was approved by the Human Research Ethics Committee of the institution (Project ID: 02-01-184D). The study included patients with fragility hip fractures who received treatment at all hospitals within Kamphaeng Phet Province between January 2020 and December 2023. Data were retrieved from the electronic medical record system (HosXP) of the Kamphaeng Phet Provincial Public Health Office.

The inclusion criteria were (1) patients aged ≥50 years, (2) diagnosed with hip fracture corresponding to ICD-10 codes S72.0 (fracture of neck of femur), S72.1 (pertrochanteric fracture), or S72.2 (subtrochanteric fracture), and (3) injury resulting from low-energy trauma, such as a fall from standing height or less. Exclusion criteria included (1) aged <50 years, (2) pathological fractures or periprosthetic fractures, (3) fractures due to high-energy trauma, such as severe traffic accidents, and (4) non-Thai nationality.

Collected data included demographic information (age, sex, and health insurance scheme), clinical characteristics (fracture type and operative management), and time-related variables across patient care. Three key time intervals were calculated; (1) time from injury to hospital, analyzed among patients with complete data, (2) time from arrival to admission, defined as the interval between hospital arrival and ward admission, with subgroup analysis based on arrival shifts (office hours [08:00–16:00] vs. off-hours [16:00–08:00]), and (3) time from admission to surgery. To evaluate treatment efficacy, clinical outcomes were identified as dependent variables, including in-hospital mortality, discharge status, and length of stay (LOS).

Data analysis was performed using standard statistical software. Descriptive statistics, including frequency, percentage, mean, and standard deviation (mean ± SD), were used to present demographic and clinical characteristics. The incidence of hip fractures was calculated per 100,000 population annually using the provincial population aged ≥50 years obtained from the Kamphaeng Phet Provincial Statistical Office as the denominator.

For inferential analysis, differences in continuous variables between groups were analyz-

ed using the independent t-test or Mann–Whitney U test, as appropriate. The association between independent variables (time to surgery, fracture type, and shift of arrival) and categorical clinical outcomes (in-hospital mortality) was evaluated using the Chi-square or Fisher's exact test. Multivariate logistic regression was performed to identify independent predictors of adverse clinical outcomes, calculating adjusted odds ratios (aOR) with 95% confidence intervals (CI). Furthermore, a survival analysis was conducted. The Kaplan–Meier method was used to estimate survival probabilities, and the log-rank test was used to compare survival curves between groups (early vs. delayed surgery). Cox proportional hazards regression model was employed to determine the hazard ratios (HR) of factors affecting survival. Statistical significance was set at $p < 0.05$.

## RESULTS

This study included 901 patients with fragility hip fractures (mean age; 77.3 ± 13.5 years, 66.0% women),. Most patients were covered under the Universal Coverage (UC) health insurance scheme (78.4%).

The most common fracture type was intertrochanteric (55.8%), followed by neck of femur (39.1%) and subtrochanteric (5.1%). Most patients underwent surgical treatment (89.5%), and the in-hospital mortality rate was 2.1% (Table 1).

**Table 1** General characteristics and clinical profiles of patients with fragility hip fractures (n = 901).

| Characteristics | Mean ± SD |
|---|---|
| Age (years) | 77.3 ± 13.5 |
| SEX | |
| Women | 595 (66.0) |
| Men | 306 (34.0) |
| Type of Hip Fracture | |
| Neck of femur | 352 (39.1) |
| Intertrochanteric | 503 (55.8) |
| Subtrochanteric | 46 (5.1) |
| Treatment | |
| Surgery | 806 (89.5) |
| No Surgery | 95 (10.5) |
| Discharge status | |
| Improved | 855 (94.9) |
| Refer out | 27 (3.0) |
| Dead | 19 (2.1) |

The average incidence of fragility hip fractures in Kamphaeng Phet Province over four years is 89.2 per 100,000 population annually. If stratified by sex and age, the incidence is consistently higher in women across all age groups. A marked increase in incidence is observed with advancing age, with individuals aged ≥80 years exhibiting an incidence at 653.2 per 100,000 population (Table 2).

Data analysis showed that the mean time from injury to hospital arrival among patients with available records was 101.4 ± 214.2 h (approximately 4.2 days).

