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ORIGINAL RESEARCH

# Effects of Pre-Hospital Dexamethasone Administration on Outcomes of Patients with COPD and Asthma Exacerbation; a Cross-Sectional Study

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**Abstract:** **Introduction:** Chronic obstructive pulmonary disease (COPD) and asthma exacerbation are two common emergency situations. This study aimed to investigate the impact of pre-hospital dexamethasone initiation on treatment outcomes of these patients. **Methods:** In this retrospective cross-sectional and comparative study, data from the emergency medical service (EMS) care report of patients with a final diagnosis of asthma or COPD, coded with Thailand's emergency medical triage protocol, collected between January 1, 2021, and October 31, 2022, were used. Data on baseline characteristics, emergency department length of stay (ED-LOS), and hospital admission rates were collected from electronic medical records and compared between cases with and without pre-hospital dexamethasone administration by EMS. **Results:** 200 patients with COPD (n = 93) and asthma (n = 107) exacerbation were enrolled. The dexamethasone-treated group had a lower but statistically non-significant hospital admission rate (71.0% versus 81.0%, absolute difference: 10%, 95% confidence interval (CI): 21.76, 1.76; p = 0.100). In patients with asthma, the dexamethasone-treated had lower median ED-LOS time (235 (IQR: 165.5–349.5) versus 322 (IQR: 238–404) minutes; p = 0.003). Dexamethasone-treated asthma patients had lower but statistically non-significant hospital admission rates (60.4% versus 78.0%, absolute difference: 17.55%, 95% CI: 34.96, 0.14; p = 0.510). In COPD patients the dexamethasone-treated and untreated groups had non-significantly lower hospital admission rates (80.8% versus 85.40%, absolute difference: 4.60%, 95% CI: 19.82, 10.63; p = 0.561) and non-significantly lower ED-LOS (232 (IQR: 150 – 346) versus 296 (IQR: 212 – 330) minutes, absolute difference: 59 (130.81, 12.81); p = 0.106). **Conclusion:** The dexamethasone administration by EMS in pre-hospital setting for management of asthma and COPD patients is beneficial in reducing the ED-LOS and need for hospital admission but its effects are not statistically significant, except regarding the ED-LOS of asthma exacerbation cases.

**Keywords:** Asthma; Pulmonary disease, chronic obstructive; Dexamethasone; Emergency medical services; Length of stay

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## 1. Introduction

Chronic respiratory diseases are defined by the World Health Organization as diseases that affect the respiratory tract and other pulmonary structures and have acute exacerbations. Aside from smoking, other risk factors include air pollution, occupational chemicals and dust, and incurable infections (1). The most common types of chronic respiratory diseases seen in the emergency department (ED) include asthma and chronic obstructive pulmonary disease (COPD). In the United States of America alone, approximately 4 million patients visit the ED each year due to asthma and COPD, which reduce health-related quality of life and significantly increase mortality risk (2). According to an Australian study, asthma and COPD were found to be associated with an increased mortality rate, and one million patients died from asthma or COPD exacerbations while being frequently served by emergency medical services (EMSs) (3), which were able to initiate diagnosis and treatment at the scene (4). In patients with acute COPD exacerbations who called on EMS, prompt treat-

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ment by the advanced life support (ALS) team influenced the ED length of stay (ED-LOS) and the hospital admission rate (5).

According to standard treatment guidelines, the treatment of patients with asthma and COPD in the context of EMS differed in each area. In hospitals, corticosteroids are used to treat patients with asthma and COPD, and their benefits have been widely accepted (6). Since the main pathophysiologic mechanisms are airway inflammation in asthma (7) and mucus hypersecretion, airflow obstruction and hyperinflation, and an abnormal inflammatory response in the lungs in COPD (8), corticosteroids are the medications of choice for these disorders (9, 10). Early corticosteroid administration would help reduce the need for hospitalization and improve outcomes (5). A systematic review found that initiating corticosteroids within one hour of arrival at the ED was associated with a lower need for hospitalization (11). Corticosteroids are natural hormones secreted from the adrenal cortex that have anti-inflammatory, metabolic, and immunological effects (3). In Thai EMS, dexamethasone was used as an alternative to treat patients with acute asthma and COPD exacerbations (12). The present study aimed to evaluate the outcomes of initiating dexamethasone injection in pre-hospital setting on ED-LOS and hospital admission rates in patients with asthma and COPD.

