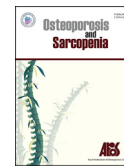


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Original Article

# Evaluation of Police General Hospital's Fracture Liaison Service (PGH's FLS): The first study of a Fracture Liaison Service in Thailand

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## Abstract

**Objectives:** The purpose of the study was to assess the effectiveness of the Fracture Liaison service (FLS) in preventing secondary fracture and decreasing 1-year mortality rate after osteoporotic hip fracture, in patients at Police General Hospital, Bangkok, Thailand.

**Methods:** A prospective cohort study was conducted. We studied male and female patients, 50 years of age and older, who presented with a fragility fracture around the hip due to low energy trauma and were admitted to Police General Hospital, participating in PGH's Liaison service from April 1, 2014–March 30, 2015. The sample size was 75 patients, with a follow up time of 1 year. The data from this study was compared with that of a previous study done by Tanawat A. et al. [9] prior to commencement of the FLS project.

**Results:** After a follow up period of 1 year, the mortality rate was measured to be 10.7% and there was no evidence of secondary fragility fracture. Post-injury bone mineral density follow up and osteoporotic medication treatment rates were 48% and 80%, respectively. Patients who participated in the project were found to have a decreasing rate of secondary fracture from 30% to 0% ( $P < 0.0001$ ), an increasing post-injury BMD follow up rate from 28.3% to 48% ( $P = 0.0053$ ), and an increase in post-injury osteoporotic medication administration rate from 40.8% to 80% ( $P = 0.0148$ ), all with statistical significance. However, the 1-year mortality rate was not significant ( $P = 0.731$ ) when compared to the previous study.

**Conclusions:** Patients with recent hip fractures participating in the Fracture Liaison service had a significantly higher post-injury BMD follow up and osteoporotic medication administration rates. This resulted in a lower risk of secondary fracture than those who did not participate in the Fracture Liaison service at a follow up time of one year.

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**Keywords:** Fracture; Osteoporosis; Thailand

## 1. Introduction

Osteoporosis is defined as a generalized disorder of the skeleton characterized by low bone mass and alterations of bone tissue microarchitecture, leading to an increased risk of bone fragility fracture, especially in postmenopausal women. Recently, the prevalence of elderly patients with osteoporosis is increasing in Thailand and worldwide, resulting in an increase in fragility fracture.

This has become a large public health care issue as the fracture events have increased morbidity and mortality as well as altered the patients' quality of life, particularly in the first year after injury. Furthermore, patients with an incident fracture have an increased risk of refracture [1]. Data from a study in Korea (Y.K. Lee et al.) found that first year mortality rate in osteoporotic hip fracture is 15.4% and 11.1% in men and women, respectively. They also found that for osteoporotic vertebral fracture in men and women the rates were 14.6% and 7.16%, respectively [2,3]. Another study conducted in Chiang Mai, Thailand (P. Wongtriratanachai et al.) found that first year mortality in hip fracture is approximately 18–20% [4]. A study conducted in Finland (E. Lonnroos et al.) displayed data

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indicating that secondary fragility fracture in the first and second year are 5.08% and 8.11%, respectively [5]. Currently assessment rates for secondary prevention of osteoporosis are low [6–8], with a substantial gap existing between known evidence-based therapy and clinical practice.

Although our hospital (Police General Hospital) has previously had a specific set of guidelines for osteoporotic treatment according to the Thai Osteoporosis Foundation (TOPF) since 2011, the osteoporotic hip fracture patients still received inadequate treatment and had a high incidence of mortality and secondary fracture at 1 year after fracture. From data of a previous study conducted by Tanawat A. et al., it was found that the mortality rate, secondary fracture occurrence and follow up of bone mineral density at 1 year after initial fracture were 9.2%, 30%, and 28.33% respectively. It was also shown that osteoporotic treatment 1 year after initial fracture with calcium and vitamin D, non-bisphosphonate drugs and bisphosphonate drugs were 20.83%, 15%, and 5% respectively. Follow-up of the patients one year after fracture was found to be less than 2% [9].