Upon hospital arrival, the admission process, from entering the emergency department to being admitted to the inpatient ward, had a mean duration (Time from arrival to admission) of only 3.8 ± 2.5 h. However, if analyzed by arrival shift, a statistically significant difference was observed ($p < 0.05$). Patients arriving during office hours (08:00–16:00) experienced a shorter waiting time, averaging 3.2 ± 1.8 h, compared with those arriving

outside office hours (16:00–08:00), who had an average waiting time of 4.5 ± 2.9 h.

For patients who underwent surgical treatment, the mean time from admission to surgery was 58.4 ± 32.6 h (approximately 2.4 days). The total time from arrival to surgery averaged 62.2 ± 33.1 h (Table 3).

**Table 2** Incidence of fragility hip fractures by year, sex, and age group (per 100,000 population).

| Category | 2020 | 2021 | 2022 | 2023 | 4-year average |
|---|---|---|---|---|---|
| Overall | 85.3 | 66.9 | 74.5 | 129.9 | 89.2 |
| SEX | | | | | |
| Women | 107.5 | 88.7 | 95.5 | 175.4 | 116.8 |
| Men | 61.1 | 43.2 | 51.8 | 81.0 | 59.3 |
| Age group (years) | | | | | |
| 50 – 59 | 18.2 | 15.4 | 13.6 | 22.6 | 17.5 |
| 60 – 69 | 80.8 | 56.7 | 66.4 | 122.0 | 81.5 |
| 70 – 79 | 252.6 | 210.0 | 208.3 | 331.9 | 250.7 |
| ≥ 80 | 543.5 | 432.7 | 518.2 | 1118.2 | 653.2 |

Analysis of time to care intervals

**Table 3** Time intervals and clinical outcomes (n = 901).

| Variables | N | Mean ± SD) or N (%) |
|---|---|---|
| Time from injury to hospital (h) | 901 | 101.4 ± 214.2 (approx. 4.2 days) |
| Time from arrival to admission (h) | 901 | 3.8 ± 2.5 |
| By arrival shift | | |
| Morning shift (08:00–16:00) | 485 | 3.2 ± 1.8[a] |
| Evening/night shift (16:00–08:00) | 416 | 4.5 ± 2.9 |
| Time from admission to surgery (h) | 806 | 58.4 ± 32.6 |
| Total time from arrival to surgery (h) | 806 | 62.2 ± 33.1 |
| Length of stay (days) | 901 | 9.5 ± 6.2 |
| Treatment costs (Baht) | 901 | 56,420 ± 28,500 |
| In-hospital mortality | 19 | 19 (2.1%) |

**Note:** a $p < 0.05$ if compared with the evening/night shift.
Time to surgery was calculated only among patients who underwent surgical treatment

Multivariate logistic regression analysis was performed. In the bivariate analysis, age group, shift of arrival, and time to surgery were evaluated against in-hospital mortality. After adjusting for potential confounders in the multivariate model, delayed surgery was identified as a significant independent predictor of in-hospital mortality (aOR = 2.45, 95% CI; 1.20 – 4.98, p = 0.012). Conversely, arrival during office hours showed a potential protective trend but did not reach statistical significance in the final model (p = 0.450) (Table 4).

Furthermore, Kaplan–Meier survival analysis demonstrated that patients who underwent surgery within 48 h had a higher survival probability compared to those with delayed surgery (log-rank test, p = 0.008). The Cox proportional hazards model confirmed that age ≥70 years (HR = 3.10, 95% CI; 1.45–6.65, p = 0.004) and delayed surgery (HR = 2.25, 95% CI; 1.15–4.40, p = 0.018) were significantly associated with an increased hazard of mortality.

**Table 4** Multivariate logistic regression analysis of factors associated with in-hospital mortality.

| Variables | Crude OR (95% CI) | p-value | Adjusted OR (95% CI)* | p-value |
|---|---|---|---|---|
| Age group | | | | |
| <70 years | Reference | Reference | Reference | Reference |
| ≥70 years | 2.80 (1.10–7.10) | 0.030 | 2.65 (1.05–6.80) | 0.038 |
| Arrival shift | | | | |
| Morning shift | Reference | Reference | Reference | Reference |
| Evening/night shift | 1.40 (0.80–2.45) | 0.230 | 1.25 (0.70–2.20) | 0.450 |
| Time to surgery | | | | |
| ≤48 h | Reference | Reference | Reference | Reference |
| >48 h | 3.10 (1.30–7.40) | 0.010 | 2.45 (1.20–4.98) | 0.012 |
| Fracture type | | | | |
| Neck of femur | Reference | Reference | Reference | Reference |
| Intertrochanteric | 1.20 (0.60–2.40) | 0.600 | 1.15 (0.55–2.35) | 0.700 |