## 2. Methods

### *2.1. Study design and settings*

The retrospective cross-sectional comparative study was conducted at the Vajira emergency medical service (V-EMS) unit, Faculty of Medicine Vajira Hospital, Navamindradhiraj University, Bangkok, Thailand. Of nine EMS areas in Bangkok, V-EMS was the leader of EMS unit zone area 1, dispatched from Erawan Center, Bangkok, networking with a total of six public and private hospitals in the entire responsible area, which was 50 square kilometers and included 500,000 people (13, 14). In patient-managing operations, the EMS team of V-EMS in the area included at least three staff members who were paramedics or Emergency Nurse Practitioners (ENPs) as operation team leaders and emergency medical technicians for each operation. In each operation, paramedics, or ENPs followed offline, and online medical protocols as directed by emergency physicians. In the study area, there were standard prehospital patient management guidelines endorsed by the National Institute for Emergency Medicine for patients with asthma and COPD (12). These guidelines allowed paramedics or ENPs to diagnose COPD or asthma exacerbations based on pertinent symptoms, wheezing lung sounds, shortness of breath, poor air entry, and underlying COPD, or asthma. They also allowed for the evaluation of initial management, including airway, breathing, and circulation, and the monitoring of vital signs, oxygen saturation, and end-tidal CO2, as well as the administration of salbutamol or ipratropium bromide (Berodual) via nebulization or a metered dose inhaler (MDI) with a spacer. Furthermore, they allowed immediate intravenous (IV) administration one dose of 8 mg IV dexamethasone at the scene. If patients did not respond to treatments and their symptoms worsened, a prehospital intubation was considered under the online medical protocol. In this study, we compared the outcomes of COPD and asthma cases with and without pre-hospital administration of dexamethasone by EMS between January 1, 2021, and October 31, 2022.

### *2.2. Ethical statement*

This study was conducted in accordance with the tenets of the Helsinki Declaration of 1975 and its revisions in 2000. It was approved by the Institutional Review Board of the Faculty of Medicine, Vajira Hospital, Navamindradhiraj University (COA no. 006/2566). The informed consent requirement was waived because of the retrospective nature of the study and anonymity of all patient data.

### *2.3. Participants*

Data of patients with acute COPD and asthma exacerbations were collected from EMS patient care reports. Adult patients over the age of 18 with a final diagnosis of acute COPD or asthma exacerbations, symptom group 5 red 1 – 5 red 9, treated by V-EMS, and transported to the ED, Faculty of Medicine Vajira Hospital, Navamindradhiraj University, Bangkok, Thailand, were eligible to participate. Patients who refused treatment or transportation to the hospital, were unable to provide medical history by themselves or had no relatives to provide previous medical history, had incomplete or missing data, or were receiving end-of-life, or palliative care were excluded from this study.

### *2.4. Data collection*

The data were collected from the EMS patient care report, which was a standard form used for recording the data of advanced EMS operations in the Bangkok EMS (Erawan Center) and the Bangkok advanced emergency operation unit. This form included data on EMS operation units, patients, vital signs, and all EMS treatments as recorded by dispatchers and paramedics, or ENPs, at the scene. These data were part of the remuneration for EMS operation units. All data were filled in Microsoft Excel, including patients' general characteristics (gender, age, prehospital diagnosis, comorbidities, treatment period, smoking history, bronchodilator use prior to EMS arrival, and history of severe exacerbation), patients' prehospital parameters (systolic blood pressure [SBP], diastolic blood pressure [DBP], heart rate [HR], respiratory rate [RR], temperature, pulse oximetry, wheez-

ing, prehospital intubation, fluid resuscitation, bronchodilator type, bronchodilator dose, and bronchodilator administration method), patients' ED parameters (SBP, DBP, HR, RR, temperature, pulse oximetry, wheezing, intubation, bronchodilator), and patient disposition (ED-LOS time in minutes and hospital admission). All data were reviewed by a principal investigator from the Vajira Hospital's electronic medical records (EMRs).

### 2.5. Outcome measures

The primary outcome was ED-LOS, while the secondary outcome was hospital admission rate.