Previously, the International Osteoporotic Foundation (IOF) has established a Fracture Liaison service named ‘Capture the fracture’ in 2012 intended to prevent secondary fracture by facilitating the implementation of Fracture Liaison Services (FLS) by increasing communication and cooperation which results in a close working relationship between personnel and organizations in order to provide appropriate osteoporotic treatment, fall risk assessment, and post-treatment exercise and education programs. Many studies have shown that after implementing the Fracture Liaison service, there was a significantly decreasing mortality rate and re-fracture rate [10], as well as an increasing rate of osteoporotic treatment following standard guidelines [11,12]. Up until now, previously no other hospitals in Thailand other than Police General Hospital have implemented a Fracture Liaison service for specific patient group care and assessment of its effectiveness.

The purpose of the study was to assess the effectiveness of the Fracture Liaison service in decreasing 1st year secondary fracture rate and mortality rate, and increasing osteoporotic hip fracture treatment in Police General Hospital (PGH).

## 2. Methods

A prospective single-center cohort study was conducted. We studied male and female patients, 50 years of age and older, who presented with fragility fracture around the hip due to low energy trauma (defined as a fall from a standing height or lesser impact) that had been admitted to Police General Hospital and participated in PGH's Liaison service from April 1, 2014–March 30, 2015. The sample size was 75 patients, with a follow up time of 1 year. Exclusion criteria were patients who had a fracture due to high energy trauma, secondary osteoporosis (e.g. chronic kidney disease-mineral and bone disorders; CKD-MBD) and bone tumors (Fig. 1).

Demographic data were collected using a standardized questionnaire for each patient at baseline: sex, age, underlying

disease, type of fracture, previous fragility fracture history, current osteoporotic medication, type of fracture treatment, and history of BMD evaluation.

The primary outcomes were the evaluation of secondary fragility fracture and mortality rate after one year of participation in this project. Secondary outcomes measured included bone mineral density (BMD) follow up and administration of osteoporotic medication after fragility fracture. This article was approved by Ethic review committee for Human research, Police General Hospital, Bangkok, Thailand (COA No.15/2015).

Statistical analysis with a p-value of <0.05 for statistical significance was performed. Continuous data were presented as maximum, minimum, mean and standard deviation. Categorical data were presented as a proportion. 95% CI was used to select factors.

## 3. Result

We had 100 osteoporotic hip fracture patients participating in Police General Hospital's Fracture Liaison Service (PGH's Liaison). We classified 89 as fragility fracture patients (primary osteoporotic fracture) and 11 as secondary osteoporotic patients (10 CKD-MBD, and one bone tumor case). After one year, we had a remaining number of 75 patients for inclusion in this study due to loss of follow up. All included patients were able to follow the project's protocol (Fig. 2).

## 4. Demographic data

The demographics of the patients who met the eligibility criteria are summarized in Table 1. There were 63 females (84%) and 12 males (16%). The average age was 79.7 years old (females 80.6 years old; males 74.3 years old) and the maximum and minimum ages were 97 and 51, respectively. Thirty-four patients (45.3%) were older than 80 years. The most common chronic underlying illnesses were hypertension in 56 patients (74.7%), diabetes mellitus in 27 patients (36%), and dyslipidemia in 21 patients (28%). Thirty-five patients (46.7%) had femoral neck fractures, 38 patients (50.7%) had intertrochanteric fractures and 2 patients (2.6%) had greater trochanteric fractures. Twelve (16%) patients had previous fragility fractures. Sixty-four patients (85.3%) underwent operative treatment, whereas the remaining 11 patients (14.7%) were treated non-operatively. The common reason for non-operative management was severe associated medical conditions. Operative treatment was divided in two types; fixation or arthroplasty and patient selection for each type was done according to fracture type. For treatment by fixation, 25 cases (33.3%) were treated by proximal femoral nail antirotation (PFNA) fixation, 7 cases (9.3%) were treated by dynamic hip screw fixation, and 3 cases (4%) were treated by multiple screw fixation. For treatment by arthroplasty, 27 cases (36%) were treated by hemiarthroplasty and 2 cases (2.7%) were treated by total hip arthroplasty. Seventeen patients (22.7%) received calcium supplementation alone, 14 patients (18.7%) received calcium and vitamin D supplementation, 4 patients (5.3%) received