## DISCUSSION

Knowingly, this is the first comprehensive epidemiological report and care process analysis of fragility hip fractures in Kamphaeng Phet Province. The findings demonstrate that the average incidence was 89.2 per 100,000 population annually, which is substantially lower than the national average (146.9 per 100,000) [6] and markedly lower than the incidence reported in Nan Province (238.5 per 100,000) [11]. Based on the severity classification proposed by Kanis et al., which categorizes hip fracture incidence as high (>250/100,000), moderate (150–250/100,000), or low (<150/100,000) (18), Kamphaeng Phet falls within the "low-severity" category. These differences may reflect variations in population structure or geographical factors between the upper and lower northern regions. Additionally, the reliance on government hospital records may contribute to a slight underestimation if some patients sought treatment in private hospitals or outside the province. However, the observed pattern of higher incidence in women and an increase with advancing age aligns with global trends and other studies conducted in Thailand [4, 6, 12].

Regarding treatment timelines, the study identified a noteworthy "bottleneck" contributing to delays. The mean time from injury to hospital arrival was 101.4 h (approximately 4.2 days), which is considerably longer than the approximately two-day delay reported by Rungchamrussopa et al. in Bangkok [10]. This discrepancy may be attributable to the rural and agricultural context of Kamphaeng Phet, in which patients or family members may underestimate the severity of the injury or face greater transportation barriers compared with those in urban settings. These findings highlight that most delays occur in the pre-hospital phase.

Conversely, upon hospital arrival, the admission process appeared highly efficient. The mean time from arrival at the emergency department to admission to an inpatient ward was only 3.8 h, with most patients admitted within 24 h. However, shift-based analysis revealed a statistically significant difference; patients arriving during office hours were admitted more rapidly (3.2 h) than those arriving off-office hours (4.5 h). This discrepancy may reflect differences in staffing levels, support systems, and bed management capacity between shifts.

The mean time to surgery was 58.4 h (approximately 2.4 days), slightly exceeding the internationally recommended window of 24–48 h [16]. However, this time frame is consistent with reports from tertiary hospitals in Thailand, in which optimization of medical comorbidities in older patients often requires additional time [13]. The in-hospital mortality rate of 2.1% is considered low compared with previous studies [1, 13]. Notably, this study did not assess postoperative functional outcomes, which are essential indicators of long-term quality of life (2).

Findings from Waiwattana et al. in northern Thailand [15], along with general risk factor data [17], underscore the importance of preventive strategies. Evidence supports the effectiveness of multidisciplinary orthogeriatric care models [14] and establishment of Fracture Liaison Services (FLS), both of which reduce refracture rates and mortality [3]. Implementing such models in Kamphaeng Phet, alongside public education campaigns aimed at reducing pre-hospital delays, could significantly enhance the quality of patient care.

A key finding of this study is the significant association between delayed surgery and increased in-hospital mortality. Patients who underwent surgical fixation after 48 h from admission had a 2.45-fold increased risk of death (aOR = 2.45, 95% CI; 1.20–4.98, p = 0.012). This finding aligns with international guidelines and multiple studies that emphasize that early surgery is critical for reducing postoperative complications and improving survival rates in patients with geriatric hip fracture [13, 16].

## CONCLUSIONS

Furthermore, the survival analysis provided robust evidence that advanced age (≥70 years) and surgical delay are independent predictors of reduced survival probability. The hazard of mortality for patients with delayed surgery was more than double compared to those treated within the 48-h window (HR = 2.25, p = 0.018). These results underscore the clinical necessity of streamlining the preoperative clearance process and optimizing hospital resource management to ensure timely intervention, especially for the oldest-old population who are at the highest risk.

## ACKNOWLEDGMENT

The researcher would like to express sincere gratitude to the hospital administrators and Human Research Ethics Committee of Kamphaeng Phet Hospital for their support and approval of this study. Appreciation is extended to the medical records staff and orthopedic surgery team for their valuable assistance in collecting and managing the data used in this research.

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