### 2.6. Definitions

- Thailand's emergency medical triage protocol and criteria-based dispatch code were severity codes derived from data on prehospital situation evaluation and patients' symptoms at the scene. It includes 26 symptom groups. ED-LOS was defined as the time between patient arrival and discharge from the ED, whereas hospital admission rate was defined as rate of hospitalization following ED treatment (15).
- Comorbidities are coexistent diseases in patients with COPD and asthma. The data were collected from history taking from patients or patients' relatives.
- History of severe exacerbation is having a history of emergency department visit by themselves or being transported by emergency medical service with acute asthma and COPD exacerbations before the emergency call.

### 2.7. Statistical analysis

The sample size in the present study was estimated using sample size estimation from G power Version 3.1.9.4, with an alpha confidence level of 0.05 and a power of 90%. The allocation ratio was 1 and the effect size (d) was 0.5 (medium) (16) because there have been no studies referring to the statistical data used to calculate the effect size. Thus, the calculated sample size from the program was at least 86 per group, and after 10% of the sample size was added, the sample size was at least 96. Therefore, in the present study, the sample size of patients with acute COPD and asthma exacerbation was 200 in total, where the EMS had administered dexamethasone for 100 and 100 had not received dexamethasone at the scene.

Continuous variables were presented as means and standard deviations, or medians and interquartile ranges (IQRs), while categorical variables were presented as frequencies and proportions. The two groups were compared using the independent t-test or Mann-Whitney U test for numeric variables and the chi-squared test or Fisher's exact test for categorical variables.

ED-LOS and vital sign changes were compared between dexamethasone-treated and untreated groups using the independent t-test or Mann-Whitney U test, as appropriate, and were analyzed using multivariable logistic regression analysis.

Hospital admission rates were compared between dexamethasone-treated and untreated groups using the chi-squared test or Fisher's exact test, as appropriate, and were analyzed using the multivariable logistic regression analysis and median regression model.

IBM Statistical Package for the Social Sciences software (IBM SPSS Statistics for Windows, Version 26.0; Armonk, NY, USA: IBM Corp.) was used for statistical analysis. All statistical tests were considered statistically significant if the p-value was less than 0.05.

## 3. Results

### 3.1. Patients' baseline characteristics

200 patients with COPD (n = 93) and asthma (n = 107) exacerbation were enrolled. Table 1 compares the baseline characteristics of patients between cases with and without prehospital dexamethasone administration.

**COPD cases**

COPD cases treated with dexamethasone (n = 52) in prehospital setting had lower mean ages (p = 0.016), higher male/female ratio (p = 0.035), higher comorbidity (p = 0.006), higher smoking history (p = 0.001), higher mean SBP (p = 0.002), higher mean DBP (p = 0.003), higher mean heart rate (p = 0.024), higher wheezing frequency (p < 0.001), and received more than one dose of the bronchodilator (p = 0.043).

**Asthma cases**

In patients with asthma exacerbation, the dexamethasone-treated group had higher male to female ratio (p = 0.034), higher rate of received a bronchodilator prior to EMS arrival (p = 0.004), higher mean SBP (p < 0.001), higher mean DBP (p < 0.001), lower mean temperature (p = 0.046), lower median pulse oximetry (p = 0.015), higher wheezing frequency (p < 0.001), higher median bronchodilator dose received (p < 0.001), and lower bronchodilator administration via a nebulizer (p < 0.001).

### 3.2. Patient outcomes

Table 2 compares the ED-LOS and need for hospital admission between cases with and without prehospital dexamethasone administration by EMS. Overall, the dexamethasone-treated group had a lower but statistically non-significant hospital admission rate (71.0% versus 81.0%, absolute difference: 10%, 95% CI: 21.76, 1.76; p = 0.100) and significantly lower ED-LOS (235 versus 313.5 minutes; absolute difference: 77%, 95% CI: 118.55, 35.45; p = 0.100).