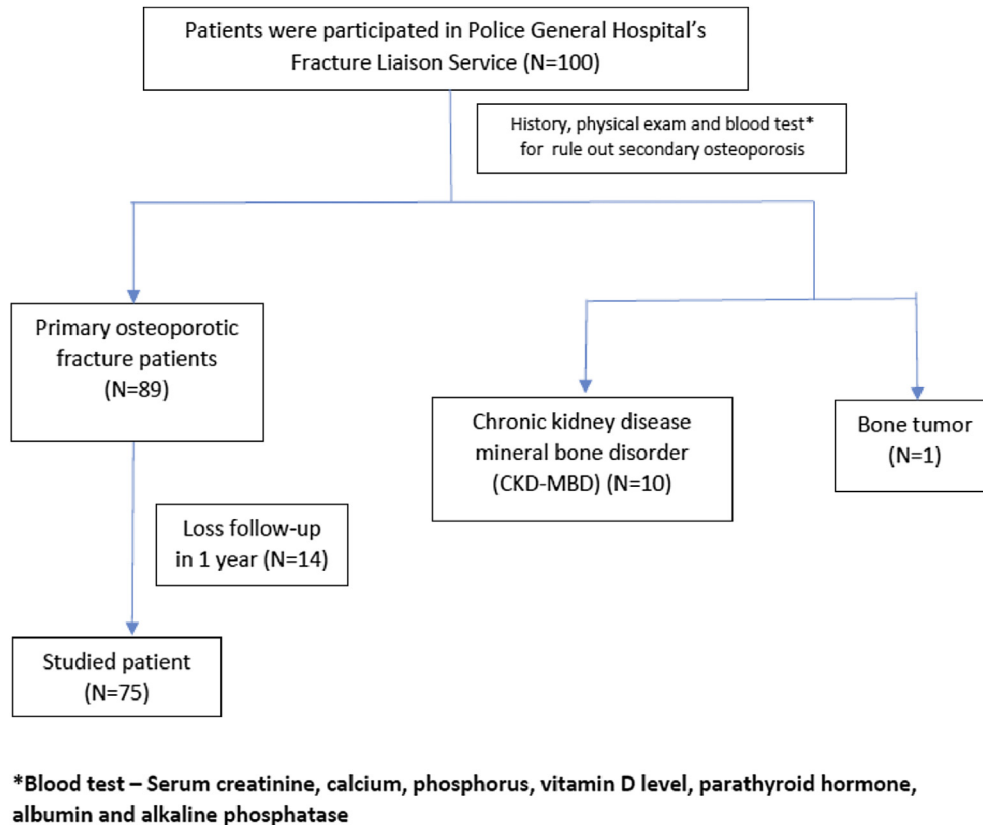


Fig. 1. Study population flow diagram.

antiresorptive agents and 2 patients (2.7%) received anabolic agents prior to initial fracture (Fig. 3). Only 7 patients (9.3%) had undergone pre-injury bone mineral density (BMD) evaluation. We compared all demographic data with the previous study done prior to the FLS project by Tanawat. A et al. [9], and found no statistically significant differences ( $P > 0.05$ ).

At 1 year after the implementation of the Fracture Liaison Service, 8 patients were deceased (10.7%), with 2 from the non-operative group and 6 from the operative group. No evidence of secondary fragility fracture after 1st year follow-up was seen. Sixty patients (80%) were being treated with osteoporotic medication after a follow-up period of approximately 1 year. We classified treatment as calcium or vitamin D (either inactive or active form) alone, calcium and vitamin D together, antiresorptive drugs (bisphosphonate, Rank-ligand inhibitor etc.), anabolic agents (parathyroid hormone analogue), and other drugs (calcitonin nasal spray, strontium ranelate). The number of patients who adhered to each treatment at a follow up period of 12 months is displayed in Table 2 and is shown to be 8 (10.7%), 43 (57.3%), 17(22.7%), 5(6.7%) and 4 (5.3%) respectively. No cases of osteonecrosis of the jaw or atypical femoral fracture were reported.

At follow up examination of patients in this project, it was seen that bone mineral density follow up was done in 36 patients (48%) compared to previously being done in only 34 patients (28.3%). After the project it was seen that there was a 100% rate of evaluation of patients for fracture risk.

We compared the current data with a previous study (Tanawat A. et al., 2015) that collected data regarding fragility hip fractures of patients occurring before the implementation of the FLS in Police General Hospital, as seen in Tables 1 and 2. It can be seen that the demographic data between 2 groups has no statistically significant difference. We found statistically significant decreasing secondary fracture rates from 30% to 0% ( $P < 0.0001$ ) and increasing post-injury BMD follow up from 28.3% to 48% ( $P = 0.0053$ ) and increased post-injury osteoporotic medication administration from 40.8% to 80% ( $P = 0.0148$ ) after participation in this project. However, the 1st year mortality rate change was not significant ( $P = 0.731$ ).