In patients with asthma, the dexamethasone-treated had lower median ED-LOS time (235 (IQR: 165.5–349.5) versus 322 (IQR: 238–404) minutes; p = 0.003). Dexamethasone-

**Table 1:** Comparing the Baseline characteristics of patients with chronic obstructive pulmonary disease (COPD) and asthma exacerbation between cases with and without prehospital dexamethasone administration

| Variables | COPD (n = 93) | | | Asthma (n = 107) | | |
|---|---|---|---|---|---|---|
| | Treated (n = 52) | Untreated (n = 41) | P-value | Treated (n = 48) | Untreated (n = 59) | P-value |
| Gender | | | | | | |
| Male | 44 (84.6) | 27 (65.9) | 0.035 | 31 (64.6) | 26 (44.1) | 0.034 |
| Female | 8 (15.4) | 14 (34.1) | | 17 (35.4) | 33 (55.9) | |
| Age (years) | | | | | | |
| Mean ± SD | 69.79 ± 11.79 | 75.73 ± 11.35 | 0.016 | 68.67 ± 14.30 | 70.73 ± 15.74 | 0.484 |
| Comorbidities | | | | | | |
| No | 0 (0.0) | 6 (14.6) | 0.006 | 10 (20.8) | 7 (11.9) | 0.207 |
| Yes | 52 (100) | 35 (85.4) | | 38 (79.2) | 52 (88.1) | |
| Treatment period | | | | | | |
| From 8 a.m. to 4 p.m. | 18 (34.6) | 16 (39.0) | 0.760 | 18 (37.5) | 20 (33.9) | 0.920 |
| From 4 to 12 p.m. | 19 (36.5) | 12 (29.3) | | 18 (37.5) | 24 (40.7) | |
| From 12 p.m. to 8 a.m. | 15 (28.8) | 13 (31.7) | | 12 (25.0) | 15 (25.4) | |
| Smoking history | | | | | | |
| No | 10 (19.2) | 21 (51.2) | 0.001 | 35 (72.9) | 49 (83.1) | 0.204 |
| Yes | 42 (80.8) | 20 (48.8) | | 13 (27.1) | 10 (16.9) | |
| Bronchodilator use prior to EMS arrival | | | | | | |
| No | 21 (40.4) | 21 (51.2) | 0.279 | 20 (41.7) | 41 (69.5) | 0.004 |
| Yes | 31 (59.6) | 20 (48.8) | | 28 (58.3) | 18 (30.5) | |
| History of severe exacerbation | | | | | | |
| No | 39 (75.0) | 30 (73.2) | 0.841 | 30 (62.5) | 42 (71.2) | 0.341 |
| Yes | 13 (25.0) | 11 (26.8) | | 18 (37.5) | 17 (28.8) | |
| Vital signs at ED | | | | | | |
| SBP (mmHg) | 153.46 ± 31.17 | 133.39 ± 27.42 | 0.002 | 161.10 ± 30.97 | 128.58 ± 30.28 | <0.001 |
| DBP (mmHg) | 90.33 ± 25.05 | 77.27 ± 16.74 | 0.003 | 94.58 ± 23.69 | 75.36 ± 21.68 | <0.00 |
| HR (bpm) | 115.88 ± 23.82 | 104.44± 23.99 | 0.024 | 112.48 ± 18.96 | 109.78 ± 24.63 | 0.534 |
| Temperature (°C) | 37.05 ± 0.48 | 37.15 ± 0.61 | 0.383 | 36.96 ± 0.57 | 37.23 ± 0.79 | 0.046 |
| RR (bpm) | 31.98 ± 5.70 | 30.15 ± 7.20 | 0.173 | 32.42 ± 4.59 | 30.58 ± 6.66 | 0.095 |
| Pulse oximetry | | | | | | |
| Median (IQR) | 94 (90–96) | 93 (88–96) | 0.352 | 92 (88–94) | 94 (90–97) | 0.015 |
| > 94% | 24 (46.2) | 15 (36.6) | 0.353 | 10 (20.8) | 28 (47.5) | 0.004 |
| <94% | 28 (53.8) | 26 (63.4) | | 38 (79.2) | 31 (52.5) | |
| Wheezing | | | | | | |
| No | 10 (19.2) | 26 (63.4) | <0.001 | 10 (20.8) | 48 (81.4) | <0.001 |
| Yes | 42 (80.8) | 15 (36.6) | | 38 (79.2) | 11 (18.6) | |
| Intubation in the prehospital setting | | | | | | |
| No | 46 (88.5) | 39 (95.1) | 0.459 | 48 (100.0) | 55 (93.2) | 0.126 |
| Yes | 6 (11.5) | 2 (4.9) | | 0 (0.0) | 4 (6.8) | |
| Fluid resuscitation | | | | | | |
| No | 20 (38.5) | 24 (58.5) | 0.054 | 22 (45.8) | 19 (32.2) | 0.149 |
| Yes | 32 (61.5) | 17 (41.5) | | 26 (54.2) | 40 (67.8) | |
| Bronchodilator type | | | | | | |
| Berodual | 50 (96.2) | 37 (90.2) | 0.400 | 42 (87.5) | 51 (86.4) | 0.872 |
| Salbutamol | 2 (3.8) | 4 (9.8) | | 6 (12.5) | 8 (13.6) | |
| Bronchodilator dosage (dose) | | | | | | |
| Median (IQR) | 2 (1–2.5) | 1 (1–2) | 0.101 | 2 (1–3) | 1 (1–1) | <0.001 |
| 1 dose | 22 (42.3) | 26 (63.4) | 0.043 | 15 (31.3) | 47 (79.7) | <0.001 |
| > 1 dose | 30 (57.7) | 15 (36.6) | | 33 (68.8) | 12 (20.3) | |
| Bronchodilator administration method | | | | | | |
| Nebulizer | 36 (69.2) | 30 (73.2) | 0.678 | 30 (62.5) | 54 (91.5) | <0.001 |
| MDI | 16 (30.8) | 11 (26.8) | | 18 (37.5) | 5 (8.5) | |

Data are presented as numbers (%), means ± standard deviations, or medians (interquartile ranges). SBP: systolic blood pressure; DBP: diastolic blood pressure; HR: heart rate; RR: respiratory rate; MDI: metered dose inhaler; SD: standard deviation; EMS: emergency medical service; IQR: interquartile range; ED: emergency department.

**Table 2:** Comparing the emergency department length of stay and need for hospital admission between asthma and COPD cases with and without prehospital dexamethasone administration

| Outcomes | Treated | Untreated | Absolute difference (95% CI) | Effect estimate (95% CI) | P-value |
|---|---|---|---|---|---|
| COPD (n = 93) | | | | | |
| ED-LOS (minutes) | 232 (150 – 346) | 296 (212 – 330) | 59 (130.81, 12.81) | - | 0.106 |
| Hospital admission | 42 (80.8) | 35 (85.4) | 4.6 (19.82, 10.63) | 0.72 (0.24–2.18) | 0.561 |
| Asthma (n = 107) | | | | | |
| ED-LOS (minutes) | 235 (165.5 – 249.5) | 322 (238 – 404) | 85 (139.53, 30.47) | - | 0.003 |
| Hospital admission | 29 (60.4) | 46 (78.0) | 17.55 (34.96, 0.14) | 0.43 (0.19–1.00) | 0.510 |
| Total | | | | | |
| ED-LOS (minutes) | 235 (158–324.5) | 313.5 (222–375) | 77 (118.55, 35.45) | - | 0.003 |
| Hospital admission | 71 (71.0) | 81 (81.0) | 10.00 (21.76, 1.76) | 0.57(0.30–1.11) | 0.510 |

Data are presented as numbers (%) or medians (interquartile ranges). ED-LOS: Emergency Department length of stay; CI: confidence interval; COPD: chronic obstructive pulmonary disease.

treated asthma patients had lower but statistically non-significant hospital admission rates (60.4% versus 78.0%, absolute difference: 17.55%, 95% CI: 34.96, 0.14; p = 0.510).

In COPD patients the dexamethasone-treated and untreated groups had non-significantly lower hospital admission rates (80.8% versus 85.40%, absolute difference: 4.60%, 95% CI: 19.82, 10.63; p = 0.561) and non-significantly lower ED-LOS (232 (IQR: 150 – 346) versus 296 (IQR: 212 – 330) minutes, absolute difference: 59 (130.81, 12.81); p = 0.106).

## 4. Discussion

Dexamethasone administration by EMS in pre-hospital setting for management of asthma and COPD patients is beneficial in reducing the ED-LOS and need for hospital admission but its effects are not statistically significant, except regarding the ED-LOS of asthma exacerbation cases.