## 5. Discussion

According to a recent study done prior to the FLS project by Jennings LA et al., out of 51,346 patients who were hospitalized for osteoporotic hip fracture, only 7% received an antiresorptive or bone forming medication [13]. From the data of Tanawat A. et al. studying the population of patients in Police General Hospital, it was found that 1st year mortality rate, secondary fracture occurrence and follow up of bone mineral density were 9.2%, 30% and 28.3% respectively. It was also seen that osteoporotic treatment 1 year after fracture with calcium and Vitamin D, non-bisphosphonate drugs and bisphosphonate drugs were 20.8%, 15%, and 5% respectively. Follow-up after fracture at 1 year was found to be less than 2% [9]. Underdiagnosis

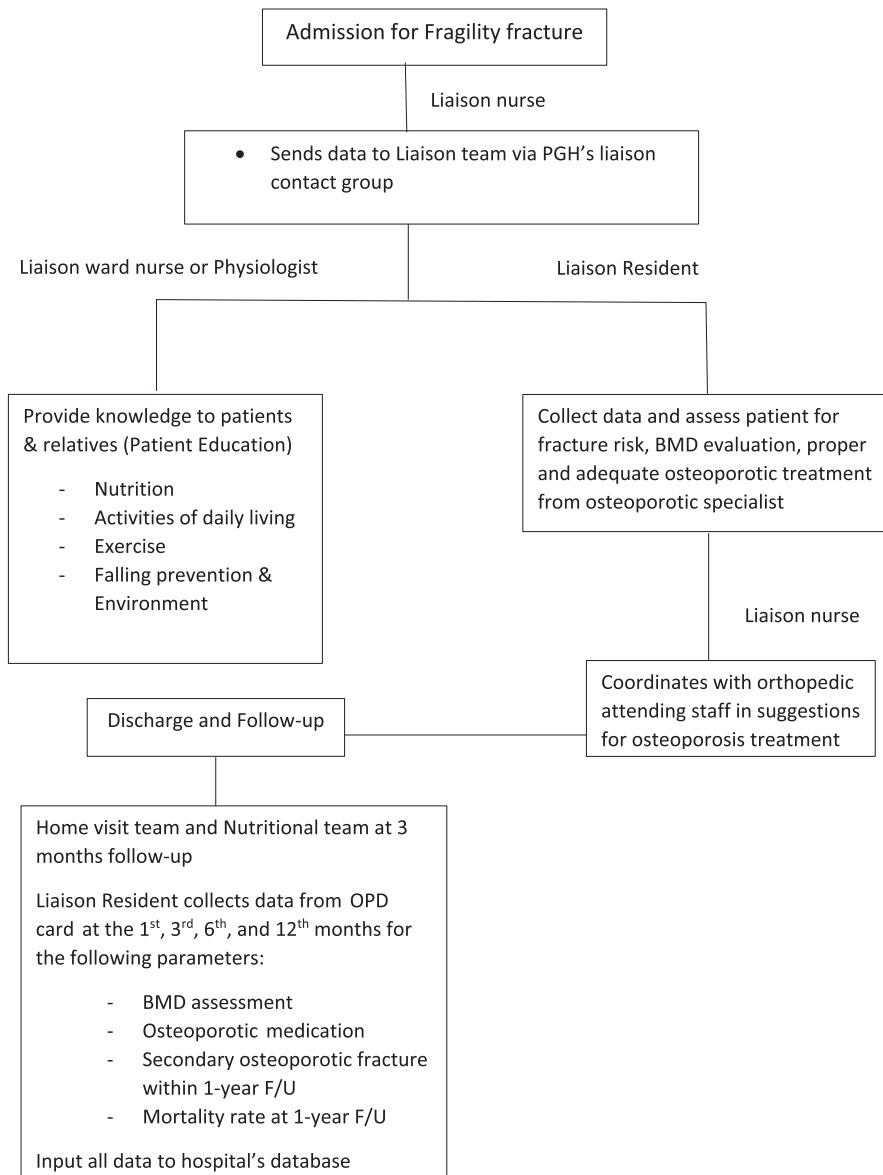


Fig. 2. Flow chart of Police General Hospital Fracture Liaison service.

as well as undertreatment of osteoporotic fracture is still a problem and is prevalent worldwide.