The present study found that immediate initiation of IV dexamethasone administration by EMS at the scene could reduce ED-LOS only in patients with asthma. Patients with asthma exacerbations who received IV dexamethasone had a significantly shorter median ED-LOS time than those who did not. These findings were consistent with a previous study finding that patients receiving corticosteroid injections, such as dexamethasone, or hydrocortisone, in the ED had a lower risk of hospitalization and exacerbation recurrence (17, 18). In patients with asthma, COPD, and anaphylaxis, offline protocols in some areas, such as Australia (3), Thailand (12), and Florida (19), allowed EMS personnel to initiate IV administration of systemic corticosteroids, such as dexamethasone, methylprednisolone, or prednisolone. However, there have been limited studies on the initiation of IV systemic corticosteroids in the ED for patients with asthma exacerbations, as recommended by the latest Global Initiative for Asthma (GINA) update 2023, because the anti-inflammatory effect can relieve the symptoms more quickly and reduce the risk of exacerbation recurrence (20). A previous study demonstrated that patients with asthma who received IV dexamethasone had a lower risk of disease exacerbation after ED discharge and a lower ED-LOS time (21). Similarly, a systematic review and meta-analysis reported that children under the age of 18 years with asthma exacerbations, who received a two-dose regimen of dexamethasone in the ED had a shorter ED-LOS time, less symptom persistence, a lower risk of return visits or hospital readmissions, and a higher quality of life. These findings suggested that dexamethasone be administered immediately in the ED (22). However, studies on the outcomes of initiating corticosteroids, such as dexamethasone, by EMS in patients with asthma exacerbations are scarce. A study on EMS found that administering corticosteroids as part of the EMS protocol was not associated with vital sign changes or ED-LOS time in pediatric patients with asthma. Protocols in the area allowed only IV methylprednisolone administration, which was usually reserved for patients with severe asthma (19). The EMS protocol in the study area allowed paramedics or ENPs to use IV dexamethasone (8 mg) as an alternative for adult patients with asthma and COPD exacerbations at the scene. Although no benefit was found for systemic use of corticosteroids in the present study, Thai EMS used dexamethasone in patients with COPD exacerbations to decrease ED-LOS time. Despite this, the Global Initiative for Chronic Obstructive Lung Disease (GOLD) (The 2020 GOLD Science Committee Report) supports the initiation of systemic corticosteroids in the acute phase or in the ED, and corticosteroids are regularly used in clinical practice for the management of COPD exacerbations, as previously recommended (23).

A previous randomized clinical trial compared the efficacy of methylprednisolone with that of dexamethasone in management of COPD exacerbations and found no significant difference in terms of ED-LOS time. Patients receiving dexamethasone had better dyspnea control (p = 0.02), but the group receiving methylprednisolone had better cough control (p = 0.035). There was no significant difference between the two

drugs in terms of side effects on the 7th and 14th days. Furthermore, the authors suggested that physicians should consider the most prominent symptoms of COPD patients under treatment when selecting each type of corticosteroid (24). The present study was consistent with a previous study in a Thai province that compared patients with COPD exacerbations in the ED and found that patients receiving IV dexamethasone had no difference in terms of ED-LOS time (25). A narrative review reported that both short- and long-term corticosteroid use had relatively high side effects, including new or aggravated diabetes, hypertension, fractures, particularly in the elderly, venous thrombosis, sepsis, and gastrointestinal hemorrhage. Accordingly, corticosteroid administration should be reduced, particularly in patients with COPD exacerbations (26). The use of corticosteroids, such as dexamethasone, in patients with COPD exacerbations may not be beneficial in the prehospital setting in terms of reduced ED-LOS time. Furthermore, drug administration should be initiated on a case-by-case basis and with the permission of the local EMS protocol in each area.

In the present study, initiating prehospital IV dexamethasone administration by EMS in patients with asthma and COPD exacerbations had no beneficial effect on hospital admission rates. This was consistent with a previous ED study that reported a significantly lower rate of hospitalization in pediatric patients with mild and moderate asthma who received corticosteroids (27). In addition, a previous study in the ambulance setting on pediatric patients aged 2–18 years with asthma exacerbations found that hospital admission rates were significantly lower in those who received corticosteroids by paramedics than in those who did not. Besides, initiating prehospital corticosteroid administration by EMS has been suggested to reduce hospital expenses for treating patients with acute asthma (26).