A study after the FLS project that was done by Kristen M.B Huntjens et al. showed that in nonvertebral osteoporotic fracture patients who participated in Fracture Liaison Service had a decreased mortality rate of approximately 35% (95% CI 0.53–0.79) and a secondary fracture rate of 56% (95% CI 0.25–0.79) [10]. This is consistent with another study performed by N. Dehamchia-Rehailia et al. that displayed a bone mineral density follow up rate of 100%, administration of osteoporotic medication rate of 70%, and fracture risk assessment of more than 90% [12].

A FLS is likely to result in an environment of improved co-ordination of multi-disciplinary care with better communication between healthcare professionals. The comprehensive assessment and inspection of routine laboratory examinations and medical history that an osteoporosis nurse specialist

carries out may also contribute to the identification of secondary diseases and comorbidities. It has been shown to improve fracture care.

After 1 year of implementing our FLS project, we found the post-injury bone mineral density follow up of patients increasing from 28.3% to 48%, administration of osteoporotic treatment increasing to 80% with no evidence of secondary fracture, and all were statistically significant. We managed to evaluate all patients participating in this study for fracture risk. From the data, it can be seen that this project provides evidence of the potential success of a secondary fracture prevention program, including improved assessment and treatment rates.

Although 1-year mortality rate was 10.7%, this was not statistically significant, however it was lower than the rate seen in a study performed by Center JR et al., which displayed a 20% mortality rate 1 year after osteoporotic hip fracture [14].

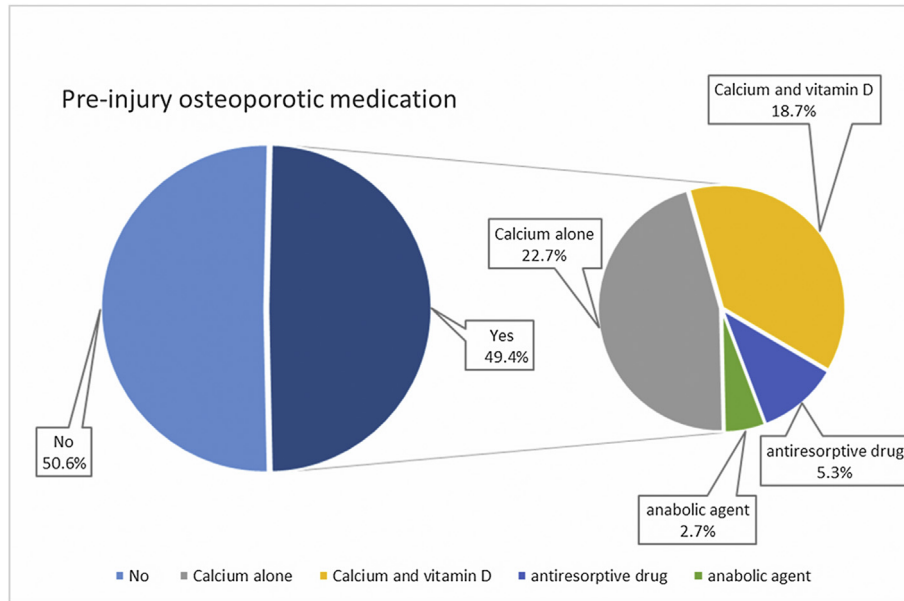


Fig. 3. Pre-injury osteoporotic medication.

Table 1  
Demographic data.

Characteristics	Before project [9] (N = 120)	After project (N = 75)	P-value*
Sex			0.083
Male	32 (26.7%)	12 (16%)	
Female	88 (73.3%)	63 (84%)	
Age (year)			0.784
≤ 80	68 (57%)	41 (54.7%)	
> 80	52 (43%)	34 (45.3%)	
Underlying disease			0.115
Hypertension	84 (70%)	56 (74.7%)	
Diabetes mellitus	21 (17.5%)	27 (36%)	
Dyslipidemia	33 (27.5%)	21 (28%)	
Type of fracture			0.201
Neck of femur	55 (45.8%)	35 (46.7%)	
Intertrochanteric	63 (52.5%)	38 (50.7%)	
Greater trochanter	0 (0%)	2 (2.7%)	
Type of treatment			0.603
Conservative	21 (17.5%)	11 (14.7%)	
Operative	99 (82.5%)	64 (85.3%)	
Fixation			
Sliding hip screw	10 (8.3%)	7 (9.3%)	
Nail	41 (34.2%)	25 (33.3%)	
Multiple screw	3 (2.5%)	3 (4%)	
Arthroplasty			
Hemiarthroplasty	39 (32.5%)	27 (36%)	
Total hip arthroplasty	4 (3.3%)	2 (2.7%)	
Pre-injury BMD checking	8 (6.7%)	7 (9.3%)	0.4966

\*P < 0.05 is significant.

It is also lower than the results found in another study conducted by P. Wongtriratanachai et al. done in Chiang Mai, Thailand, which displayed a 1st year mortality rate in hip fracture of approximately 18–20% [5]. Because our study included an elderly age group (average age was 79.7 years) the patients had many underlying diseases and the cause of death in most of the patients were not related to the fractures at all. A

Table 2  
Results before FLS project and after in a follow-up time period of 1 year.

Characteristics	Before project [9] (N = 120)	After project (N = 75)	P-value*
Death	11 (9.2%)	8 (10.7%) [M 4/12, (33.3%)/F 4/63, (6.3%)]	0.731
Secondary fracture	36 (30%)	0 (0%)	<0.0001
Post-injury osteoporotic medication			0.0148
No	71 (59.2%)	15 (20%)	
Yes	49 (40.8%)	60 (80%)	
Calcium alone		8 (10.7%)	
Calcium and vitamin D	25 (20.8%)	43 (57.3%)	
Antiresorptive	18 (15%)	17 (22.7%)	
Anabolic	6 (5%)	5 (6.7%)	
Other		4 (5.3%)	
Post-injury BMD checking	34 (28.3%)	36 (48%)	0.0053
Fracture risk assessment	No data	75 (100%)	NA

\*P < 0.05 is significant, NA – Not assessment.

total of 8 patients were deceased at follow up, with a 33.3% mortality rate for the male patients (4 out of 12 male patients included in the study) and a 6.3% mortality rate for the female patients (4 out of 63 female patients included in the study). This clearly displays that male patients have a statistically significantly higher mortality rate after osteoporotic hip fracture when compared to female patients. These results are similar to those seen in a report by Pia Nimann Kannedaard et al. [15], which displayed a substantially higher mortality rate in male patients presenting with osteoporotic hip fracture when compared to female patients, despite the fact that the male patients were an average of 4 years younger than the female patients at the time of initial fracture.

Even though the rate of drug administration had improved from 40.8% to 80%, most of the patients (68%) were receiving

only calcium and/or vitamin D supplements due to the high cost of other osteoporotic medications (antiresorptive and anabolic drugs). This issue may be prevented if the cost of osteoporotic medication is lowered so that all types of treatment are accessible to patients of lower socio-economic status. Twenty percent of patients discontinued osteoporosis treatment within the first year. The main course of treatment discontinuation was non-renewal of the prescription by the patient's attending physician.

Poor compliance with medication for chronic diseases is a common concern in many elderly patients. Patients with an inadequate understanding of their disease are more likely to be noncompliant with their treatment. This project can help them recognize the severity of their disease and improved outcomes of long-term adherence to treatment.

Some strengths seen in this study include the following. This study is the first of its kind in Thailand, with the FLS project being implemented for the first time in Thailand here at Police General Hospital. This study also had a 100% rate of evaluation of fracture risk and ruling out secondary osteoporosis in all patients participating in the project. In terms of fall prevention, this project provided a liaison nurse to evaluate fall risk, a physiologist to direct proper muscle balance training and muscle strengthening, and a home visit team that was able to give proper advice to the patients and their caregivers, as well as evaluate risk of falling individualized for each elderly patients that participated in the project. We believe that in addition to treating osteoporosis medically, prevention of falling is very important in decreasing the incidence of a secondary fracture.

The study displayed some limitations. The population size of patients that were observed to compare between the two groups in the same situation was small, but this limitation can be revised by continuous data collection in further studies. The population in the study was comprised of Thai nationals only. Due to this, the findings might not be generalizable to other racial or ethnic groups. The authors compared the current data with a previous study (historical comparison) that collected data regarding fragility hip fractures of patients occurring before the implementation of the FLS in Police General Hospital.

## 6. Conclusion

Patients with recent hip fractures participating in the Fracture Liaison service had a significantly higher post-injury BMD follow up and osteoporotic medication administration rates. This resulted in a lower risk of secondary fracture than those who did not participate in the Fracture Liaison service at a follow up time of one year.

## Conflict of interest

All the authors had no conflict of interest in this study.

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