Furthermore, a previous study comparing the administration of IV methylprednisolone (125 mg) by EMS to IV methylprednisolone in the ED found that initiating methylprednisolone administration by EMS helped decrease hospital admission rates in patients with moderate to severe asthma (28). According to the present standard recommendations of Global Initiative for Asthma (GINA) update 2023, IV systemic corticosteroid administration should be initiated immediately in patients with asthma exacerbations because it could reduce hospital and intensive care unit admission rates (20). In patients with COPD exacerbations, the present study reported a reduced risk of hospitalization with IV dexamethasone administration by EMS. This was in contrast with a previous study demonstrating that patients with COPD exacerbations at the ED receiving IV dexamethasone did not reduce overall hospital and intensive care unit admission rates (25), which may be due to the fact that patients with COPD and asthma exacerbations serviced by EMS mostly have severe symptoms. According to the present study, the incidence of prehospital intubation in patients with COPD was 16.4%, while it was only 6.8% in patients with asthma. In addition, no asthmatic patients receiving IV dexamethasone administered by EMS required prehospital intubation. Furthermore, in patients with COPD, and asthma, vital signs, such as RR, oxygen saturation levels, HR, and wheezing, did not differ between groups that received and did not receive IV dexamethasone administered by EMS. This is because all of these patients were treated with a bronchodilator, salbutamol, or ipratropium bromide + fenoterol (Berodual) via nebulizer or MDI with a spacer before initiating dexamethasone administration, as well as a relatively delayed dexamethasone effect that would take an hour (29), resulting in no clear difference in prehospital and ED vital signs.

## 5. Limitations

This study has some limitations. First, the present study was a retrospective single-center study that used two data sources: the EMS patient care report and the EMR database, which could introduce a selection bias. Second, there may be unmeasured confounding factors associated with ED-LOS times and hospital admission rates, such as emergency room triage severity, patient overcrowding at the ED, the order of medical investigation, the order of additional laboratory tests, and so on, that influenced the outcomes. Third, patients in this study were only transported to the Vajra Hospital's ED. Patients delivered to other hospitals' EDs should be collected because the level of the hospital ED may potentially affect ED-LOS times and hospital admission rates. Fourth, in the present study, there was no classification of severity level of patients with asthma attacks and COPD exacerbations (classified as mild, moderate, and severe) due to the retrospective nature of this observational study. Paramedics or ENPs did not record the data regarding severity level in prehospital patient record. Fifth, there was no data collection about receiving systemic corticosteroid before acute exacerbation, which was believed to affect results of the study. Sixth, for COPD patients in dexamethasone group, there was higher prevalence of smoking history and also significantly lower age in dexamethasone group. These were believed to affect the results of the study and may cause bias. Finally, since not all patients, or relatives could provide a clear medical history, it was difficult for paramedics or ENPs to distinguish between asthma and COPD in the prehospital setting, particularly, in patients without treatment history or new patients. Hence, the final diagnosis in the hospital was chosen as the criterion for differentiating these two diseases.

## 6. Conclusion

Dexamethasone administration by EMS in pre-hospital setting for management of asthma and COPD patients is beneficial in reducing the ED-LOS and need for hospital admission but its effects are not statistically significant, except regarding the ED-LOS of asthma exacerbation cases.

## 7. Declarations

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### 7.2. Conflict of interest

The authors have no conflicting interests to declare.

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### 7.4. Authors' contribution

Conceptualization: Thongpitak Huabbangyang, Jukkit Kumkong, Tanut Srithanayuchet, Parinya Chamnanpol and Theeraphat Meechai; Methodology: Thongpitak Huabbangyang and Agasak Silakoon; Software: Thongpitak Huabbangyang; Validation: Thongpitak Huabbangyang; Agasak Silakoon and Jareeda Sukhuntee; Formal analysis: Thongpitak Huabbangyang; Investigation: Thongpitak Huabbangyang, Jukkit Kumkong, Tanut Srithanayuchet, Parinya Chamnanpol and Theeraphat Meechai; Resources: Thongpitak Huabbangyang, Jukkit Kumkong, Tanut Srithanayuchet, Parinya Chamnanpol and Theeraphat Meechai; Data Curation: Thongpitak Huabbangyang; Writing – Original Draft: Thongpitak Huabbangyang; Writing - Review Editing: Thongpitak Huabbangyang and Agasak Silakoon; Visualization: Thongpitak Huabbangyang and Jareeda Sukhuntee; Supervision: Thongpitak Huabbangyang and Chunlanee Sangketchon; Project administration: Thongpitak Huabbangyang; Funding acquisition: Thongpitak Huabbangyang. All authors read and approved the final version of manuscript.

### 7.5. Data Availability

Not applicable.

### 7.6. Using artificial intelligence chatbots

None.

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